Information:

First Name: Scott
Last Name: McGlynn
Company: Continental Service Group, Inc.
Mailing Address 1: 200 CrossKeys Office Park
Mailing Address 2:
City: Fairport
State: NY
Zip Code: 14450
Email Address: smcglynn@conserve-arm.com
Phone: 5854211000
Required copies of the records: Yes

List of specific record(s):
ConServe was naturally very disappointed to learn of the committee's decision to select another provider for the Port Authority of NY NJ RFP NO. 38391 General Collection Services for the Electronic Toll Collection Program. As we are aware of the proposal contents, ConServe knows that the proposals submitted do not contain any information meeting an exception to the Freedom of Information Act, therefore we are requesting copies of winning proposals along with the scoring matrix. ConServe would accept proposals released in part, with redacted financial statements, compliance audits, and any personal identifiable information.

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY
PUBLIC RECORD ACCESS FORM

Action by (print / type name):

William Shalewitz, Freedom of Information Administrator

Signature: William Shalewitz

Date: 07/25/2016

On behalf of the Secretary of the Port Authority, as Records Access Officer and Custodian of Government Records of the Port Authority.

☐ The requested records are being made available.

☐ Any responsive records that may exist are currently in storage or archived, and a diligent search is being conducted. The Port Authority will respond by:

☐ A diligent search has been conducted, and no records responsive to your request have been located.

☐ The requested records that have been located are not being made available, as they are exempt from disclosure for the following specific reasons:

☑ Some requested records that have been located are being made available. The remainder are exempt from disclosure for the following specific reasons:

Security.

☐ The request does not reasonably describe or identify specific records; therefore, the Port Authority is unable to search for and locate responsive records. Please consider submitting a new request that describes or identifies the specific records requested with particularity and detail.

☑ Other:

Material responsive to your request can be found on the Port Authority's website at http://corpinfo.panynj.gov/documents/15752-C/. Paper copies of the available records are available upon request.

This form is promulgated by the Port Authority pursuant to the Port Authority Public Records Access Policy and is intended to be construed consistent with the New York Freedom of Information Law and the New Jersey Open Public Records Act. It is intended to facilitate requests for Port Authority public records and does not constitute legal advice.

THE PORT AUTHORITY OF NY & NJ

April 20, 2005

DHL
ACS State & Local Solutions, Inc.
375 McCarter Highway
Newark, NJ 07114
Attention: Donald R. Becan, Director, Contracts

Re: Open Highway Tolling Software License Agreement – Purchase Order No. 4500040949

Dear Mr. Becan:

Enclosed herewith is one fully executed original copy of the above-referenced Agreement between the Port Authority of New York and New Jersey and ACS State & Local Solutions, Inc.

For invoicing, payment and administrative purposes, Purchase Order #4500040949 has been assigned to this Agreement.

Sincerely,

Andrea Roitman
Assistant Director
Procurement Department

Enc.

One Madison Avenue, 7th fl.
New York, NY 10010
T: 212 435 7000

Software License Agreement

1. PREAMBLE

This Software License Agreement (this "Agreement") is entered into as of the 19th of ~~March~~ April, 2005 ("Execution Date") between ACS State & Local Solutions, Inc a New York corporation with offices at 1800 M Street NW-Suite 800, Washington DC 20036 ("LICENSOR"), and The Port Authority of New York & New Jersey, with offices at 225 Park Avenue South, New York, NY 10003 ("LICENSEE").

2. RECITALS

WHEREAS, LICENSOR owns certain software for operating high speed toll lanes; and

WHEREAS, LICENSOR wishes to license the above referenced software to LICENSEE for LICENSEE's use in operating high speed toll lanes in up to eight (8) toll facilities operated by the LICENSEE and for testing purposes in the Lemoine test environment; and

WHEREAS, LICENSEE desires to purchase a license to the software for the purposes of operating high speed toll lanes within their toll system; and

WHEREAS, LICENSEE agrees to pay LICENSOR a set fee for said license to use such software and supporting documentation in accordance with the license grant for the term of this Agreement.

NOW THEREFORE, the parties agree as follows

3. DEFINITIONS

3.1. ACCEPTANCE is defined in Section 10.2 below.

3.2. CONFIDENTIAL INFORMATION shall mean all OBJECT CODE and SOURCE CODE thereof as well as any other materials specifically marked as CONFIDENTIAL INFORMATION or with a similar restrictive legend. Confidential information shall also mean any proprietary, confidential, or other trade secret information specifically marked by either party. Confidential information does not include information that:

3.2.1. was in a party's possession before receipt from the other party,

3.2.2. is or becomes a matter of public knowledge through no fault of the other party,

3.2.3. is rightfully received by a party from a THIRD-PARTY without a duty of confidentiality,

3.2.4. is disclosed by a party to a THIRD-PARTY without a duty of confidentiality on the THIRD-PARTY,

3.2.5. is independently developed by the other party,

3.2.6. is disclosed with a party's prior written approval.

3.3 DERIVATIVE WORKS shall mean work that is based on the LICENSED PRODUCTS, such as a revision, enhancement, major or minor upgrade, improvement, update, modification, translation, changes to system

ign, changes to source or object coding, abridgement, condensation, expansion, or any other form in which such work may be recast, transformed, or adapted. Any computer program documentation developed by LICENSOR for LICENSEE's specific application shall be a DERIVATIVE WORK. For purposes hereof, a DERIVATIVE WORK also shall include any compilation that incorporates such pre-existing work. DERIVATIVE WORKS shall not include the underlying LICENSED PRODUCT as a whole, or the remaining original code of the LICENSED PRODUCT residing within the DERIVATIVE WORK. Any software corrections or patches to LICENSED PRODUCTS made to repair software problems are not considered DERIVATIVE WORKS.

3.4. LICENSED PRODUCTS UPGRADE shall mean improvements made by the LICENSOR as follows:

3.4.1. NO COST UPGRADE As the LICENSOR continues to refine the LICENSED PRODUCTS over time, it will make available certain functional or performance improvements. These changes will be the result of independent research paid for by the LICENSOR to keep the LICENSED PRODUCTS functioning to their designed capacity. NO COST UPGRADEs shall be announced by and made available through the LICENSOR. LICENSOR agrees to publish these improvements in a periodic news bulletin to its licensed customers to inform them that an upgrade is available. LICENSEE has the option to request that the upgrade be incorporated into its system, but is under no obligation to accept NO COST UPGRADEs. LICENSOR agrees to make upgrades available to LICENSEE for the Base Period and any exercised option periods.

3.4.2. OPTIONAL UPGRADE As the high speed electronic equipment manufacturers introduce changes in their equipment offerings, certain hardware may be discontinued, become obsolete or functionally improved, thereby changing the parameters of its original design base. LICENSEE has the option of purchasing adequate spare parts for its inventory, which will not necessitate any change to the LICENSED PRODUCTS. LICENSOR will endeavor to support such hardware changes and where these changes are supported, licensed customers would be offered no charge upgrades to the LICENSED PRODUCTS. Where LICENSOR does not support a particular equipment change and LICENSEE desires such change, LICENSEE would be charged for an OPTIONAL UPGRADE. If, however, the LICENSED PRODUCTS distributed to LICENSOR's customers are affected by a hardware manufacturer's change in product offering, LICENSOR may upgrade the LICENSED PRODUCTS, determine the overall cost and allocate those costs across its LICENSED PRODUCTS customer base thereby mitigating the upgrade costs to any one customer for a condition beyond the control of the LICENSEE or LICENSOR.

3.5. LICENSED PRODUCTS ENHANCEMENT shall mean changes requested by the LICENSEE to the LICENSED PRODUCTS, which modify or increase the functionality of the software specifically for LICENSEE's use. They shall be provided to the LICENSEE for its sole benefit as it relates to the high speed toll lanes in its toll system. Such changes may include changing the LICENSED PRODUCT to perform differently than it was originally designed, function with new or different products, or produce results beyond its current design parameters. The procedure for addressing future software enhancements/modifications is covered in Section 13.

3.6. INTELLECTUAL PROPERTY RIGHTS shall mean, any and all rights and interest existing now or in the future under patent law, copyright law, rights of authorship, moral rights law, trade secret law, know-how rights, trademark law, unfair competition law, publicity rights law, privacy rights law, and any and all similar proprietary rights, and any and all renewals, extensions, and restorations thereof, arising under state, federal, or common law, now or hereafter in force and effect worldwide.

3.7. LICENSED PRODUCTS shall mean the LICENSOR's computer software including the related system software as listed in ATTACHMENT A – LICENSED PRODUCTS.

3.8. LICENSEE shall mean the employees, job shoppers, consultants and contractors working on behalf of the Licensee.

.9. OBJECT CODE shall mean any machine executable code derived in whole or in part from the LICENSOR'S SOURCE CODE.

.10. **SOURCE CODE** shall mean computer software, instructions and related material written in a human-readable source language in a form capable of serving as the input to a compiler or assembler program, and in a form capable of being modified, supported and enhanced by programmers reasonably familiar with the source language.

3.11. **THIRD-PARTY** shall mean any individual, party, legal person, or governmental entity, other than LICENSEE or the LICENSOR.

3.12. **USEABLE TRANSACTION AND AXLE COUNTING** shall mean the action of charging the correct vehicle account the correct vehicle toll. A useable transaction shall be defined as a set of data from a single vehicle that is sufficient to collect the correct toll from the correct customer and report the transaction correctly at both the lane and ECH data point. Vehicles that are detected and reported but are not present in the video review shall be considered unusable transactions.

3.13. **BASE DATE** shall mean the date of operational acceptance or ninety (90) days after the introduction of the software into revenue service, whichever date comes first.

3.14. **BASE PERIOD** shall mean a period of ten (10) years from the BASE DATE.

4. GRANTS TO LICENSEE

4.1. LICENSOR grants to LICENSEE a limited non-exclusive license to use the products listed in ATTACHMENT A – LICENSED PRODUCTS within the Field of Use without the right to own, sublicense, copy, decompile, reverse engineer, assign, create derivative works or modify the LICENSED PRODUCTS under LICENSOR'S INTELLECTUAL PROPERTY RIGHTS for the term of this Agreement. This grant includes the right to reinstall from a copy of back-up, if required.

4.2. DOCUMENTATION. LICENSOR grants LICENSEE a non-exclusive license for use only to the LICENSED PRODUCTS' DOCUMENTATION under the LICENSOR'S INTELLECTUAL PROPERTY RIGHTS for the term of this Agreement. Such documentation shall be defined in the Scope of Work for Task Order No.9 version 2, dated October 18, 2004, under ACS Agreement #407-01-013.

4.3. FIELD OF USE. LICENSEE may use the LICENSED PRODUCTS solely for the purpose of processing highway speed toll transactions in up to eight (8) toll facility locations operated by the LICENSEE and for testing purposes in the Lemoine test environment. Should LICENSEE decide to deploy the LICENSED PRODUCTS at additional facilities in the future, LICENSOR reserves the right to renegotiate the license agreement at such time.

4.4. OTHER INTELLECTUAL PROPERTY. LICENSOR does not grant a license to LICENSED PRODUCTS' SOURCE CODE, any DERIVATIVE WORKS or any other INTELLECTUAL PROPERTY RIGHTS not expressly granted hereunder

4.5. BACK-UP COPIES. LICENSEE is permitted up to two (2) copies of the LICENSED PRODUCTS, in OBJECT CODE for backup purposes to support authorized use under the license. Each such copy shall be labeled "Copy for Back-Up purposes only and Not for Resale." LICENSEE is permitted to make additional copies of documentation for internal use in accordance with this agreement. All copies are the property of LICENSOR.

5. ADDITIONAL FUTURE GRANTS TO LICENSEE

5.1. DERIVATIVE WORKS. Nothing in this Agreement shall be construed to grant LICENSEE, any License, ownership rights, title, or interest in any DERIVATIVE WORKS created by LICENSOR.

6. TITLE TO MATERIALS

6.1. TITLE TO LICENSED PRODUCTS and DERIVATIVE WORKS. All right, title, and interest in and to the LICENSED PRODUCTS is and shall remain the sole property of the LICENSOR.

7. CONSIDERATION

7.1. In consideration for the rights granted hereunder and acceptance of the LICENSED PRODUCTS from LICENSOR to LICENSEE, LICENSEE agrees to pay LICENSOR:

7.1.1. FOR LICENSED PRODUCTS – A fee of nine hundred thousand dollars ($900,000.00) shall be paid by LICENSEE to LICENSOR for use of the LICENSED PRODUCTS for the ten (10) year Base Period. The payment shall be paid in two installments. The first installment of eight hundred and fifty thousand dollars ($850,000.00) shall be invoiced upon the introduction of the high speed toll system facility into revenue service at the first toll facility. The remaining fifty thousand dollars ($50,000.00) of the payment shall be invoiced upon LICENSEE's Acceptance of the system as described in section 10.2. The annual fee for each one-year option period shall not exceed $90,000.00. Payment terms are net thirty (30) days.

8. ADDITIONAL OBLIGATIONS

8.1. SOFTWARE SERVICES. After acceptance of the LICENSED PRODUCTS, LICENSOR has an obligation to provide services related to LICENSED PRODUCTS or LICENSEE's use of LICENSED PRODUCTS pursuant to the terms and conditions set forth in this Agreement. LICENSOR recognizes that LICENSEE may desire to implement changes in the existing LICENSED PRODUCTS ("Enhancements"). Any changes defined as Enhancements in Section 3.5 or as Optional Upgrades in Section 3.4.2 to LICENSED PRODUCTS by the LICENSOR will be addressed by LICENSOR under Section 13 of this Agreement. Any changes required to maintain functionality and performance in accordance with Sections 10.3 and 10.4 shall be performed by the LICENSOR in accordance with Section 3.4.1.

8.2. ATTRIBUTION. LICENSOR shall not issue or permit to be issued, any press release, advertisement, or literature of any kind which refers to LICENSEE or the services to be performed in connection with this Agreement unless LICENSOR first obtains the written approval of LICENSEE. Such approval may be withheld if for any reason LICENSEE believes that the publication of such information would be harmful to the public interest or is in any way undesirable. Any public use of LICENSOR's trademark, service mark or trade dress, shall be coordinated with and shall be subject to the written approval by LICENSOR prior to release.

9. CONFIDENTIAL INFORMATION

9.1. Each party and all agents, consultants, contractors, and other representatives thereof agree to protect the other party's CONFIDENTIAL INFORMATION by using the same degree of care, but no less than a reasonable degree of care, to prevent the unauthorized use, dissemination, or publication of the CONFIDENTIAL INFORMATION, that the first party uses to protect its own CONFIDENTIAL INFORMATION, provided that the LICENSEE's non-disclosure obligations shall be subject to the provisions of its freedom of information policy, a copy of which is annexed.

9.2. A party's confidentiality obligations shall only extend to CONFIDENTIAL INFORMATION that is described in Section 3.2, above, and

9.2.1. is marked as confidential or with a similar restrictive legend at the time of disclosure; or

9.2.2. is first orally or visually disclosed, is identified as confidential at the time of disclosure, and is designated as confidential in a written memorandum, sent to the other party consistent with the notice procedures proscribed in Section 15.7, within thirty (30) calendar days of disclosure, summarizing the CONFIDENTIAL

INFORMATION sufficiently for identification.

9.3. TERM OF NONDISCLOSURE OBLIGATIONS. The parties' obligations set forth in this Section will survive the termination of this Agreement, and will bind the receiving party's representatives, consultants, contractors, agents, successors and assigns.

10. ACCEPTANCE AND PERFORMANCE

10.1. LICENSOR warrants that it has not granted any licenses in LICENSED PRODUCTS that would conflict with the grants in this Agreement, that it is the lawful owner of the INTELLECTUAL PROPERTY RIGHTS in the LICENSED PRODUCTS or that it has sufficient rights necessary to convey to LICENSEE the rights specifically granted in this agreement.

10.2. Acceptance of the LICENSED PRODUCTS shall be in accordance with a Final Acceptance Test, to be developed under Task 11, OBX Implementation Support, of the ACS Agreement #407-01-013.

10.3. The LICENSED PRODUCTS shall perform at a performance level of 99.5% for USEABLE TRANSACTION AND AXLE COUNTING accuracy. This level of performance applies equally to both free flowing and stop-and-go traffic. This accuracy is conditioned upon LICENSEE's installation of equipment in accordance with design specifications submitted by LICENSOR to LICENSEE for the Stage 3 Design of the OBX and applicable design documents for the remaining toll facilities. However, if it is determined that the Recommended Solution is not adequate to support the performance of the LICENSED PRODUCTS, LICENSOR shall make necessary software modifications at no cost to LICENSEE and LICENSOR shall provide LICENSEE with a new Attachment B with the new required hardware specifications. This performance is further conditioned upon LICENSEE's hardware operating properly and LICENSEE implementing and properly maintaining the hardware solution. In the event that LICENSOR is not the LICENSEE designated equipment maintainer, LICENSOR requires that during the term of this license all of LICENSEE's hardware is maintained correctly and is operating properly. To the extent that LICENSOR demonstrates that improper hardware equipment maintenance or operation have affected the USEABLE TRANSACTION AND AXLE COUNTING accuracy of the system, no guarantee will apply until said improper hardware maintenance or operations are corrected by LICENSEE.

10.4. WARRANTY LICENSOR warrants that for the Base Period of ten (10) years from the Base Date the LICENSED PRODUCTS will meet the required accuracy specified in 10.3, and be free from material defects. Should the LICENSED PRODUCTS fail to meet the stated performance requirements, or material defects are identified, then LICENSOR will correct the LICENSED PRODUCTS under the term of the license agreement at no additional cost to LICENSEE.

11. SOFTWARE INDEMNIFICATION

11.1. LICENSOR shall indemnify, hold harmless and defend LICENSEE and its officers, directors, employees, attorneys, representatives and agents, against any and all liability, damages, costs, and expenses, including but not limited to, defense costs and attorneys' fees, for or by reason of any actual or alleged infringement of any United States patent, copyright, trademark, or any actual or alleged trade secret disclosure or misappropriation, arising from, related to, or in connection with the operation and utilization of the LICENSED PRODUCTS under this Agreement. LICENSOR shall pay all settlements entered into and damages awarded against such person to the extent based on such action

11.2. If the Software becomes, or in the opinion of LICENSOR may become, the subject of a claim of infringement, LICENSOR may, at its option: (i) procure for LICENSEE the right to use such Software free of any liability; or (ii) replace or modify such Software to make it non-infringing. If LICENSOR cannot or does not perform as set forth in items (i) – (ii) above, then LICENSOR shall refund a prorated portion of the fee paid by

LICENSEE therefore. Such refund shall be prorated from the Base Date.

11.3. All indemnification obligations under this Section shall be subject to the requirements: (a) the LICENSEE shall provide the LICENSOR with prompt written notice of any claim; (b) the LICENSEE shall permit the LICENSOR to assume and control the defense of any action; and (c) the LICENSEE shall not enter into any settlement or compromise of any claim without the LICENSOR's prior written consent which shall not be unreasonably withheld. In addition, the LICENSEE may, at its own expense, participate in its defense of any claim.

12. LIMITATIONS ON LIABILITY

12.1. EXCLUSION OF DAMAGES. NOTWITHSTANDING THIS OR ANY OTHER LANGUAGE OR PROVISION OF THIS AGREEMENT, AND REGARDLESS WHETHER ANY REMEDY SET FORTH HEREIN FAILS OF ITS ESSENTIAL PURPOSE OR OTHERWISE, IN NO EVENT WILL EITHER PARTY BE LIABLE TO THE OTHER FOR ANY SPECIAL, INCIDENTAL, INDIRECT, CONSEQUENTIAL, OR PUNITIVE DAMAGES, WHETHER BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE), PRODUCT LIABILITY, OR OTHERWISE, AND WHETHER OR NOT LICENSEE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

12.2. LIMITED LIABILITY OF LICENSOR. LICENSOR'S TOTAL LIABILITY UNDER THIS AGREEMENT OR FOR BREACH THEREOF, WHETHER IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY OR ANY OTHER LEGAL THEORY, SHALL NOT EXCEED THE TOTAL AMOUNTS PAID TO LICENSOR UNDER THIS AGREEMENT EXCEPT FOR INTELLECTUAL PROPERTY INDEMNIFICATION FOR WHICH NO LIMIT SHALL APPLY.

13. FUTURE SOFTWARE ENHANCEMENTS/MODIFICATIONS

13.1. LICENSOR understands that LICENSEE may request changes to the LICENSED PRODUCTS which are outside the scope of this Agreement. Upon the LICENSEE's request for such enhancements/ modifications (hereinafter, "enhancements"), LICENSOR shall prepare a scope of work and shall submit a cost proposal including all costs and schedules including key milestones pertaining to furnishing the LICENSEE with the enhancements.

13.2. Following the LICENSEE's acceptance of all enhancements, such enhancements shall be considered as part of the LICENSED PRODUCTS as such term is defined in Section 3.6 hereof for all purposes under this Supplement. LICENSOR shall provide the LICENSEE, with written confirmation of the date the enhancement was applied to the LICENSED PRODUCTS within ten (10) business days of acceptance by LICENSEE.

13.3. If any enhancement to the LICENSED PRODUCTS is not acceptable to the LICENSEE as per the specifications in the applicable Agreement, the LICENSEE may refuse to accept same and, in such event, LICENSOR agrees to maintain the LICENSED PRODUCTS in the form in effect on the date the LICENSOR requested the LICENSEE to accept such enhancements or in the form in effect immediately prior to the start of the enhancement task, as specified by the LICENSEE.

13.4. Title to all enhancements to the LICENSED PRODUCTS shall rest solely with LICENSOR. However, LICENSOR shall deem such enhancements once accepted and paid for (if applicable) to come within the license granted pursuant to Section 4 hereof.

14. TERM AND TERMINATION

14.1. TERM AND EFFECTIVE DATE. This Agreement shall run for a period of ten (10) years from the Base Date for the first facility of the LICENSED PRODUCTS ("Base Period") by LICENSEE unless earlier

terminated by either party as provided below. LICENSEE shall have the right to extend the term of the Agreement for up to ten (10) additional one-year periods at its sole discretion upon sixty (60) days written notice to the LICENSOR each year that the LICENSEE elects to extend the Agreement.

14.2. EARLY TERMINATION. LICENSEE may terminate this Agreement immediately upon written notice if LICENSOR (i) institutes bankruptcy or similar proceedings; (ii) has bankruptcy or similar proceedings instituted against it, and such proceedings are not stayed or dismissed within sixty (60) days; (iii) makes an assignment of property or assets for the benefit of its creditors. Either party may terminate this Agreement sixty (60) days after written notice to the other of the other's material breach of any of its other material obligations under this Agreement in any material respect, which breach is not remedied within such 60-day period.

In addition to the foregoing, LICENSOR may terminate this Agreement (a) sixty (60) calendar days after written notice to LICENSEE of LICENSEE's breach of Section 4 or Section 9; or (b) sixty (60) calendar days after written notice to LICENSEE of LICENSEE's breach of any of its payment obligations, which breach is not remedied in such 60-day period.

14.3. EVENTS OF DEFAULT. This Agreement may be terminated by LICENSEE in the event that LICENSEE does not accept the LICENSED PRODUCTS or the LICENSOR fails to comply with any of the other material terms of this Agreement. This Agreement may be terminated by LICENSOR for LICENSEE' failure to materially comply with any of the material terms set out in this Agreement.

14.4. NOTICE OF DEFAULT. Any termination shall be effective no less than Sixty (60) calendar days after written notice thereof has been received by the non-terminating party if the default has not been cured within sixty (60) calendar days of receipt of the notice of termination. Acceptance of either party's tender of cure shall not be unreasonably rejected.

14.5. TERMINATION FOR CONVENIENCE. After the first four (4) years of the Base Period LICENSEE shall have the right to terminate this Agreement without cause upon thirty (30) days written notice to LICENSOR and shall be entitled to a prorated refund of the License fees which shall be calculated as follows: the total ten (10) year license fee ($900,000.00) shall be multiplied by a fraction, the numerator of which shall be the remaining months in the ten-year period and the denominator shall be the total number of months in the Base Period (i.e. 120 months)

14.6. EFFECT OF TERMINATION. Upon any termination of this Agreement other than LICENSEE's termination for default of LICENSOR or termination for convenience, LICENSEE is required to pay the remaining balance on the fees agreed upon in Section 7. In the event of termination of this Agreement for any reason, LICENSEE is also required to return all LICENSED PRODUCTS and any backup copies thereof created by LICENSEE as well as any other DOCUMENTATION or CONFIDENTIAL INFORMATION provided by LICENSOR to LICENSEE under this Agreement. In the event this Agreement is terminated for the default of the LICENSOR, upon LICENSEE's return of all copies of the software and documentation LICENSEE shall be entitled to a prorated refund of the License fees calculated in accordance with the formula set forth in Section 14.5.

14.7. SURVIVAL. Sections 3 (Definitions), 4. (Grants to LICENSEE), 6 (Title to Materials), 9 (Confidential Information), 12 (Limitations of Liability), and 15 (Miscellaneous Provisions) as well as any accrued payment obligations, shall survive any expiration or termination of this Agreement.

14.8. ESCROW ACCOUNT. The LICENSED PRODUCTS will be deposited in the escrow Agreement dated December 1, 2001 under Contract MF-274.038 in place with Iron Mountain Intellectual Property Management (formerly DSI Technology Escrow Services) for the software listed in Attachment A within sixty (60) days after the LICENSED PRODUCTS are accepted or after the introduction of revenue service, whichever is later, at no charge to the LICENSEE. The LICENSOR shall also deposit any updates, changes, modifications, corrections or enhancements to the LICENSED PRODUCTS in the Escrow Account no later than sixty (60) days after such updates are accepted. Any such revisions made to the LICENSED PRODUCTS in the first year immediately following the initial deposit shall be made at no charge to the LICENSEE. After the first year, the LICENSEE shall bear the cost of such deposits.

15. MISCELLANEOUS

15.1. RELATIONSHIP OF THE PARTIES. Nothing in this Agreement is to be construed as creating an agency, partnership, or joint venture relationship between LICENSOR and LICENSEE.

15.2. ADDITIONAL PROVISIONS. The additional provisions, if any, included in an Attachment as well as ATTACHMENT A- LICENSED PRODUCTS and ATTACHMENT B – OPEN ROAD TOLLING (ORT) EQUIPMENT.

15.3. ENTIRE AGREEMENT. The provisions of this Agreement including the Attachment (s) constitute the entire agreement between the parties with respect to the subject matter hereof, except for Acceptance, as set forth in Sections 4.2 and 10.2, and supercede any and all prior agreements, oral or written, all other communications 973-622-6293relating to the subject matter hereof and any custom or practice of the parties. No amendment or modification of any provision of this Agreement shall be effective unless set forth in a document that purports to amend this Agreement by specific reference and is executed by both parties hereto.

15.4. NO WAIVER. The failure of any party to enforce any of the provisions of this Agreement shall not be construed to be a waiver of the right of such party thereafter to enforce such provisions.

15.5. GOVERNING LAW AND JURISDICTION. This Agreement shall be governed by and interpreted in accordance with the laws of the State of New York. All disputes arising out of or related to this Agreement will be subject to the exclusive jurisdiction and venue of the New York State courts and the corresponding U.S. District Court, and the parties hereby consent to such jurisdiction and venue. The United Nations Convention on Contracts for the Sale of Goods does not apply to this Agreement.

15.6. BINDING ON SUCCESSORS AND ASSIGNS. Subject to, and unless otherwise provided in this Agreement, each and all of the covenants, terms, provisions, and agreements contained in this Agreement shall be binding on, and inure to the benefit of, the permitted successors, executors, heirs, representatives, administrators, and assigns of the parties hereto.

15.7. NOTICE. Any notice required or permitted to be made or given by either party under this Agreement shall be made in writing and be sent or transmitted by (i) registered or certified mail, postage prepaid, (ii) hand-delivery or courier service delivery that obtains receipt of delivery; or (iii) facsimile message, provided its receipt is evident or acknowledged; and in the case of the LICENSOR addressed to:

ACS State & Local Solutions, Inc.

Attn: Group Counsel

1800 M St. NW

Washington, DC 20036

In the case of LICENSEE addressed to:

Port Authority of New York and New Jersey

225 Park Avenue South

New York, NY 10003

15.8. SEVERABILITY. If any provision of this Agreement is held by a court of competent jurisdiction to be contrary to law, the remaining provisions of this Agreement will remain in full force and effect.

5.9. HEADINGS. The section headings contained in this Agreement are included for convenience only, and shall not limit or otherwise affect the terms of this Agreement.

15.10. COUNTERPARTS. This Agreement may be executed in two counterparts, both of which taken together shall constitute a single instrument. Execution and delivery of this Agreement may be evidenced by facsimile transmission.

15.11. FORCE MAJEURE. Neither party will be liable to the other for any failure or delay in performance under this Agreement due to circumstances without its fault and beyond its reasonable control, including Acts of God, acts of war, acts of terrorism, accident, labor disruption, acts, omissions and defaults of third parties, and judicial action which was not the fault of the party failing or delaying in performance.

15.12. ORDER OF PRECEDENCE. In the event of any conflict between this Agreement and the Attachments hereto, the following order of precedence shall apply:

15.12.1. This Software License Agreement

15.12.2. ATTACHMENT A –LICENSED PRODUCTS

15.12.3. ATTACHMENT B - OPEN ROAD TOLLING (ORT) EQUIPMENT

By executing below, LICENSOR and LICENSEE agree to be bound by the terms and conditions of this Agreement. Capitalized terms are defined in Section 1 of the License Terms and Conditions.

LICENSOR:

ACS State & Local Solutions, Inc.

By: Francis K. O'Connor
Name: FRANCIS K. O'CONNOR
Title: VICE PRESIDENT
Date: 4/8/05

LICENSEE:

The Port Authority of New York and New Jersey

OK form

By: Andrea Roitman
Name: Andrea Roitman
Title: Asst Director, Procurement
Date: 4/12/05

Contact Information of Licensor:

Address: 375 McCARTER HIGHWAY
NEWARK, N.J. 07114
Tel.: 973-368-1530
Fax: 973-622-6293
Email: FRANCIS.OCONNOR@ACS-INC.com

Contact Information of Licensee:

Address: Andy Fogel, Asst. Director. Regional E-ZPass Unit, Tunnels, Bridges & Terminals Dept.
One Madison Avenue, 5th Floor
New York, NY 10010
Tel.: 212-435-4953
Fax: 212-435-4960
Email: afogel@panynj.gov

APPROVED TERMS: AF 4/12/05

ATTACHMENT A

LICENSED PRODUCT

LICENSED PRODUCTs shall include and be limited to the following:

$Vector_{Express}$ Version 1.3, application software provides data acquisition and process control functionality in a high-speed, open-road tolling environment. The software provides high-level control of all devices required to capture events that describe a toll transaction in the open-road tolling environment for up to four (4) lane configurations. .

$Vector_{Express}$ accurately records the transactions and transmits complete representations of the transactional attributes, including any image files, to compatible back-end systems.

The current version numbers of the various components are:

$Vector_{Express}$	Version 1.3

ATTACHMENT B
OPEN ROAD TOLLING EQUIPMENT

The list below identifies the major components for Open Road Tolling and defines the minimum equipment, hardware and associated software versions. If any later equipment, hardware or associated software versions are tested and accepted for OBX, such versions shall replace the version specified below. Depending on the number of lanes and plaza configurations, the quantities may vary by toll facility.

Open Road Tolling Equipment

1. ACS Lane Controller
2. ACS Vector Express Lane Electronics, including Automatic Vehicle Classification System
3. ACS Vector Express Violation Enforcement System
4. ACS Vector Express AVI System

1. ACS LANE CONTROLLER

The Lane Controller is one hundred percent supplied by ACS and has no outside vendor system components that must be provided.

ACS Vector Express Lane Controller v.1.3	
Single Board Computer with Intel Pentium IV, 2.4GHz, 512KB, 533MHz, Socket 478	
256M RAM	
Passive Backplane	
Industrial Case	
Redundant Power Supply	
RAID Controller Device	
Hard Drive, 40Gig	
CD ROM/Floppy Combo Drive	
Misc Cables	
Digital I/O Card	
Linux Operating System 8.0	
Bea Message Queue version 5.0	

2. ACS VECTOR EXPRESS LANE ELECTRONICS AND AVC EQUIPMENT

The ACS Vector Lane Electronics equipment provides interface and control for the Automatic Vehicle Classification (AVC) equipment, provided by Peek Traffic Corp. The Peek equipment is installed in the ACS Lane Electronics Cabinet, supplied by ACS, and in the roadway. The Peek AVC major system components are as follows:

Product Description	Part Number	Vendor	
PEEK Loop Detection System –	82-1616-03	PEEK	

nbedded SmartToll unit and Idris software. Includes 10 position rack, 2 main Idris detectors and 2 Axle Idris detectors IDRIS software version N			

3. ACS VECTOR EXPRESS VIOLATION ENFORCEMENT SYSTEM

The Video Enforcement System equipment is supplied by PULNiX. Major components are as follows:

Product Description	Part Number	Vendor	
PULNiX VIC Image Capture Computer W/ PULNiX/ACS software version 1.8	VIC/4U	PULNIX	
PULNiX J-Panel	VIS-J-Panel	PULNIX	
PULNiX Camera	VISCAM-200	PULNIX	
PULNiX Flash	TNF-20B	PULNIX	
PULNiX Light Sensors	TLS-200A	PULNIX	

ACS Vector Express AVI System

The AVI equipment is supplied by Mark IV. The major equipment components required are as follows:

Product Description	Part Number	Vendor	
Mark IV Badger Reader with Memory Upgrade – RS 422	800740-302	Mark IV	
Field Cabinet	800127-101	Mark IV	
Antenna IAG-2 Lane Kit	800122-012	Mark IV	
Badger Reader with 8 MB - RS 422	800740-202	Mark IV	

Note: The Roadcheck readers currently operating in the PANYNJ traditional toll lanes that are not 800680 series readers cannot be upgraded to Badger readers or accept memory upgrade. Therefore, at each plaza where open highway E-ZPass is installed the purchase of a Badger reader for use in the traditional toll lanes may be required, in addition to the Badger reader required for the high speed lanes.

Rich Bastan
[illegible]

Xerox State & Local Solutions, Inc.
[illegible]
[illegible], MD [illegible]

[illegible]
[illegible]
[illegible]

October 2, 2013

Mr. Charlie Fausti
Port Authority of NY & NJ
4 Montgomery Street
4th floor
Jersey City, NJ 07302

Re: Contract for Integrated Toll Collection System (ITCS) In-Lane Maintenance and System Administration Services and E-ZPass Plus System Administration Services: Contract # 4600006009 / Option Year term of service (01/01/016-12/31/016)

Dear Mr. Fausti:

Xerox Services is pleased to provide this offer letter of notification for an additional option year Xerox maintenance service for the period of January 1, 2016 through December 31, 2016.

The Option year for this proposed term of service will follow the scope and terms and conditions of our current contract in effect reference as; Integrated Toll Collection System (ITCS) In-Lane Maintenance and System Administration Services and E-ZPass Plus System Administration Services: Contract # 4600006009.

The annual cost of the option year term for the period of January 1, 2016 through December 31, 2016 is estimated to be $5,117,712.

Xerox appreciates the opportunity to assist the Authority in achieving their business objectives and trust our proposal will be viewed favorably. Please contact Mark Cantelli via telephone at 301-820-4205 or e-mail: mark.cantelli@xerox.com should you require any additional clarification regarding this additional maintenance option year offer letter of notification.

Sincerely,

Rich Bastan
Group President
Xerox State & Local Solutions, Inc.

EXHIBIT A - Revised June 13, 2014

Revised Cost Proposal Sheets (including ORT lanes and spares)

Itemized Preventive and Remedial Maintenance and Repairs

Tunnel, Holland Tunnel and Training Academy

ITCS item	(A) Monthly Maintenance and Remedial Repair Cost per Item of Equipment	(B)[5] Number of Items of Equipment at all Facilities	(C) Estimated Total Monthly Maintenance and Remedial Repair Cost per Item of Equipment
AVI Antenna[1] (Mark IV Service & Spare Parts)	$ 41.84	73	$ 3,054
AVI Reader[1](Mark IV Service & Spare Parts)	$ 469.83	13	$ 6,108
AVI UPS[1](Mark IV Service & Spare Parts)	$ 352.38	13	$ 4,581
Booth Equipment[2]	$ 447.56	58	$ 25,959
ETC Canopy Traffic Light	$ 44.26	69	$ 3,054
Communications[3]	$ 458.09	Quantity N/A	$ 458
Deposit workstation equipment	$ 47.72	24	$ 1,145
Driver Feedback Sign and Traffic Light	$ 98.67	58	$ 5,723
Lane Controller	$ 376.37	71	$ 26,722
Lane Mode Sign	$ 398.34	69	$ 27,486
Loops	$ 153.32	209	$ 32,043
ORT Lane Electronic Components	$ 152.70	2	$ 305
ORT Loops (2 axle, 6 Main)	$ 23.47	8	$ 188
ORT Light Sensors	$ 99.25	2	$ 199
Overhead Vehicle Profiler	$ 287.69	69	$ 19,851
Plaza Supervisor workstation	$ 45.81	10	$ 458
Treadle[4]	$ 97.37	69	$ 6,719
UPS-Lane Controller	$ 236.57	71	$ 16,796
VES Equipment (including lights)	$ 659.13	139	$ 91,619
VES Equipment (including lights) -ORT	$ 610.79	10	$ 6,108
Video Monitoring & VCR	$ 75.20	8	$ 602
VES VIC Computers -- ORT	$ -	3	$ -
Training Academy:			
Booth Equipment	$ 248.13	8	$ 1,985
Deposit workstation	$ 38.17	2	$ 76
Plaza Workstation	$ 38.17	4	$ 153

Total Estimated Monthly Maintenance Cost at River Crossings or TB&T

$ $ 281,390

(Sum of column [C])

1. Mark IV diagnostic and service replacement
2. Includes ETC override switches located in separate enclosures attached to the lane controller cabinets at GWB.
3. PAWNET connection at each Plaza and related ITCS network equipment and connection.
4. Includes maintenance of treadle drains

Note: All prices will be inclusive of parts and replacement costs if required, and personnel costs. Also, all prices will cover components and subcomponents related to ITCS

EXHIBIT B

Cost Proposal Sheets
Computerized Maintenance Management System
River Crossings or TB&T

Software	**Cost per Authority Licensed User**	**Required Number of Authority Licensed Users**	**Monthly Total**
Software Licenses (per user)	$ 1,009.66	**3**	$ 3,028.99
Other		**3**	
Other:		**3**	
Other:		**3**	
Other:		**3**	
Other:		**3**	
Other:		**3**	

Total Monthly Price for Computerized Maintenance Management System at all River Crossings or TB&T (sum of column "Monthly Total") **$ 3028.99**

EXHIBIT C - Revised June 13, 2014

Cost Proposal Sheets – System Administration Services and Hardware/Software Support

River Crossings or TB&T

I. Total Monthly Price for System Administration at all River Crossings or TB&T	**$**	$ 34,352.04
II. Total Estimated Monthly cost for ACS Proprietary Software Support for the ECH	**$**	$ 7,763.12
III. Total Estimated Monthly cost for IBM Hardware Maintenance Licenses and OBX ORT license cost	**$**	$ 31,757.11
IV. Total Estimated Monthly cost for Oracle Software Support	**$**	$ 4,933.29
V. Total Estimated Annual cost for COTS Software Support (non-Oracle)	**$**	$ 2,782.00
Total Monthly Price for System Administration and Harware and Software Support at all River Crossings or TB&T	**$**	$ 81,587.56
		(Sum of I through V above)

Notes:

1. For the purpose of this proposal, the yearly cost for H/S support will calculated as a monthly charge.

EXHIBIT D - Revised Revised June 13, 2014

Cost Proposal Sheets - System Administration Services and Hardware/Software Support Aviation

I. Total Monthly Price for System Administration for the ACH	**$**	$	10,996.76
II. Total Estimated Monthly cost for ACS Proprietary Software Support for the ACH	**$**	$	1,440.78
III. Total Estimated Monthly cost for Actuate Hardware/Software Support	**$**	$	2,906.77
Total Monthly Price for System Administration, Hardware and Software Support for Aviation	**$**	$	15,344.31
			(Sum of I through III above)

Notes:

1. For the purpose of this proposal, the yearly cost for H/S support will calculated as a monthly charge.

EXHIBIT E

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services and Additional Repairs due to negligence not the River Crossings or TB&T
Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regualr Hourly Rate*	10	$ 120.50	$ 1,205.04
Data Base Administrator Overtime Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 120.50	$ 602.52
System Administrator Regular Hourly Rate*	10	$ 96.84	$ 968.35
System Administrator Overtime Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Premium Overtime Hourly Rate*	5	$ 96.84	$ 484.18

Total Estimated Monthly Additional System Administration **$** $ 4,346.77

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

Maintenance and Repair Personnel	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly AdditionalRepairs due to negligence not the faultof the Contractor
Laborers Regular Hourly Rate*	15	$ 97.43	$ 1,461.47
Laborers Overtime Regular Hourly Rate*	10	$ 137.35	$ 1,373.53
Laborers Premium Hourly Rate*	5	$ 177.27	$ 886.37
Elecricians Regular Hourly Rate*	15	$ 146.78	$ 2,201.74
Electrian Overtime Hourly Rate*	10	$ 211.39	$ 2,113.85
Electrians Premium Overtime Hourly Rate*	5	$ 276.00	$ 1,380.00
Mechanics Regular Hourly Rate*	15	$ 115.84	$ 1,737.56
Mechanics Overtime Hourly Rate*	10	$ 164.96	$ 1,649.62
Mechanic Premium Overtime Hourly Rate*	5	$ 214.09	$ 1,070.43

Total Estimated Monthly Additional Repairs due to negligence **$** $ 13,874.56

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours”

**Wage rates shall be all-inclusive including overhead, taxes, including tolls, travel time, cost of vehicle use and profit.

List additional personnel if appropriate to the submitted Proposal.

The above additional maintenance and repair personnel rates shall be for loss or damage caused by willful of negligent acts by third persons not the fault of the Contractor or for Extra Work if ordered by the Authority.

EXHIBIT F

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services
Aviation (for ACH)

This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regualr Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Overtime Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 120.50	$ 602.52
System Administrator Regular Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Overtime Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Premium Overtime Hourly Rate*	5	$ 96.84	$ 484.18

Total Estimated Monthly Additional System **$** $ 3,260.08

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours"

**Wage rates shall be all-inclusive including overhead, taxes, including tolls, travel time, cost of vehicle use and profit.

List additional personnel if appropriate to the submitted Proposal.

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

EXHIBIT G - Revised June 13, 2014

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services and Additional Repairs for Non-River Crossings or TB&T
Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regualr Hourly Rate*	10	$ 120.50	$ 1,205.04
Data Base Administrator Overtime Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 120.50	$ 602.52
System Administrator Regular Hourly Rate*	10	$ 96.84	$ 968.35
System Administrator Overtime Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Premium Overtime Hourly Rate*	5	$ 96.84	$ 484.18

Total Estimated Monthly Additional System Administration **$** $ 4,346.77

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

Maintenance and Repair Personnel	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Repairs and maintenance for non-emergency extra work
Laborers Regular Hourly Rate*	15	$ 97.43	$ 1,461.47
Laborers Overtime Regular Hourly Rate*	10	$ 137.35	$ 1,373.53
Laborers Premium Hourly Rate*	5	$ 177.27	$ 886.37
Elecricians Regular Hourly Rate*	15	$ 146.78	$ 2,201.74
Electrian Overtime Hourly Rate*	10	$ 211.39	$ 2,113.85
Electrians Premium Overtime Hourly Rate*	5	$ 276.00	$ 1,380.00
Mechanics Regular Hourly Rate*	15	$ 115.84	$ 1,737.56
Mechanics Overtime Hourly Rate*	10	$ 164.96	$ 1,649.62
Mechanic Premium Overtime Hourly Rate*	5	$ 214.09	$ 1,070.43

Total Estimated Monthly Repairs and Maintenance for non-emerg **$** $ 13,874.56

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours"

**Wage rates shall be all-inclusive subject, but not limited to, overhead, taxes, including tolls, travel time, cost of vehicle use and profit. The rates set forth above shall not be subject to mark up as set forth in Section 13. Compensation for Extra Work of Part II - General Contract Provisions.

List additional personnel if appropriate to the submitted Proposal.

The above additional maintenance and repair personnel rates shall be for loss or damage caused by willful of negligent acts by third persons not the fault of the Contractor or for Extra Work if ordered by the Authority.

EXHIBIT H- Revised June 13, 2014

Cost Proposal Sheets

Skills & Hourly Rates/Additional System Administration Services for Non-Emergency Extra Work

Aviation (for ACH)

Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regular Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Overtime Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 120.50	$ 602.52
System Administrator Regular Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Overtime Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Premium Overtime Hourly Rate*	5	$ 96.84	$ 484.18

Total Estimated Monthly Additional System Administration Personnel Aviationfor Non-emergency Extra Work **$** $ 3,260.08

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours”

**Wage rates shall be all-inclusive subject, but not limited to, overhead, taxes, including tolls, travel time, cost of vehicle use and profit. The rates set forth above shall not be subject to mark up as set forth in Section 13. Compensation for Extra Work of Part II - General Contract Provisions.

List additional personnel if appropriate to the submitted Proposal.

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

EXHIBIT I - Revised June 13, 2014

Cost Proposal Sheets - Price Summary Sheet

Item	Category of Work	Estimated Price
1.	**From Exhibit "A"** Estimated Monthly Preventative and Remedial Maintenance and Repairs at all River Crossings or TB&T.	$ 281,390.22
2.	**From Exhibit "B"** Estimated Monthly Computerize Maintenance Management System at River Crossings or TB&T.	$ 3,028.99
3.	**From Exhibit "C"** Estimated Monthly System Administration Services and Harware/Software Support at River Crossings or TB&T.	$ 81,587.56
4.	**From Exhibit "D"** Estimated Monthly System Administration Services and Hardware/Software Support (for ACH) at Aviation.	$ 15,344.31
5.	**From Exhibit "E"** Estimated Monthly Extra Services for System Administration Personnel and Maintenance and Repair Personnel- River Crossings or TB&T.	$ 18,221.34
6.	**From Exhibit "F"** Estimated Monthly Extra Services, System Administration Personnel (for ACH) - Aviation	$ 3,260.08
7	**From Exhibit "G"** Estimated Monthly Non-Emergency Extra Work Services for System Administration Personnel and Maintenance and Repair Personnel- River Crossings or TB&T.	$ 18,221.34
8	**From Exhibit "H"** Estimated Monthly Non-Emergency Extra Work Services, System Administration Personnel (for ACH) - Aviation	$ 3,260.08

I. River Crossings or TB&T:

TOTAL ESTIMATED CONTRACT EXTENSION PRICE: River Crossings or TB&T

A. $ 4,829,393.27

(Multiply Total Estimated Price of Items 1, 2, 3, 5 and 7 by 12 months; from 1/1/17-12/31/17)

B. $ 18,221.34

(Insert the one-time charge from Item 7)

II. Aviation:

TOTAL ESTIMATED CONTRACT EXTENSION PRICE: Aviation

$ 262,373.66

(Multiply Total Estimated Price of Item 4, 6 and 8 by 12 months, from 1/1/17-12/31/17)

TOTAL EST. CONTRACT PRICE FOR ONE YEAR

$ 5,109,988.26

(Sum of I.A., I.B., and II above)

IBM quotes for ECH upgrade:	Qty
1) x3650 M4 - Annual Essential Support 24x7 4 Hour Response	9
2) V5000 Control and Expansion Shelves (Primary Location)	10
a) IBM System Storage Storwize V5000 Software Maintenance	
b) IBM v5000 Hardware Maintenance	
3) V5000 Control and Expansion Shelves (DR Location)	7
a) IBM System Storage Storwize V5000 Software Maintenance	
b) IBM v5000 Hardware Maintenance	

Software maintenenace included in pricing:	Qty
1) WebSphere Base license - Application Server - Annual Maintenance	2
2) Oracle EE (CPU license) - Annual Maintenance - primary / secondary	12
3) Oracle ADG (CPU License) - Annual Maintenance	12
4) Oracle PART (CPU License) - Annual Maintenance	12
5) Crystall Reports - Annual Maintenance	4
6) Linux Enterprise Server - Redhat - Annual License	5

Ken Philmus
Senior Vice President and Managing Director
Transportation Solutions Group

ACS, A Xerox Company
375 McCarter Highway
Newark, NJ 07114

Ken.philmus@acs-inc.com
tel 973.368.1518

September 10. 2010

James Summerville
Senior Buyer
Port Authority of NY and NJ
One Madison Avenue
New York City, New York 10010

Dear Mr. Summerville:

We are pleased to provide this change order proposal for ITCS maintenance services pursuant to your request of August 27th, 2010. We know that the Authority fully appreciates that the age of the systems prevents it from being maintained with the same economy as it could before the system reached end-of-life.

ACS is very interested in continuing its work with the Port Authority so we have worked hard with our finance and engineering maintenance team to provide you with continued coverage at a rate comparable to our present contract. We did find it necessary to make an adjustment for the costs related to increased replacement parts and aging equipment based on what we have experienced in our past few years of performing this maintenance contract. This is to be expected given that this contract will run to ten years beyond the start of the last contract which we priced in 2005.

Here is the method we used to derive the contract costs. At the end of the current contract, Price Index adjustments will bring the maintenance contract to slightly over $3.2MM per year. With this as a starting point, we have calculated the price for the 2012 to 2014 period using a projected expense growth rate of 5% on top of the current price index increase. Together, these will cover replacement parts and all other increased maintenance costs. Our pricing is provided in the attached price forms.

Assumptions:

- **Mark IV AVI Equipment** - Contract Section 2.A.b Mark IV AVI Equipment applies: "ACS will enter into a maintenance contract with Mark IV on behalf of the PANYNJ. This maintenance contract will be consistent with the terms and conditions of the IRO and will be invoiced separately with no mark ups. Mark IV will be responsible for providing all labor and materials in conduct of the maintenance agreement including, but not limited to, MOT, bucket trucks, RF power meters, oscilloscope, spectrum analyzers, etc. All AVI maintenance activities will be coordinated through ACS with advance notice. In the event the PANYNJ changes AVI vendors within the term of this agreement, ACS will enter into similar maintenance agreement and invoice the PANYNJ separately for this maintenance contract."
- **Period** - Since this new extension price will exceed the price of the existing contract's second option, we used a start date after the 120 day bridge period. The new 2012-2014 base period will run for a period of 35months from February 1, 2012 to December 31, 2015.
- **Limitations** - In keeping with ACS's current practices, monthly liquidated damages will be capped at 10% of the monthly maintenance fee. This protects ACS from performance problems arising from the anticipated increase in end-of-life failures of

individual components and from new obsolescence issues. In addition, Liability will be limited to 20% of the value of the contract and ACS will not be liable for indirect, incidental, special, punitive or consequential damages.

- **Maintenance of Traffic** – ACS will perform and implement the maintenance and protection of traffic as depicted in Attachment 1 of the base contract.

  In April of this year the MOT for the OBX ORT lanes modified the requirement by starting the closure point to begin at the NJ side of the bridge and extending throughout the entire span of the bridge. This represented a change to the original requirement for MOT. The estimated cost for semi-annual preventive maintenance activity for the OBX ORT lanes is included in this proposal. We routinely work with PANYNJ to try and join ORT closures by other contractors thus eliminating the need for ACS to take on the closure responsibilities.

  Note: Any OBX ORT closures beyond the semi-annual PM's within a year will be charged on a time and material basis.

- **Organization and Communication** - As a result of the "lean" part of the "Xerox Lean Six-Sigma" approach ACS is adopting, we will be improving communication with and access to oversight personnel for the on-site functional staff by eliminating management tiers in the command chain. We will implement a formal communication plan with clear responsibilities for who to go to for various functions. As part of this organizational approach, we will have a full time program manager at our headquarters to focus communication and facilitate obtaining and expediting resources needed by field personnel.

- **Obsolescence** – ACS understands the PANYNJ position on adding any additional bureaucracy to the program which was not the intent of our proposal. The Obsolescence Management program would have established procedures for identifying, evaluating, testing, and implementation of replacements for obsolete components. PANYNJ should note by not accepting this effective part of the program we lack any specificity on how these very likely events will be handled, not to mention the components for which we have already identified and exhausted replacement solutions.

  Therefore, the performance levels or standards that are related to those components we have identified as obsolete, including, Overhead Vehicle Separator (TOM), Lane Mode Sign (LMS), Manual Lane Terminal (touch screens), and Violation Enforcement System (cameras, lights, lens) will need to be eliminated. Penalties for maintenance activities related to these devices such as response and repair times, lane availability, inventory management, and others will need to be waived during this extension period. This waiver does not relieve ACS from performing the duties and obligation of the contract to the best of their ability given the current state of the system.

- **Software Support** – Help Desk and Software Modifications will be performed pursuant to Section 4. ACS Proprietary Software Support System and Section 4.b Software Modifications.

ACS is committed to improving the operational levels of the current system in a cost effective manner. We suggest a meeting at your earliest convenience to review this proposal and to jointly refine overall approach.

ACS appreciates the opportunity to assist the Authority in achieving their business objectives and trusts our proposal will be viewed favorably. Please contact Charlie Mitchell at (914) 388.7168 with any questions and to make arrangements for the meeting.

Sincerely,

ACS State and Local Solutions, Inc.

By:

Ken Philmus

CC:
Charlie Fausti, PANYNJ, Senior Program Manager, E-ZPass Projects
Jerry Ingersoll, PANYNJ, E-ZPass Maintenance Manager
Alan Allegretto, ACS, Vice President, Director ETC Programs
Mark Shannon, ACS MD, Director of IT
Helen Barton, ACS NJ, VP of Operations
Mark Cantelli, ACS MD, Chief Technology Officer
Matt Dovens, ACS MD, Senior Director of Engineering
Carlos Mata, ACS NJ, Maintenance Manager
Charlie Mitchell, ACS NY, Account Executive

EXHIBIT A - Revised June 11, 2010

Revised Cost Proposal Sheets (including ORT lanes and spares)

Itemized Preventive and Remedial Maintenance and Repairs

Tunnel, Holland Tunnel and Training Academy

ITCS item	(A) Monthly Maintenance and Remedial Repair Cost per Item of Equipment	(B)[5] Number of Items of Equipment at all Facilities	(C) Estimated Total Monthly Maintenance and Remedial Repair Cost per Item of Equipment
AVI Antenna[1] (Mark IV Service & Spare Parts)	$ 38.25	73	$ 2,792.03
AVI Reader[1](Mark IV Service & Spare Parts)	$ 429.54	13	$ 5,584.06
AVI UPS[1](Mark IV Service & Spare Parts)	$ 322.16	13	$ 4,188.05
Booth Equipment[2]	$ 409.18	58	$ 23,732.27
ETC Canopy Traffic Light	$ 40.46	69	$ 2,792.03
Communications[3]	$ 418.80	Quantity N/A	$ 418.80
Deposit workstation equipment	$ 43.63	24	$ 1,047.01
Driver Feedback Sign and Traffic Light	$ 90.21	58	$ 5,232.27
Lane Controller	$ 344.09	71	$ 24,430.28
Lane Mode Sign	$ 364.18	69	$ 25,128.29
Loops	$ 140.27	209	$ 29,316.33
ORT Lane Electronic Components	$ 139.60	2	$ 279.20
ORT Loops (2 axle, 6 Main)	$ 21.46	8	$ 171.71
ORT Light Sensors	$ 90.74	2	$ 181.48
Overhead Vehicle Profiler	$ 263.02	69	$ 18,148.21
Plaza Supervisor workstation	$ 41.88	10	$ 418.80
Treadle[4]	$ 89.02	69	$ 6,142.47
UPS-Lane Controller	$ 216.28	71	$ 15,356.18
VES Equipment (including lights)	$ 602.60	139	$ 83,760.96
VES Equipment (including lights) -ORT	$ 558.41	10	$ 5,584.06
Video Monitoring & VCR	$ 68.75	8	$ 550.03
VES VIC Computers -- ORT	$ 93.07	3	$ 279.20
Training Academy:			
Booth Equipment	$ 226.85	8	$ 1,814.82
Deposit workstation	$ 34.90	2	$ 69.80
Plaza Workstation	$ 34.90	4	$ 139.60

Total Estimated Monthly Maintenance Cost at River Crossings or TB&T

$ 257,557.96

(Sum of column [C])

1. Mark IV diagnostic and service replacement
2. Includes ETC override switches located in separate enclosures attached to the lane controller cabinets at GWB.
3. PAWNET connection at each Plaza and related ITCS network equipment and connection.
4. Includes maintenance of treadle drains

Note: All prices will be inclusive of parts and replacement costs if required, and personnel costs. Also, all prices will cover components and subcomponents related to ITCS

EXHIBIT B

Cost Proposal Sheets
Computerized Maintenance Management System
River Crossings or TB&T

Software	**Cost per Authority Licensed User**	**Required Number of Authority Licensed Users**	**Monthly Total**
Software Licenses (per user)	$ 967.07	**3**	$ 2,901.21
Other		**3**	
Other:		**3**	
Other:		**3**	
Other:		**3**	
Other:		**3**	
Other:		**3**	

Total Monthly Price for Computerized Maintenance Management System at all River Crossings or TB&T (sum of column "Monthly Total") **$ $ 2,901.21**

EXHIBIT C - Revised June 11, 2010

Cost Proposal Sheets – System Administration Services and Hardware/Software Support

River Crossings or TB&T

I. Total Monthly Price for System Administration at all River Crossings or TB&T	**$**	29774.65
II. Total Estimated Monthly cost for ACS Proprietary Software Support for the ECH	**$**	5520.00
III. Total Estimated Monthly cost for HP/Compaq Hardware/Software Support	**$**	8054.60
IV. Total Estimated Monthly cost for Oracle RDB Software Support	**$**	506.00
V. Total Estimated Monthly cost for BEA MessageQ Software Support	**$**	506.00
Total Monthly Price for System Administration and Hardware and Software Support at all River Crossings or TB&T	**$**	44361.25 (Sum of I through V above)

Notes:

1. For the purpose of this proposal, the yearly cost for H/S support will calculated as a monthly charge.

EXHIBIT D - Revised June 11, 2010

Cost Proposal Sheets - System Administration Services and Hardware/Software Support Aviation

I. Total Monthly Price for System Administration for the ACH	**$**	10,532.85
II. Total Estimated Monthly cost for ACS Proprietary Software Support for the ACH	**$**	1,380.00
III. Total Estimated Monthly cost for Actuate Hardware/Software Support	**$**	2,784.15
Total Monthly Price for System Administration, Hardware and Software Support for Aviation	**$**	14,697.00 (Sum of I through III above)

Notes:

1. For the purpose of this proposal, the yearly cost for H/S support will calculated as a monthly charge.

EXHIBIT G

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services and Additional Repairs due to negligence not River Crossings or TB&T
Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regular Hourly Rate*	10	$ 115.42	$ 1,154.23
Data Base Administrator Overtime Hourly Rate*	5	$ 115.42	$ 577.12
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 115.42	$ 577.12
System Administrator Regular Hourly Rate*	10	$ 92.75	$ 927.50
System Administrator Overtime Hourly Rate*	5	$ 92.75	$ 463.75
System Administrator Premium Overtime Hourly Rate*	5	$ 92.75	$ 463.75

Total Estimated Monthly Additional System Administration **$** 4,163.47

The above rates by the Contractor shall be for additional System Administration Services as ordered by the Authority.

Maintenance and Repair Personnel	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional Repairs due to negligence not the fault of the Contractor
Laborers Regular Hourly Rate*	15	$ 85.86	$ 1,287.90
Laborers Overtime Regular Hourly Rate*	10	$ 121.04	$ 1,210.41
Laborers Premium Hourly Rate*	5	$ 156.22	$ 781.11
Electrician Regular Hourly Rate*	15	$ 129.35	$ 1,940.28
Electrician Overtime Hourly	10	$ 186.28	$ 1,862.84
Electricians Premium Overtime Hourly Rate*	5	$ 243.22	$ 1,216.09
Mechanics Regular Hourly Rate*	15	$ 102.08	$ 1,531.17
Mechanics Overtime Hourly Rate*	10	$ 145.37	$ 1,453.68
Mechanic Premium Overtime Hourly Rate*	5	$ 188.66	$ 943.29

Total Estimated Monthly Additional Repairs due to negligen **$** 12,226.78

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours”

**Wage rates shall be all-inclusive including overhead, taxes, including tolls, travel time, cost of vehicle use and profit.

List additional personnel if appropriate to the submitted Proposal.

The above additional maintenance and repair personnel rates shall be for loss or damage caused by willful of negligent acts by third persons not the fault of the Contractor or for Extra Work if ordered by the Authority.

EXHIBIT H

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services
Aviation (for ACH)

This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regular Hourly Rate*	5	$ 115.42	$ 577.12
Data Base Administrator Overtime Hourly Rate*	5	$ 115.42	$ 577.12
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 115.42	$ 577.12
System Administrator Regular Hourly Rate*	5	$ 92.75	$ 463.75
System Administrator Overtime Hourly Rate*	5	$ 92.75	$ 463.75
System Administrator Premium Overtime Hourly Rate*	5	$ 92.75	$ 463.75

Total Estimated Monthly Additional System **$** 3122.601

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours"

**Wage rates shall be all-inclusive including overhead, taxes, including tolls, travel time, cost of vehicle use and profit.

List additional personnel if appropriate to the submitted Proposal.

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

EXHIBIT K - Revised June 11, 2010

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services and Additional Repairs for Non-Emergency River Crossings or TB&T
Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regular Hourly Rate*	10	$ 115.42	$ 1,154.23
Data Base Administrator Overtime Hourly Rate*	5	$ 115.42	$ 577.12
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 115.42	$ 577.12
System Administrator Regular Hourly Rate*	10	$ 92.75	$ 927.50
System Administrator Overtime Hourly Rate*	5	$ 92.75	$ 463.75
System Administrator Premium Overtime Hourly Rate*	5	$ 92.75	$ 463.75

Total Estimated Monthly Additional System Administration **$** 4163.468

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

Maintenance and Repair Personnel	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Repairs and maintenance for non-emergency extra work
Laborers Regular Hourly Rate*	15	$ 85.86	$ 1,287.90
Laborers Overtime Regular Hourly Rate*	10	$ 121.04	$ 1,210.41
Laborers Premium Hourly Rate*	5	$ 156.22	$ 781.11
Electrician Regular Hourly Rate*	15	$ 129.35	$ 1,940.28

Electrician Overtime Hourly Rate*	10	$ 186.28	$ 1,862.84
Electricians Premium Overtime Hourly Rate*	5	$ 243.22	$ 1,216.09
Mechanics Regular Hourly Rate*	15	$ 102.08	$ 1,531.17
Mechanics Overtime Hourly Rate*	10	$ 145.37	$ 1,453.68
Mechanic Premium Overtime Hourly Rate*	5	$ 188.66	$ 943.29

Total Estimated Monthly Repairs and Maintenance for non-emergen **$** 12226.782

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours"

**Wage rates shall be all-inclusive subject, but not limited to, overhead, taxes, including tolls, travel time, cost of vehicle use and profit. The rates set forth above shall not be subject to mark up as set forth in Section 13. Compensation for Extra Work of Part II - General Contract Provisions.

List additional personnel if appropriate to the submitted Proposal.

The above additional maintenance and repair personnel rates shall be for loss or damage caused by willful of negligent acts by third persons not the fault of the Contractor or for Extra Work if ordered by the Authority.

EXHIBIT L- Revised June 11, 2011

Cost Proposal Sheets

Skills & Hourly Rates/Additional System Administration Services for Non-Emergency Extra Work

Aviation (for ACH & TCH)

Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regular Hourly Rate*	5	$ 115.42	$ 577.12
Data Base Administrator Overtime Hourly Rate*	5	$ 115.42	$ 577.12
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 115.42	$ 577.12
System Administrator Regular Hourly Rate*	5	$ 92.75	$ 463.75
System Administrator Overtime Hourly Rate*	5	$ 92.75	$ 463.75
System Administrator Premium Overtime Hourly Rate*	5	$ 92.75	$ 463.75

Total Estimated Monthly Additional System Administration Personnel Aviation for Non-emergency Extra Work **$** 3122.601

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours”

**Wage rates shall be all-inclusive subject, but not limited to, overhead, taxes, including tolls, travel time, cost of vehicle use and profit. The rates set forth above shall not be subject to mark up as set forth in Section 13. Compensation for Extra Work of Part II - General Contract Provisions.

List additional personnel if appropriate to the submitted Proposal.
The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

EXHIBIT M - Revised June 11, 2010

Cost Proposal Sheets - Price Summary Sheet

Item	Category of Work	Estimated Price
1.	**From Exhibit "A"** Estimated Monthly Preventative and Remedial Maintenance and Repairs at all River Crossings or TB&T.	$ 257,557.96
2.	**From Exhibit "B"** Estimated Monthly Computerize Maintenance Management System at River Crossings or TB&T.	$ 2,901.21
3.	**From Exhibit "C"** Estimated Monthly System Administration Services and Hardware/Software Support at River Crossings or TB&T.	$ 44,361.25
4.	**From Exhibit "D"** Estimated Monthly System Administration Services and Hardware/Software Support (for ACH) at Aviation.	$ 14,697.00
5.	**From Exhibit "G"** Estimated Monthly Extra Services for System Administration Personnel and Maintenance and Repair Personnel- River Crossings or TB&T.	$ 16,390.25
6.	**From Exhibit "H"** Estimated Monthly Extra Services, System Administration Personnel (for ACH) - Aviation	$ 3,122.60
7	**From Exhibit "K"** Estimated Monthly Non-Emergency Extra Work Services for System Administration Personnel and Maintenance and Repair Personnel- River Crossings or TB&T.	$ 16,390.25
8	**From Exhibit "L"** Estimated Monthly Non-Emergency Extra Work Services, System Administration Personnel (for ACH & TCH) - Aviation	$ 3,122.60

I. River Crossings or TB&T:

TOTAL ESTIMATED CONTRACT EXTENSION PRICE: River Crossings or TB&T

A. $ $ 11,816,032.24

(Multiply Total Estimated Price of Items 1, 2, 3, 5 and 7 by 35 months; from 2/1/12-12/31/15)

B. $ $ 16,390.25

(Insert the one-time charge from Item 7)

II. Aviation:

TOTAL ESTIMATED CONTRACT EXTENSION PRICE: Aviation

$ $ 732,977.07

(Multiply Total Estimated Price of Item 4, 6 and 8 by 35 months; from 2/1/12-12/31/15)

TOTAL EST. CONTRACT PRICE FOR TWO YEARS

$ $ 12,549,009.31

(Sum of I.A., I.B., and II above)

THE PORT AUTHORITY OF NY & NJ

August 27, 2010

ACS State & Local Solutions, Inc.
1800 M. Street, N.W.
Washington, DC 20036
Attn: Ken Philmus

RE: ACS' Change Order Proposal for the extension of the Integrated Toll Collection System (ITCS) In-Lane Maintenance and System Administration Services and E-ZPass Plus System Administration Services: Contract #4600006009 / Purchase Order #4500043187

Dear Mr. Philmus:

Thank you for your Change Order Proposal to replace certain equipment maintained under the subject Contract, which expires on September 30, 2011. We acknowledge the difficulty to maintain ageing equipment. However, the Port Authority (the Authority) does not believe that replacing the equipment outlined in your Proposal is a sound investment at this time. Because we will replace the Authority's toll collection system (the System) in a few years, we cannot afford to divert valuable, scarce resources to implementing your proposed changes. We are also wary of the uncertain, possibly expensive ramifications of your proposed changes on the prospective proposers' designs of the new System, and of the undisclosed non-recurring engineering costs to deploy your proposed initiatives (e.g. Canopy Signs). And we hesitate to add another layer of bureaucracy in the Obsolescence Management Plan.

We appreciate your efforts to propose enhancements in the operation of the System. However, there should be less disruptive, less costly opportunities to extend the useful life of the current equipment. Take the LMS signs, for example. Though the original manufacturer of the signs went out-of-business in 2005, by working with ACS we have been able to maintain their operation. When it could no longer obtain the mechanism to control the movement of the scroll sign, ACS designed an alternative control mechanism for deployment thus far in fifteen lanes. The Authority has reimbursed ACS for the added expense of rebuilding the signs with the new mechanism. (By working together, ACS and the Authority should be able to avoid the proposed $30,000- to $70,000-per-lane-cost to replace the existing signs.)

The LMS signs exemplify the collaboration, ingenuity, and adaptation required to maintain the current system for the next few years. We are willing to work with ACS to identify similar opportunities.

Though we decline your Change Order Proposal, we still require your price proposal to maintain the System under the same terms and conditions of the subject Contract. According to the cover note of the subject Change Order Proposal, "Should the Authority not desire these enhancements, ACS would need to revisit the base maintenance pricing." We are unsure, then, if your maintenance extension-price proposal depends on the Authority's acceptance of the Change Order Proposal.

We would appreciate clarification of this matter as soon as possible. If your maintenance extension-price proposal is predicated on the Authority's acceptance of the Change Order Proposal, we hereby request a revised price proposal, using the spreadsheets attached hereto, to maintain the System until December 31, 2014 (with an option for an additional year at the Authority's discretion). As noted in our meeting with your colleagues on July 12th, it is very important to conclude negotiations on the extension of the maintenance of the System as soon as possible.

One Madison Avenue, 7th Floor
New York, NY 10010
T: 212 435 7000

THE PORT AUTHORITY OF NY & NJ

Therefore, **by 3:00 PM on September 10, 2010**, please either confirm that your maintenance extension-price proposal dated August 6, 2010 is not dependent on the Authority's acceptance of your Change Order Proposal or provide a revised maintenance extension-price proposal.

Please contact me if you have any questions.

Thank you,

James Summerville, Sr. Buyer
Port Authority of NY & NJ
Procurement Department
212-435-3954
jsummerville@panynj.gov

EXHIBIT A - Revised June 11, 2010

Revised Cost Proposal Sheets (including ORT lanes and spares)

Itemized Preventive and Remedial Maintenance and Repairs

Tunnel, Holland Tunnel and Training Academy

ITCS item	(A) Monthly Maintenance and Remedial Repair Cost per Item of Equipment	(B)[5] Number of Items of Equipment at all Facilities	(C) Estimated Total Monthly Maintenance and Remedial Repair Cost per Item of Equipment
AVI Antenna[1] (Mark IV Service & Spare Parts)		73	
AVI Reader[1](Mark IV Service & Spare Parts)		13	
AVI UPS[1](Mark IV Service & Spare Parts)		13	
Booth Equipment[2]		58	
ETC Canopy Traffic Light		69	
Communications[3]		Quantity N/A	
Deposit workstation equipment		24	
Driver Feedback Sign and Traffic Light		58	
Lane Controller		71	
Lane Mode Sign		69	
Loops		209	
ORT Lane Electronic Components		2	
ORT Loops (2 axle, 6 Main)		8	
ORT Light Sensors		2	
Overhead Vehicle Profiler		69	
Plaza Supervisor workstation		10	
Treadle[4]		69	
UPS-Lane Controller		71	
VES Equipment (including lights)		139	
VES Equipment (including lights) -ORT		10	
Video Monitoring & VCR		8	
VES VIC Computers -- ORT		3	
Training Academy:			
Booth Equipment		8	
Deposit workstation		2	
Plaza Workstation		4	

Total Estimated Monthly Maintenance Cost at River Crossings or TB&T

$ _____

(Sum of column [C])

1. Mark IV diagnostic and service replacement
2. Includes ETC override switches located in separate enclosures attached to the lane controller cabinets at GWB.
3. PAWNET connection at each Plaza and related ITCS network equipment and connection.
4. Includes maintenance of treadle drains

Note: All prices will be inclusive of parts and replacement costs if required, and personnel costs. Also, all prices will cover components and subcomponents related to ITCS

EXHIBIT B

Cost Proposal Sheets
Computerized Maintenance Management System
River Crossings or TB&T

Software	**Cost per Authority Licensed User**	**Required Number of Authority Licensed Users**	**Monthly Total**
Software Licenses (per user)		3	
Other		3	
Other:		3	
Other:		3	
Other:		3	
Other:		3	
Other:		3	

Total Monthly Price for Computerized Maintenance Management System at all River Crossings or TB&T (sum of column "Monthly Total") **$** _____

EXHIBIT C - Revised June 11, 2010

Cost Proposal Sheets – System Administration Services and Hardware/Software Support

River Crossings or TB&T

I. Total Monthly Price for System Administration at all River Crossings or TB&T	**$** _____
II. Total Estimated Monthly cost for ACS Proprietary Software Support for the ECH	**$** _____
III. Total Estimated Monthly cost for HP/Compaq Hardware/Software Support	**$** _____
IV. Total Estimated Monthly cost for Oracle RBD Software Support	**$** _____
V. Total Estimated Monthly cost for BEA MessageQ Software Support	**$** _____
Total Monthly Price for System Administration and Harware and Software Support at all River Crossings or TB&T	**$** _____ (Sum of I through V above)

Notes:

1. For the purpose of this proposal, the yearly cost for H/S support will calculated as a monthly charge.

EXHIBIT D - Revised June 11, 2010

Cost Proposal Sheets - System Administration Services and Hardware/Software Support Aviation

I. Total Monthly Price for System Administration for the ACH	**$**	_____
II. Total Estimated Monthly cost for ACS Proprietary Software Support for the ACH	**$**	_____
III. Total Estimated Monthly cost for Actuate Hardware/Software Support	**$**	_____
Total Monthly Price for System Administration, Hardware and Software Support for Aviation	**$**	_____ (Sum of I through III above)

Notes:

1. For the purpose of this proposal, the yearly cost for H/S support will calculated as a monthly charge.

EXHIBIT G

Cost Proposal Sheets

Skills & Hourly Rates/Additional System Administration Services and Additional Repairs due to negligence not the River Crossings or TB&T

Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regualr Hourly Rate*	10		
Data Base Administrator Overtime Hourly Rate*	5		
Data Base Administrator Premium Overtime Hourly Rate*	5		
System Administrator Regular Hourly Rate*	10		
System Administrator Overtime Hourly Rate*	5		
System Administrator Premium Overtime Hourly Rate*	5		

Total Estimated Monthly Additional System Administration $ _____

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

Maintenance and Repair Personnel	**Estimated Number of Hours per Month**	**All Inclusive Hourly Rate****	**Total Estimated Monthly AdditionalRepairs due to negligence not the faultof the Contractor**
Laborers Regular Hourly Rate*	15		
Laborers Overtime Regular Hourly Rate*	10		
Laborers Premium Hourly Rate*	5		
Elecricians Regular Hourly Rate*	15		
Electrian Overtime Hourly Rate*	10		
Electrians Premium Overtime Hourly Rate*	5		
Mechanics Regular Hourly Rate*	15		
Mechanics Overtime Hourly Rate*	10		
Mechanic Premium Overtime Hourly Rate*	5		

Total Estimated Monthly Additional Repairs due to negligence n **$** _____

* Refer to Section entitled "Definitions" for definitions of "Regular Working Hours", Overtime Working Hours" and "Premium Overtime Working Hours"

**Wage rates shall be all-inclusive including overhead, taxes, including tolls, travel time, cost of vehicle use and profit.

List additional personnel if appropriate to the submitted Proposal.

The above additional maintenance and repair personnel rates shall be for loss or damage caused by willful of negligent acts

EXHIBIT H

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services
Aviation (for ACH)

'his information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regualr Hourly Rate*	5		
Data Base Administrator Overtime Hourly Rate*	5		
Data Base Administrator Premium Overtime Hourly Rate*	5		
System Administrator Regular Hourly Rate*	5		
System Administrator Overtime Hourly Rate*	5		
System Administrator Premium Overtime Hourly Rate*	5		

Total Estimated Monthly Additional System $ _____

* Refer to Section entitled "Definitions" for definitions of "Regular Working Hours", Overtime Working Hours" and "Premium Overtime Working Hours"

**Wage rates shall be all-inclusive including overhead, taxes, including tolls, travel time, cost of vehicle use and profit.

List additional personnel if appropriate to the submitted Proposal.

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

EXHIBIT K - Revised June 11, 2010

Cost Proposal Sheets

Skills & Hourly Rates/Additional System Administration Services and Additional Repairs for Non-Emergency River Crossings or TB&T

Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regualr Hourly Rate*	10		
Data Base Administrator Overtime Hourly Rate*	5		
Data Base Administrator Premium Overtime Hourly Rate*	5		
System Administrator Regular Hourly Rate*	10		
System Administrator Overtime Hourly Rate*	5		
System Administrator Premium Overtime Hourly Rate*	5		

Total Estimated Monthly Additional System Administration $ _____

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

Maintenance and Repair Personnel	**Estimated Number of Hours per Month**	**All Inclusive Hourly Rate****	**Total Estimated Monthly Repairs and maintenance for non-emergency extra work**
Laborers Regular Hourly Rate*	15		
Laborers Overtime Regular Hourly Rate*	10		
Laborers Premium Hourly Rate*	5		
Elecricians Regular Hourly Rate*	15		
Electrian Overtime Hourly Rate*	10		
Electrians Premium Overtime Hourly Rate*	5		
Mechanics Regular Hourly Rate*	15		
Mechanics Overtime Hourly Rate*	10		
Mechanic Premium Overtime Hourly Rate*	5		

Total Estimated Monthly Repairs and Maintenance for non-emergen $ _____

* Refer to Section entitled "Definitions" for definitions of "Regular Working Hours", Overtime Working Hours" and "Premium Overtime Working Hours"

**Wage rates shall be all-inclusive subject, but not limited to, overhead, taxes, including tolls, travel time, cost of vehicle use and profit. The rates set forth above shall not be subject to mark up as set forth in Section 13. Compensation for Extra Work of Part II - General Contract Provisions.

List additional personnel if appropriate to the submitted Proposal.

The above additional maintenance and repair personnel rates shall be for loss or damage caused by willful of negligent

EXHIBIT L- Revised June 11, 2011

Cost Proposal Sheets

Skills & Hourly Rates/Additional System Administration Services for Non-Emergency Extra Work

Aviation (for ACH & TCH)

Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regular Hourly Rate*	5		
Data Base Administrator Overtime Hourly Rate*	5		
Data Base Administrator Premium Overtime Hourly Rate*	5		
System Administrator Regular Hourly Rate*	5		
System Administrator Overtime Hourly Rate*	5		
System Administrator Premium Overtime Hourly Rate*	5		

Total Estimated Monthly Additional System Administration Personnel Aviationfor Non-emergency Extra Work $ _____

* Refer to Section entitled "Definitions" for definitions of "Regular Working Hours", Overtime Working Hours" and "Premium Overtime Working Hours"

**Wage rates shall be all-inclusive subject, but not limited to, overhead, taxes, including tolls, travel time, cost of vehicle use and profit. The rates set forth above shall not be subject to mark up as set forth in Section 13. Compensation for Extra Work of Part II - General Contract Provisions.

List additional personnel if appropriate to the submitted Proposal.

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

EXHIBIT M - Revised June 11, 2010

Cost Proposal Sheets - Price Summary Sheet

Item	Category of Work	Estimated Price
1.	**From Exhibit "A"** Estimated Monthly Preventative and Remedial Maintenance and Repairs at all River Crossings or TB&T.	
2.	**From Exhibit "B"** Estimated Monthly Computerize Maintenance Management System at River Crossings or TB&T.	
3.	**From Exhibit "C"** Estimated Monthly System Administration Services and Harware/Software Support at River Crossings or TB&T.	
4.	**From Exhibit "D"** Estimated Monthly System Administration Services and Hardware/Software Support (for ACH) at Aviation.	
5.	**From Exhibit "G"** Estimated Monthly Extra Services for System Administration Personnel and Maintenance and Repair Personnel- River Crossings or TB&T.	
6.	**From Exhibit "H"** Estimated Monthly Extra Services, System Administration Personnel (for ACH) - Aviation	
7	**From Exhibit "K"** Estimated Monthly Non-Emergency Extra Work Services for System Administration Personnel and Maintenance and Repair Personnel- River Crossings or TB&T.	
8	**From Exhibit "L"** Estimated Monthly Non-Emergency Extra Work Services, System Administration Personnel (for ACH & TCH) - Aviation	

I. River Crossings or TB&T:

TOTAL ESTIMATED CONTRACT EXTENSION PRICE: River Crossings or TB&T

A. $ _____

(Multiply Total Estimated Price of Items 1, 2, 3, 5 and 7 by 39 months; from 10/1/11-12/31/14)

B. $ _____

(Insert the one-time charge from Item 7)

II. Aviation:

TOTAL ESTIMATED CONTRACT EXTENSION PRICE: Aviation

$ _____

(Multiply Total Estimated Price of Item 4, 6 and 8 by 39 months, from 10/1/11-12/31/14)

TOTAL EST. CONTRACT PRICE FOR TWO YEARS

$ _____

(Sum of I.A., I.B., and II above)

THE PORT AUTHORITY OF NY & NJ

PROCUREMENT DEPARTMENT
2 MONTGOMERY STREET, 3RD FLOOR
JERSEY CITY, NJ 07302

July 29, 2014

Xerox State & Local Solutions
12410 Milestone Center Drive
Germantown, MD 20876
Attn: Rich Bastan, Senior Vice President

RE: Change Order #1 to Contract 4600006009
Extension of Contract 4600006009
Extension of Contract 4600005761

Dear Mr. Bastan:

The Port Authority of New York and New Jersey (the "Authority") hereby accepts the price proposal from Xerox State & Local Solution ("Xerox"), as summarized in Xerox's letter dated July 21, 2014 (attached), to implement Change Order #1 to Contract 4600006009; extend Contract 4600006009; and extend Contract 4600005761.

1. Change Order #1 to Contract 4600006009:

   Under Change Order #1 to Contract 4600006009, Xerox shall provide the Authority with equipment, software, installation, testing, professional engineering services, and maintenance to extend the life of the existing Integrated Toll Collection System. The total price for such equipment and services, exclusive of maintenance, shall be $20,023,899.

   The requirements of Change Order 1 are set forth in the document entitled "ITCS Strategic Investment, Change Order #1 to Contract #4600006009 / Purchase Order # 4500043187, Integrated Toll Collection System (ITCS) In-Lane Maintenance and System Administration Services and E-Z Pass Plus System Administration Services" (attached).

   No other documents or submissions by Xerox, and no oral discussions or statements, are to be considered a part of this Change Order.

2. Extension of Contract 4600006009:

   Contract 4600006009 expires on December 31, 2014. The Authority has the right to renew the Contract for one additional year upon the same terms and conditions, subject to earlier termination or extension as provided for in the Contract.

The Authority shall also have the right to extend the Contract for an additional five- year period, from January 1, 2016 to December 31, 2020, subject to earlier termination or extension as provided for in the Contract. The Contract also provides for two additional one-year renewal periods upon the same terms and conditions.

Pricing for 2016 is set forth in Xerox's price sheets entitled "MAINTprice spreadsheets rev – XEROX completed – 2016 – 2014-07-17.xlxs," as accepted by the Authority. Pricing for the succeeding years of the Contract, including the options years (if exercised by the Authority), shall be determined according to the Section in the Contract entitled "Escalation."

Notes:

A. The "TOTAL ESTIMATED CONTRACT EXTENSION PRICE"S for 2016, as conveyed in Exhibit I of the aforementioned "MAINTprice spreadsheets," is hereby corrected and replaced by the summary of such pricing indicated in Xerox's letter dated July 21, 2014, as replicated below:

   "Extension of Maintenance Services for year 2016 reflected on Exhibit I. I.A:

River Crossings (TB&T):	$4,549,220.40
Aviation (ACH):	262,373.64
Total:	$4,811,594.04"

B. The Authority's decision to extend the Contract shall be conditioned upon Xerox's continuance of the Monitoring Agreement and Protocol put in place at the time the Contract was awarded.

3. <u>Extension of Contract 4600005761</u>:

The duration of Contract 4600005761 shall be extended to December 31, 2019, subject to earlier termination or extension as provided for in the Contract. The Authority shall have the option, at its sole discretion, to extend the Contract for three additional one-year periods upon the same terms and conditions.

Pricing for the extended period of the Contract is as follows:

2015: $20,250
2016: $81,000
2017: $81,000
2018: $81,000
2019: $81,000

In accordance with the insurance provisions of Contract 4600006009, and prior to the commencement of work, you shall submit an original Certificate of Insurance to the Port Authority of NY & NJ, General Manager, Risk Management, 225 Park Avenue South, 12th floor, New York, New York 10003.

The Authority's Manager for each Contract is Mr. Charles Fausti, who can be reached at 201-395-7251.

Please signify your concurrence by signing at the lower left and returning a signed copy of the letter to the attention of James Summerville, Procurement Department. One fully executed original of this letter will be returned to you following execution by the Port Authority.

If you have any questions, Mr. Summerville can be reached at (201) 395-3454.

Sincerely,

THE PORT AUTHORITY OF
NEW YORK AND NEW JERSEY

By: Lillian D. Valenti
Lillian Valenti

Title: Chief Procurement Officer

Date July 31, 2014

Agreed:

XEROX STATE AND LOCAL SOLUTIONS

By: _____
Rich Bastan

Title: Senior Vice President

Date: July 30, 2014

THE PORT AUTHORITY OF NY & NJ

Tunnels, Bridges & Terminals

ITCS Strategic Investment

Change Order #1 to Contract #4600006009 / Purchase Order # 4500043187

Integrated Toll Collection System (ITCS) In-lane Maintenance and System Administration Services and E-ZPass Plus System Administration Services

July 18, 2014

Table of Contents

1 Introduction 7

1.1 Definitions 9

1.2 Change Order Terms and Conditions 12

1.2.1 Adjustments to Service Level Agreement (SLA) 12

1.2.2 Insurance Procured by the Contractor 13

1.2.3 Net Cost Work 14

1.2.4 Compensation for Extra Work 15

1.2.5 Compensation for Emergency Delays 19

1.2.6 Idle Salaried Men and Equipment 19

1.2.7 Delays to Contractor 20

1.2.8 Prevailing Rate of Wage Certification 21

1.2.9 Extensions of Time 22

1.3 Changes to Contract 22

1.3.1 Contract Review and Compliance Audits 22

1.3.2 Authority Access to Records 23

1.4 Pass Thru Equipment 24

1.4.1 IBM, Lenovo and Cisco Procurements 24

2 Hardware Requirements 25

2.1 Non-environmentally Controlled Locations 25

2.2 Environmentally Controlled Interior Locations 25

3 System Requirements 26

3.1 Lane Controller Hardware and Equipment 26

3.2 Lane Controller Software 27

3.3 Violation Enforcement System 28

3.4 Overhead Laser Scanner 29
3.5 Network 29
3.6 Outerbridge Crossing (OBX) Open Road Tolling (ORT) 31
3.7 Close-up Lane Observation Camera Equipment 31
3.8 Lane Mode Sign 32
3.9 Replacement ITCS Supervisor and Deposit Workstations and Interface 33
3.10 ECH/CSC Interface (CSC CO #103) 34
3.11 ECH Re-platform and Upgrade 35
3.11.1 General Hardware & Software Requirements for ECH Re-platform and Upgrade 35
3.11.2 Transition Plan & Data Migration 36
3.11.3 Revenue Audit Function 36
3.11.4 Reports 36
3.11.5 Video Tolling Transaction 40
3.11.6 Image Review Process 40
3.11.7 Abusing Tags Management 40
3.11.8 ECH Storage Requirements 40
3.11.9 Off-line Storage 41
3.12 Training 41
3.12.1 Training Manuals and Materials 42
3.13 Lane Installation 42
3.13.1 Decommissioning of Lane 66 ITCS Equipment at GWB Lower Level 42
3.13.2 Relocation of Holland Tunnel Treadles 43
4 Schedule and Management 44
4.1 Kickoff Meeting 44
4.2 System Design Review Meetings 44

4.3 Project Schedule 45
4.4 Project Monthly Progress Report 45
5 Documentation 46
5.1 Detailed Design Documents (DDD) 46
5.2 Implementation Plan 46
5.2.1 Work Sequence 47
5.2.2 Checklists for Completeness of On-site Work 47
5.3 Detail Design Drawings, Shop Drawings, Catalog Cuts and Samples 47
5.3.1 Submittal Schedule 47
5.3.2 Submittal Format 48
5.4 Manuals 48
5.4.1 System Administration Manual 48
5.4.2 Operations Manual 48
5.4.3 Maintenance and Service Manual 48
5.4.4 Toll Collector Operating Manual 48
5.4.5 Toll Supervisor's Operating Manual 49
5.4.6 ECH Re-platform Training Manuals 49
5.5 Disaster Recovery Plan 49
5.6 Documentation Review and Approval Cycle 50
6 Testing 52
6.1 Factory Acceptance Test 53
6.2 On-Site First Installation Test (OFIT) 54
6.2.1 Lane OFIT 54
6.2.2 ECH OFIT 54
6.3 Field Checkout Test (FCOT) 54

6.3.1 Conventional Lane FCOT 54

6.3.2 OBX Express Lane FCOT 55

7 Maintenance and Spares 56

8 Maintenance of Traffic 56

9 Milestone Payments 56

10 Assumptions By Contractor 57

11 Hours of Work 58

12 Staging 60

13 Attachment 1 - CSC CO #103 63

14 Attachment 2 – Bill of Materials and Pricing Templates 65

15 Attachment 3 – Network Diagrams 67

16 Attachment 4 - Xerox Response to Authority Questions on ECH Upgrade and ECH to VECTOR Transaction Detail Mapping 89

17 Attachment 5 - Audit Department Controls Requirements Checklist 91

18 Attachment 6 - Applicable Authority Technical Specifications 99

19 Attachment 7 - Division 1 General Provisions 101

20 Attachment 8 – Technology Services Department (TSD) Standards & Guidelines for Port Authority Technology 157

21 Attachment 9 – ECH to VECTOR Transition Plan 159

22 Attachment 10 – Revenue Accounting Reconciliation and Toll Collector Audit Processes 161

23 Attachment 11 – ITRACS Algorithm Calculations 163

24 Attachment 12 – MOT Reference Drawings 165

-THIS PAGE INTENTIONALLY LEFT BLANK-

1 Introduction

Under this Change Order #1 to Contract #4600006009, Xerox (hereinafter called the "Contractor") shall provide the Port Authority of New York and New Jersey (the Authority) with equipment, software, installation, testing, professional engineering services, and maintenance to extend the life of the existing Integrated Toll Collection System (ITCS) hereinafter referred to as "ITCS Strategic Investment". These investments shall include, but are not limited to, the replacement of the following subsystems:

1. Lane Controller Equipment
2. Lane Controller and Electronic Central Host (ECH) Software
3. Violation Enforcement System (VES) Equipment
4. Overhead Laser Scanner (OLS) Equipment
5. Network Equipment
6. Outerbridge Crossing (OBX) Open Road Tolling (ORT) Equipment
7. Close-up Lane Observation Camera Equipment
8. Lane Mode Signs (LMS)
9. Replacement ITCS Deposit Workstations and Supervisor Workstations
10. ECH Re-platform and Upgrade including:
    a. ECH/CSC (Customer Service Center) Interface CSC CO#103 (hereafter CO#103)
    b. Storage Expansion for Video Tolling
    c. Incorporation of ITRACs functionality

As part of this Change Order, the Contractor shall perform site preparation work summarized below:

1. ARCHITECTURAL
    a. Cutting/patching of existing finishes as needed.
2. PLUMBING:
    a. Connect relocated treadles to existing plaza drainage system at the Holland Tunnel.
3. CIVIL:
    a. Excavation/paving of roadway to facilitate the Holland Tunnel treadle replacement
    b. Cut and patch island and roadway concrete as needed.
4. ELECTRICAL:
    a. Installation of new enclosures and power/communication conduits & cables as needed.
5. STRUCTURAL:
    a. Installation of equipment appurtenances as needed.
6. TRAFFIC:
    a. Construction Maintenance of Traffic (MOT) and Work Area Protection.
7. ENVIRONMENTAL:
    a. Alert the Authority to the potential presence or disturbance of any HAZMAT at any area of Work.
    b. Analysis and removal of incidental HAZ/MAT will be performed by the Authority if encountered by the Contractor at any area of Work.
    c. Allow the Authority approximately 4-6 weeks for removal and disposal of HAZMAT.

In the performance of this work, the Contractor shall comply with Attachment 6 - Applicable Authority Technical Specifications, Attachment 7 - Division 1 General Provisions and Attachment 8 – Technology Services Department (TSD) Standards & Guidelines for Port Authority Technology. Changes shall be deployed to the lanes defined in Table 1-1 below, as well as, at the TeleCenter, the Port Authority Technical Center (PATC) and the TB&T Training Academy at PATC, unless otherwise specified.

The Bayonne Bridge lanes and plaza level equipment are not included in the Scope of this Work.

Plaza	
Lane	Status
Bayonne Bridge	
2	Not Included
4	Not Included
6	Not Included
8	Not Included
Outerbridge Crossing (OBX) (7 lanes)	
2	ORT
4	ORT
8	
10	
12	
14	
16	
Goethals Bridge (8 Lanes)	
2	
4	
6	
8	
10	
12	
14	
16	
George Washington Bridge PIP (7 Lanes)	
34	
36	
38	
40	
42	
44	
46	
George Washington Bridge Lower Level (10 Lanes)	
54	
56	
58	
60	
62	
64	
66	Decommission
68	
70	
72	
74	

Plaza	
Lane	Status
GWB - Upper Level (12 Lanes)	
2	
4	
6	
8	
10	
12	
14	
16	
18	
20	
22	
24	
Holland Tunnel (9 Lanes)	
1	
2	
3	Relocate treadles
4	Relocate treadles
5	Relocate treadles
6	Relocate treadles
7	Relocate treadles
8	
9	
Lincoln Tunnel (14 Lanes)	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
23	
14 (XBL)	

Table 1-1: Lanes to be Upgraded

1.1 Definitions

The term “Contract” refers to “Contract for Integrated Toll Collection System (ITCS) In-lane Maintenance and System Administration Services and E-ZPass Plus System Administration Services Contract #4600006009, Purchase Order No. 4500043187 dated October 4, 2005.

The term "business days" or “working days” refers to a period of time and shall mean consecutive days during regular working hours with Saturdays, Sundays and holidays, excluded.

The term "business week", unless otherwise, specified, shall mean five (5) consecutive business days during regular working hours with Saturdays, Sundays, and holidays excluded.

The term "calendar days" in reference to a period of time shall mean consecutive calendar days, Saturdays, Sundays and holidays, included.

The term "calendar week", unless otherwise specified, shall mean seven (7) consecutive calendar days, Saturdays, Sundays, and holidays included.

The term "month", unless otherwise specified, shall mean a calendar month.

"Work" shall mean all structures, equipment, plant, labor, materials (including materials and equipment, if any, furnished by the Authority) and other facilities, and all other things necessary or proper for, or incidental to the activities at the Site of the Work.

The term "Site of the Work", "Facility" or words of similar import shall mean:

- River Crossings
  - Holland Tunnel
  - Lincoln Tunnel
  - George Washington Bridge
    - Upper Level
    - Lower Level
    - Palisades Parkway (PIP)
  - Goethals Bridge
  - Outerbridge Crossing
- The Port Authority Technical Center (PATC)
- Port Authority TeleCenter

"Director" shall mean the Director of Tunnels, Bridges, and Terminals Department and/or the Director of Aviation for the purpose of this Change Order, acting personally or through one of his/her authorized representatives for the purpose of this Change Order.

"Contract Manager" shall mean the person designated by the Director to manage all aspects of this Change Order or his/her successor in duties for the purpose of this Change Order, acting personally or through his/her duly authorized representative.

"TB&T Project Manager" shall mean the designated operational person or his/ her successor in duties within TB&T responsible for oversight of the functionality, as well as, testing and operational implementation of the toll collection system for the purpose of this Change Order, acting personally or through his/her duly authorized representative.

"Engineer" shall mean the Port Authority Resident Engineer or his/ her successor in duties assigned to administer the Work of this Change Order for the purpose of this Change Order, acting personally or through his/her duly authorized representative.

"Engineer of Record" shall mean a licensed Professional Engineer acting personally or through his/her duly authorized representative on behalf of the Contractor.

"Facility Manager" shall mean the General Manager of each of the "Work Sites" listed above or his/ her successor in duties for the purpose of this Change Order, acting personally or through his/her duly authorized representative.

"Inspector" shall mean the Port Authority Inspector assigned to this Work or his/ her successor in duties for the purpose of this Change Order, acting personally or through his/her duly authorized representative.

No persons other than those specifically identified above shall be deemed a representative of the Director or of the Contract Manager except to the extent specifically authorized in an express written notice to the Contractor signed by the Director or the Contract Manager, as the case may be. Further, no person shall be deemed a successor in duties of the Director unless the Contractor is so notified in writing signed by the Authority's Director of the Purchasing Department. No person shall be deemed a successor in duties of the Contract Manager unless the Contractor is so notified in writing signed by the Director.

"Subcontractor" shall mean anyone who performs Work (other than or in addition to the furnishing of materials, plant or equipment) at or about the Site of the Work directly or indirectly for or on behalf of the Contractor (and whether or not in privity of Contract with the Contractor), but shall not include any person who furnished merely his/her own personal labor or his/her own personal services. ”Subcontractor", however, shall exclude the Contractor or any subsidiary or parent of the Contractor or any person, firm or corporation which has a substantial interest in the Contractor or in which the Contractor or the parent or the subsidiary of the Contractor, or an officer or principal of the Contractor or of the parent or the subsidiary of the Contractor has a substantial interest, provided, however, that for the purpose of the clause hereof entitled "Assignments and Subcontracts" the exclusion in this paragraph shall not apply to anyone but the Contractor.

"Materialmen" shall mean anyone who furnishes materials, plant or equipment (including temporary or consumable materials) to the Contractor or any subcontractor for use at or about the Work Site in the performance of Work.

The term "Authority" refers to the Port Authority of New York and New Jersey.

"Notice" shall mean a written notification.

The term “Detail Design Drawing(s)” refers to a package composed of signed and sealed construction drawings, shop drawings, structural calculations, samples and catalog cuts prepared by the Engineer of Record and submitted to the Engineer for approval, as required to adequately define the scope of work established by this Change Order. The existing ITCS As-Built drawings shall be provided as supporting reference drawings as required to ensure proper documentation of those aspects of the ITCS system that are not impacted by this Change Order. New drawings shall contain the architectural, plumbing, civil, electrical, structural, maintenance of traffic and environmental specifics needed to execute the Work of removal, construction, installation and connection of the replacement equipment at each location. Changes to existing conditions shall be noted in new drawings with supporting reference tables indicating specific changes including, but not limited to, index of drawings, location plans, key plans, general notes, plan view drawings for removal and new installation, part plans, elevations, details, block diagram, cable type & routing, conduit fill ratios, termination details and detailed notes that supersede information in the As-Built reference drawings. Contractor proposed changes to Technical Specifications, if necessary, shall be submitted as Engineering Notes on the drawings for approval by the Engineer over the course of Work performed.

Reference to Work or its performance, "directed", "required", "permitted", "ordered", "designated", "prescribed", and words of similar import shall mean directed, required, permitted, ordered, designated, or prescribed by the Manager; and "approved", "acceptable", "satisfactory" and words of similar import shall mean approved by or acceptable or satisfactory to the Manager; and "necessary", "reasonable", "proper", "correct" and words of similar import shall mean necessary, reasonable, proper, or correct in the judgments of the Manager.

"Integrated Toll Collection System" or "ITCS" shall mean both the electronic toll collection system and the manual toll collection system.

"In-Lane Equipment" shall mean any ITCS related equipment located at a toll plaza at one of the River Crossings.

"Xerox" shall refer to Affiliated Computer Services/A Xerox Company, State and Local Solutions, Inc.

“Legal Holiday” shall refer to the following holidays observed at Port Authority offices and facilities:

New Year's Day Martin Luther King, Jr. Day Presidents Day Memorial Day Independence Day Labor Day	Columbus Day Veteran's Day Thanksgiving Day Day After Thanksgiving Christmas Day

"Regular Working Hours" - as used herein, shall mean 6:30 A.M. to 4:30 P.M., Monday through Friday, excluding legal holidays observed at the Site of the Work as defined above.

1.2 Change Order Terms and Conditions

Work performed under this Change Order shall comply with all national, state and local codes and shall comply with all Authority requirements in Attachment 6 - Applicable Authority Technical Specifications and Attachment 7 - Division 1 General Provisions.

This Change Order also includes an extension of the license to use the Xerox Open Road Tolling [hereafter ORT] software through December 31, 2020.

All other terms and conditions of the referenced Contract remain in effect and are not modified by this Change Order.

1.2.1 Adjustments to Service Level Agreement (SLA)

The Contractor shall implement the functionality described herein and shall continue to meet or exceed the performance levels established in the Contract, with the exception of the Service Level Agreement [hereafter SLA] adjustment provisions defined in Table 1-2 following.

Item	Plaza	Existing Contract	Proposed SLA Adjustment During Commissioning	Proposed SLA Adjustment After Commissioning
1-2a	BB	*Not applicable to this Change Order*		
1-2b	OBX	13.50%	18.5% + LDs threshold set to $1,000	10.60% + LDs threshold set to $2,000
1-2c	GWBL	13.50%	18.5% + LDs threshold set to $1,000	6.25% + LDs threshold set to $2,000
1-2d	GWBP	13.50%	18.5% + LDs threshold set to $1,000	6.30% + LDs threshold set to $2,000
1-2e	HT	13.50%	18.5% + LDs threshold set to $1,000	11.50% + LDs threshold set to $2,000
1-2f	LT	13.50%	18.5% + LDs threshold set to $1,000	11.35% + LDs threshold set to $2,000
1-2g	GB	19.00%	24.0% + LDs threshold set to $1,000	13.00% + LDs threshold set to $2,000
1-2h	GWBU	25.0%	30% + LDs threshold set to $1,000	15.20% + LDs threshold set to $2,000

Table 1-2: Temporary / Permanent SLA Adjustment

During the commissioning period for this Work, the Authority accepts SLA compliance parameters under the column titled "Proposed SLA Adjustment During Commissioning". After commissioning, SLA compliance parameters will change to the values noted in the column titled "Proposed SLA Adjustment After Commissioning".

1.2.2 Insurance Procured by the Contractor

The Contractor shall take out, maintain, and pay the premiums on Commercial General Liability Insurance, including but not limited to premises-operations, products-completed operations, and independent contractors coverage, with contractual liability language covering the obligations assumed by the Contractor under this Change Order and, if vehicles are to be used to carry out the performance of this Change Order, then the Contractor shall also take out, maintain, and pay the premiums on Automobile Liability Insurance covering owned, non-owned, and hired autos in the following minimum limits:

Commercial General Liability Insurance - $5 million combined single limit per occurrence for bodily injury and property damage liability. Such limit may be met through combination of primary and excess liability insurance.

Automobile Liability Insurance - $5 million combined single limit per accident for bodily injury and property damage liability. Such limit may be met through combination of primary and excess liability insurance.

In addition, the commercial general liability and business automobile liability policy(ies) shall name the Port Authority of New York & New Jersey, NYNJ Link LLC or its' designated operator related to this contract, their commissioners, directors, officers, employees and contract-related agents as additional insured, including but not limited to premises-operations, products-completed operations on the Commercial General Liability Policy for claims caused by the negligent acts or omissions of the Contractor. Such additional insured requirements may be met through a blanket additional insured basis. Moreover, the Commercial General Liability Policy shall not contain any provisions for exclusions from liability other than provisions for exclusion from liability forming part of the most up to date ISO form or its equivalent unendorsed Commercial General Liability Policy. The commercial general liability policy(ies) and certificate(s) of insurance shall contain separation of insured conditions and severability of interests clauses. These insurance requirements shall be in effect for the duration of the Change Order to include any warrantee /guarantee period and any maintenance period. An act or omission of one of the insureds shall not reduce or void coverage to the other insureds. Furthermore, the Contractor's insurance shall be primary insurance as respects to the above additional insureds. Any insurance or self-insurance maintained by the above additional insureds shall not contribute to any loss or claim

The certificate of insurance and liability policy(ies) must contain the following endorsement for the above liability coverages:

"The insurer(s) shall not, without obtaining the express advance written permission from the General Counsel of the Authority, raise any defense involving in any way the jurisdiction of the Tribunal over the person of the Authority, the immunity of the Authority, its Commissioners, officers, contract-related agents or employees, the governmental nature of the Authority, or the provisions of any statutes respecting suits against the Authority."

The Contractor shall also take out, maintain, and pay premiums on Workers' Compensation Insurance in accordance with the requirements of law of New Jersey and New York, and Employer's Liability Insurance with limits of not less than $1 million each accident.

The Contractor shall provide at least (30) days prior written notice to the Port Authority of NY and NJ, Att: Facility Contract Administrator, at the location where the work will take place and to the General Manager, Risk Financing in the event of insurance cancellation or nonrenewal.

The Port Authority may change or modify the limits and coverages of insurance at any time during the term of this Change Order. Should the modification or change results in an additional premium, the General Manager, Risk Financing for the Port Authority may consider such cost as an out-of-pocket expense. However, any increase in the types of limits shall be subject to negotiations with the Contractor.

Within five (5) days after the execution of this Change Order and prior to the start of work, the Contractor must submit an original certificate of insurance, to the Port Authority of NY and NJ, Facility Contract Administrator, at the location where the work will take place. This certificate of insurance MUST show evidence of the above insurance policy(ies), stating the Change Order number prior to the start of work. The General Manager, Risk Financing must approve the certificate(s) of insurance before any work can begin. Upon request by the Port Authority, the Contractor shall furnish to the General Manager, Risk Financing, a certified copy of each policy; however, if the Authority requests copies of applicable insurance policies during this Contract, Contractor will make the applicable insurance policy sections available at a local Xerox New York and/or New Jersey Metropolitan Area office or local Xerox's insurance broker's office, only for review purposes within thirty (30) days of such request. The Authority may review such applicable policy sections and take notes but no copies may be made by the Authority.

If at any time the above liability insurance should be canceled, materially changed as relates to this Change Order or nonrenewed so that the insurance is not in effect as above required, then, if the Engineer shall so direct, the Contractor shall suspend performance of the Change Order at the premises unless a renewal or replacement certificate is provided. If the Change Order is not suspended (whether or not because of omission of the Manager to order suspension), then the Authority may, at its option, obtain insurance affording coverage equal to the above required, the cost of such insurance to be payable by the Contractor to the Port Authority.

Renewal certificates of insurance or policies shall be delivered to the Facility Contractor Administrator, Port Authority prior to the expiration date of each expiring policy. The General Manager, Risk Financing must approve the renewal certificate(s) of insurance before work can resume on the facility. If at any time any of the certificates or policies shall become unsatisfactory to the Port Authority, the Contractor shall promptly obtain a new and satisfactory certificate and policy.

The requirements for insurance procured by the Contractor shall not in any way be construed as a limitation on the nature or extent of the contractual obligations assumed by the Contractor under this Change Order. The insurance requirements are not a representation by the Authority as to the adequacy of the insurance to protect the Contractor against the obligations imposed on them by law or by this or any other contract.

1.2.3 Net Cost Work

When and as directed by the Engineer, the Contractor shall perform the following work and will be compensated at the Net Cost thereof, as defined below:

- Repair, replace existing damaged underground utilities not shown on the Detail Design Drawings.
- Locate and uncover buried manholes, handholes, electrical boxes, or electrical cans and raise to final grade.
- Furnish and install Maintenance of Traffic and work area protection devices not shown on the Detail Design Drawings.
- Salvage and deliver to the Authority additional items not shown on the Detail Design Drawings.
- Construction schedule changes to accommodate facility operations requirements
- Perform work required to support additional requirements from Federal, State and local authorities.
- Changes to security requirements
- Implement structural changes to the toll plaza canopies.
- Repairs to concrete roadbed.
- Replace UPS batteries as required.

"Net Cost" shall be computed in the same manner as is Compensation for Extra Work, including any percentage additional to cost, as set forth in 1.2.4 Compensation for Extra Work following.

Performance of such Net Cost Work shall be as directed by the Engineer and shall be subject to all provisions of the Change Order relating to Performance of Extra Work. Compensation for said Net Cost Work shall not be charged against the total amount of compensation authorized for Extra Work.

1.2.4 Compensation for Extra Work

The Engineer shall have authority to agree in writing with the Contractor on behalf of the Authority upon lump sum or other compensation for Extra Work in lieu of the compensation for which provision is hereinafter made in this numbered clause.

If such agreement on compensation is not made, and Extra Work to be performed, the Contractor's compensation shall be increased by the following amounts and such amounts only:

A. For Extra Work consisting of refuse container services, an amount equal to the actual net cost in money of the labor and materials required for the provision of such services, plus seven per cent (7%) of such net cost.

B. For Extra Work consisting of performance of construction work at the construction site, an amount determined as follows:

   1. In the case of Extra Work performed by the Contractor personally, an amount equal to the actual net cost in money of the labor and materials required for such Extra Work, plus twenty per cent (20%) of such net cost, plus such rental for equipment (other than small tools) required for such Extra Work as the Engineer deems reasonable.

2. In the case of Extra Work performed by a subcontractor, an amount equal to the actual net cost in money of the labor and materials required for such Extra Work, plus twenty per cent (20%) of such net cost plus such rental for equipment (other than small tools) required for such Extra Work as the Engineer deems reasonable, plus seven per cent (7%) of the sum of the foregoing cost, percentage of cost, and rental.

As used in this numbered clause (and in this clause only):

"Refuse Container Services" means the delivery, removal and emptying of refuse containers as required during the performance of Extra Work subject to approval by the Engineer.

"Labor" means foremen, surveyors, laborers, mechanics and other employees below the rank of superintendent, exclusive of timekeepers, directly employed at the construction site, whether employed by the Contractor or by the subcontractors, subject to the Engineer's authority to determine what employees of any category are "required for Extra Work" and as to the portion of their time allotted to Extra Work; and "cost of labor" means the wages actually paid to and received by such employees; however, all wages actually paid that are in excess of the prevailing wages in the performance of Extra Work shall be subject, on each occasion, to the initial and continuing approval of the Engineer in advance of the performance of such Extra Work; plus a proper proportion of (a) vacation allowances and union dues and assessments which the employer actually pays pursuant to contractual obligation upon the basis of such wages, and (b) taxes actually paid by the employer pursuant to law upon the basis of such wages. At the Contractor's option, the amount of ten per cent (10%) will be applied to all wages actually paid to cover all labor costs including (a) and (b) above, but excluding paid holidays. The Contractor shall notify the Engineer whether or not the ten per cent (10%) option will be chosen prior to the initial performance of any Extra Work or Net Cost Work, if applicable. Such selection shall also apply to all subcontractors and shall remain in effect for the duration of the Change Order. "Employees" as used above mean only the employees of one employer.

For whichever option is selected, in accordance with the Contract clause entitled "Prevailing Wage (Davis-Bacon Act)", the Contractor and all subcontractors shall maintain complete and detailed payroll records, and such records shall be made available for inspection by the Authority.

"Materials" means temporary and consumable materials as well as permanent materials; and "cost of materials" means the price (including taxes actually paid by the Contractor pursuant to law upon the basis of such materials) for which such materials are sold for cash by the manufacturers or producers thereof, or by regular dealers therein, whether or not such materials are purchased directly from the manufacturer, producer or dealer (or if the Contractor is the manufacturer or producer thereof, the reasonable cost to the Contractor of the manufacture and production), plus the reasonable cost of delivering such materials to the construction site in the event that the price paid to the manufacturer, producer or dealer does not include delivery and in case of temporary materials, less their salvage value, if any.

"Work day" in reference to an item of equipment means a day other than a Saturday, Sunday or legal holiday except that if the particular item of equipment is actually utilized at the construction site by the Contractor or subcontractors under this or any other contract with the Authority on a Saturday, Sunday or legal holiday said day shall be deemed a work day.

The rental for equipment, whether owned by the Contractor or subcontractors or rented from others and notwithstanding the actual price of any rental or actual costs associated with such equipment, shall be computed by the Engineer on the basis of the following:

1. Hourly rental for those items of equipment listed in the "Rental Rate Blue Book" published by Machinery Information Division, K-III Directory Corporation, 1735 Technology Drive, Suite 410, San Jose, California 95110, (hereinafter called "the Blue Book"), shall be 100% of the applicable rates as listed in said book, reduced to an hourly basis (see formula below) except that such applicable rates shall be reduced by 50% for all hours of rental payable hereunder in excess of 8 hours each day. The edition of this publication to be used shall be the one in effect on the date of the actual rental of the equipment. The "Estimated Operating Cost per Hour" as set forth for such item of equipment in the Blue Book shall be added to the hourly rental for each hour that such equipment is actually engaged in performing Extra Work. No amount for operating cost will be allowed during periods when such equipment is not actually engaged in performing Extra Work (i.e., standby rental time). None of the provisions of the Blue Book shall be deemed referred to or included in this Change Order except as specifically set forth in this Section.
2. If no listing of rental rate and/or hourly operating cost for the item of equipment is in the Blue Book, the Engineer shall determine the reasonable rate of rental and/or hourly operating cost of the particular item of equipment by such other means as he finds appropriate.
3. In the event the Contractor is directed by the Engineer to immediately perform Extra Work within 24 hours of the direction to proceed, the Engineer shall determine the reasonable rate of rental and/all hourly operating cost of the items of equipment necessary to perform such Extra Work by such means as he finds appropriate. However, if the equipment is owned by the Contractor or owned by a subsidiary of the Contractor, the Blue Book rates will apply as set forth in this clause.

When utilizing the rental rates appearing in the Blue Book, the Engineer shall determine the applicable rate and the hourly rental determined therefrom by applying the following criteria:

1. The rate to be applied for an item of equipment used on a particular Extra Work order shall be the monthly rates from the foregoing publication.
2. The pro rata portion which one hour bears to the applicable rate shall be determined in accordance with the following formula:

Hourly rate based on monthly rental.	1/176 of monthly rental from Blue Book

3. The rental rate shall be multiplied by the applicable regional adjustment factor shown for such item of equipment in the Blue Book. The adjustment factor shall not apply to the hourly operating cost.
4. If the Engineer should determine that the nature or size of the equipment used by the Contractor in connection with Extra Work is larger or more elaborate, as the case may be, than the size or nature of the minimum equipment determined by the Engineer to be suitable for the Extra Work, the reasonable rental will not be based upon the equipment used by the Contractor but will be

based on the smallest or least elaborate equipment determined by the Engineer to have been suitable for the performance of the Extra Work.

In the case of equipment utilized only for Extra Work: (a) in addition to amounts determined as provided in subparagraphs A and B above, there will be added to the rental as computed above the taxes on the rental actually paid by the Contractor or subcontractor and the reasonable cost of transporting such equipment to and from the construction site, including applicable tolls, and (b) notwithstanding the number of hours during which such equipment is utilized, the minimum rental therefor will be for a period of eight hours.

In computing the Contractor's compensation insofar as it is based upon Extra Work, and notwithstanding any provision to the contrary appearing in the Blue Book, no consideration shall be given to any items of cost or expense not expressly set forth above, it being expressly agreed that the costs and percentage additions hereinbefore provided cover items of cost and expense to the Contractor of any type whatsoever, including administration, overhead, taxes (other than those enumerated above), clean-up, consumables including gas and oil, drafting (including printing or other reproduction), coordination, field measurements, maintenance, repairs, insurance, profit to the Contractor and small tools.

Whenever any Extra Work is performed (whether by the Contractor directly or through a subcontractor), the Contractor shall, at the end of each day, submit to the Engineer (a) daily time slips in such form as set forth below, showing the name and number of each workman employed on such Work and the number of hours which he is employed thereon, (b) a memorandum showing the wages to be paid to each workman, and unless the Contractor has notified the Engineer that he has chosen the ten per cent (10%) option set forth above, the state and federal taxes based on such wages, and vacation allowances and union dues and assessments which the employer actually pays pursuant to contractual obligation upon the basis of such wages, (c) a memorandum showing the amount and character of the materials furnished for such Work, from whom they were purchased and the amount to be paid therefor, and (d) a memorandum of equipment used in the performance of such Work, listing the actual hours of operation for each piece of equipment, together with the rental and operating cost claimed therefor. Template forms for the daily time slips will be provided to the Contractor prior to the commencement of Work. The Contractor shall complete the forms on 8½” x 14” ledger paper, individually and sequentially numbered, for all Work performed by the Contractor and any subcontractors. Submit the completed form with the Contractor’s original signature to the Engineer each day for verification by the Engineer. Upon verification, the Engineer will sign the form and provide the Contractor with a copy of the signed form. A duplicate copy of the signed form shall be submitted to the Engineer with the Contractor’s billing documentation and accompanied by such memoranda as described in (b), (c) and (d) above.

Such memoranda and time slips are for the purpose of enabling the Engineer to determine the amounts to be paid by the Authority under this numbered clause; and accordingly, they shall constitute a condition precedent to such payment and the failure of the Contractor or his subcontractors to furnish them with respect to any Work shall constitute a conclusive and binding determination on his part that such Work is not Extra Work and shall constitute a waiver by the Contractor of claims for payment for such Work. The Contractor's compensation for Extra Work shall be subject to audit review by the Authority. The Engineer will notify the Contractor that an audit review will be conducted no later than 90 days from the date of such notification. The Engineer will also provide the Contractor with an estimated duration of the

audit. During the audit review, the Contractor shall provide records to substantiate the memorandum and time slips submitted to the Engineer. Failure to provide such Contractor or subcontractor records may result in a reduction or total denial of material, equipment and labor costs for Extra Work. Upon completion of the audit review, the Contractor will be provided with the audit findings of the Authority. If the Contractor disagrees in whole or in part with the audit findings, the Contractor shall notify the Authority of such disagreement in writing within 30 days of receipt of said audit findings or the Authority will deem the audit findings to be final and acceptable to the Contractor. In the event that the Engineer and the Contractor shall agree in writing upon a lump sum or other compensation for Extra Work in lieu of compensation as provided in the second paragraph of this clause, the daily time slips and memoranda required by this paragraph shall not be required subsequent to the date on which such agreement has been reached.

1.2.5 Compensation for Emergency Delays

If the Contractor is specifically directed by the Engineer to suspend his operations as stipulated in the Section of Division 1 of the Specifications entitled "Conditions and Precautions" or if the Contractor is specifically directed not to start his operations at a time when operations are permitted to start as stipulated in such Section, and if solely because of such suspension or direction not to start any of the Contractor's or subcontractor's employees or equipment then engaged in or about to start such Work are necessarily kept idle at the construction site, during the hours when they would otherwise be engaged in the performance of the Work, then the Contractor's compensation shall be increased by an amount equal to the salaries and wages in amounts approved by the Engineer which the employer is required to pay and actually pays to such employees for the period or periods of such idleness, plus a proper proportion of (a) taxes actually paid by the employer pursuant to law upon the basis of such salaries and wages, and (b) vacation allowances and union dues and assessments which the employer actually pays pursuant to contractual obligations upon the basis of such salaries and wages, and in addition thereto such rental as the engineer deems reasonable for such equipment during the period or periods of such idleness. The rental for idle equipment shall be computed by the Engineer in accordance with the provisions of the Change Order entitled "Idle Salaried Men and Equipment".

In the event that the Contractor deems that any payment should be made pursuant to this numbered clause, he shall give prompt written notice to the Engineer stating the reasons why he believes such payments should be made and shall moreover, furnish to the Engineer at the end of each day, a memorandum showing the name, payroll title, salary rate and employer of each of the workingmen, and description, owner and claimed rental rate for each item of equipment claimed to have been kept idle. Said notice and memorandum are for the purpose of enabling the Engineer to verify the Contractor's claim at the time. Accordingly, notwithstanding any other provisions hereof, the failure of the Contractor to furnish such notice and memorandum shall constitute a conclusive binding determination on his part that he is not entitled to compensation as provided herein and shall constitute a waiver by the Contractor of all claims for such payment, such notice and memorandum being conditions precedent to payment under this numbered clause.

1.2.6 Idle Salaried Men and Equipment

If any salaried men or equipment of the Contractor or any subcontractor are necessarily kept continuously idle and wholly unoccupied at the construction site for a full day on each of two or more full days on

which they would be engaged in the performance of the Work but for causes due solely to acts or omissions of the Authority or the Engineer occurring after execution of this Change Order, and if such idleness is not due to any cause within the control of the Contractor or of any of his subcontractors or materialmen or his or their employees, then the Authority shall pay to the Contractor and the Contractor shall accept (in addition to any sums otherwise payable under this Contract, and in full satisfaction of and in liquidation of all claims for damages because of such act or omission of the Authority or the Engineer) an amount equal to that which the employer actually pays such salaried employees during such full days of idleness, plus a proper proportion of vacation allowances and union dues and assessments actually paid by the employer pursuant to contractual obligations on the basis of such salaries, and a proper proportion of the taxes actually paid by the employer pursuant to law upon the basis of such salaries and plus such rental for such idle equipment as the Engineer deems reasonable. The rental for idle equipment shall be computed by the Engineer in accordance with the provisions of the clause entitled "Compensation for Extra Work"; provided, however, that the seven per cent (7%) of the rental to be paid in accordance with said clause in the case of equipment utilized by subcontractors shall not be payable in connection with such idle equipment; and provided further that the provisions of subparagraph C of said clause shall not be applicable to such idle equipment.

The Contractor shall give written notice to the Engineer before the end of the second of the above mentioned 2 or more full days (whether or not the Authority is aware of the existence of any circumstances which might constitute a basis for payment under this numbered clause), specifically stating that salaried men or equipment have been kept idle under circumstances which might result in payment under this numbered clause; and he shall furnish with such notice, for all the days that have occurred, and shall in addition furnish at the end of each additional day of the above mentioned 2 or more full days, (a) a memorandum showing the name, payroll title, salary rate and employer of each of the salaried men claimed to have been kept idle at the construction site, and taxes based upon their salaries and the holiday and vacation allowances and union dues and assessments which the employer must actually pay pursuant to contractual obligations based on their salaries, and (b) a memorandum of the equipment claimed to be kept idle, together with the amount claimed as rental therefor. Said notice and memoranda are for the purpose of enabling the Engineer to verify the Contractor's claim at the time, and of enabling him to take such steps as may be necessary to remedy the conditions upon which the claim is based. The furnishing of such notice and memoranda shall be a condition precedent to payment under this numbered clause, so that the day on which notice is given shall be counted as not later than the second of the above mentioned 2 or more full days and no subsequent day shall be counted for which the above memoranda are not furnished at the end of such day.

1.2.7 Delays to Contractor

As between the Contractor and the Authority, the Contractor assumes the risk of all suspensions of or delays in performance of the Change Order, regardless of the length thereof, arising from all causes relating to this Change Order, except only to the extent, if any, that compensation or an extension of time may be due as expressly provided for elsewhere in this Change Order for such suspension or delays and except to the extent, if any, that compensation may be agreed to by the Engineer in writing pursuant to the clause hereof entitled "Compensation for Extra Work" for impact costs incurred by the Contractor in connection with the performance of Extra Work. Subject only to such exceptions, the Contractor shall

bear the burden of all costs, expenses and liabilities which he may incur in connection with such suspensions or delays, and all such suspensions, delays, costs, expenses and liabilities of any nature whatsoever, whether or not provided for in this Change Order, shall conclusively be deemed to have been within the contemplation of the parties. The Contractor shall not be responsible for delay which occurs for reasons beyond the reasonable control of the Contractor or subcontractors as determined by the Authority.

Notwithstanding any provisions of this Change Order, whether relating to time of performance or otherwise, the Authority makes no representation or guaranty as to when the construction site or any part thereof will be available for the performance of the Change Order or as to whether conditions at the construction site will be such as to permit the Change Order to be performed thereon without interruption or by any particular sequence or method or as to whether the performance of the Change Order can be completed by the time required under this Change Order or by any other time.

Wherever in connection with this Change Order it is required, expressly or otherwise, that the Authority shall perform any act relating to the Change Order, including making available or furnishing any real property, materials, or other things, no guaranty is made by the Authority as to the time of such performance and the delay of the Authority in fulfilling such requirement shall not result in liability of any kind on the part of the Authority except only to the extent, if any, that an extension of time or compensation may be due as expressly provided for elsewhere in this Change Order.

1.2.8 Prevailing Rate of Wage Certification

For Work performed under this Change Order, the Authority requires a certification in writing from the Contractor that he has paid and caused his subcontractors to pay at least the prevailing rate of wage and supplements required by clause 4, “Prevailing Wage (Davis Bacon Act)” of the Contract.

The Contractor and every subcontractor shall make and maintain weekly payroll records during the course of the Work and for the period set forth in the clause hereof entitled "Authority Access to Records" for all employees employed in the Work associated with this Change Order. Such records shall contain the name, address and last four digits of the social security number of each such employee (Contractors and subcontractors must maintain the full social security number of each employee and shall provide them upon request to the Port Authority Inspector General), the employee's correct payroll classification, rate of pay and supplements, daily and weekly number of hours worked, deductions made and actual wages and supplements paid. The Contractor shall submit these weekly payroll records to the Authority (on forms furnished by the Authority) as well as those of each of his subcontractors as the Authority may require with the Contractor's Payment Application, together with an affidavit by the Contractor and by each subcontractor to the effect that such payroll records are correct and complete, the wage and supplement rates contained therein are not less than those required by the provisions of this Change Order, and the classifications set forth for each employee conform with the work performed. Such copies and summaries and the original payroll records shall be available for inspection by the Authority (including its Inspector General), and the Contractor and its subcontractors shall permit designated representatives of the Authority to interview employees during working hours on the job site.

The Engineer may at any time request the Contractor to prepare a daily report on the Authority form entitled *Contractor Daily Sign-In Sheet*, copies of which can be obtained from the Engineer. The *Contractor Daily Sign-In Sheet* shall be completed as follows:

1) At the beginning of each workday, the Contractor shall:
   a) Fill in the top of the *Contractor Daily Sign-In Sheet*, including the location, date, contractor/subcontractor name and contract number;
   b) Ensure that each employee, including those of subcontractors, has printed and signed his or her name and indicated his or her work classifications, the last four digits of his or her social security number, and his or her starting time;
2) At the end of each workday, the Contractor shall:
   a) Ensure that each employee, including those of subcontractors, has signed out and indicated his or her ending time;
   b) Sign the Certification Statement at the bottom of the form to indicate that the information contained in the *Contractor Daily Sign-In Sheet* is true and accurate; and
   c) Submit the original completed form to the Engineer's representative.

In an area of his office at the Site of the Work which is accessible to his employees, the Contractor shall display such printed material as may be provided by the Engineer setting forth information for the employees of the Contractor and his subcontractors concerning the wage and supplemental benefit requirements set forth in this numbered clause. The Contractor shall also cause each of his subcontractors to display such material in a similarly accessible place in any office which the subcontractor maintains at the Site of the Work.

The Contractor's failure to comply with any provision of this numbered clause shall be deemed a substantial breach of this Contract.

1.2.9 Extensions of Time

Extensions of time, to the extent necessary, will be granted at the discretion of the Engineer after negotiations between the parties.

1.3 Changes to Contract

Delete Section 38 of the above referenced contract in its entirety and substitute therefor Section 1.3.1 below.

Delete Section 39 of the above referenced contract in its entirety and substitute therefor Section 1.3.2 below.

NOTE: For additional detail on compliance with Section 1.3.1 requirement, refer to Attachment 5 - Audit Department Controls Requirements Checklist.

1.3.1 Contract Review and Compliance Audits

The Contractor, and any subcontractors, shall provide prompt system access and reasonable assistance to the Authority's External and Internal Audit staff or its consultants in their performance of work under the Contract, including producing specific requested information and extraction of data and reports. The Contractor, and any subcontractors, shall promptly support requests related to audits

of the Contract, administrative functions and operations covered by this Contract. The Authority will require access to the Contractor's environment which supports the systems used to provide services required under the Contract on a periodic basis; the hours to be determined, at the convenience of the Authority.

The Authority reserves the right to use and load security and system software – in coordination with the Contractor - to evaluate the level of security and vulnerabilities in all systems which control, collect, dispense, contain, manage, administer, or monitor operations related to this Contract.

PA Internal Audit staff and their consultants/contractors performing Contract Review and Compliance audits shall be required to sign PA Non-Disclosure Agreement/Acknowledgments.

1.3.2 Authority Access to Records

The Authority shall have access during normal business hours to all records and documents of the Contractor relating to any amounts for which the Contractor has been compensated, or claims he should be compensated, by the Authority by payment determined on any basis other than by payment of a lump sum or unit price amount agreed upon in writing by the Contractor and the Authority; provided, however such access shall extend to certified payroll records as described in the clause entitled "Prevailing Rate of Wage Certification" regardless of the method by which the Contractor is compensated under this Change Order and above those included in the compensation set forth elsewhere herein. The most current three (3) years of original Change Order records and documents must be maintained; thereafter, digital copies of the Change Order records and documents are acceptable. All Contractor records shall be kept in the Port District (as defined in McKinney's Unconsolidated Laws §6403). The Contractor shall obtain for the Authority similar access to similar records and documents of subcontractors. Such access shall be given or obtained both before and within a period of three (3) years after Final Payment to the Contractor, provided, however, that if within the aforesaid three (3) year periods the Authority has notified the Contractor in writing of a pending claim by the Authority under or in connection with this Change Order to which any of the aforesaid records and documents of the Contractor or of his subcontractors relate either directly or indirectly, then the period of such right of access shall be extended to the expiration of six (6) years from the date of Final Payment with respect to the records and documents involved.

Upon request of the Authority, the Contractor shall furnish or provide access to the federal Form I-9 (Employment Eligibility Verification) for each individual performing Work under this Contract, including both citizens and non-citizens. The Contractor shall provide, at no cost to the Authority, access for and reasonable assistance to such auditors from the Authority or the Authority's external auditors that may, from time to time, be designated to audit detail records which support Contractor charges to the Authority. The Authority shall have access to the detail records that support Contractor charges to the Authority for up to three (3) years following the termination of the Contract.

No provision in this Contract giving the Authority a right of access to records and documents is intended to impair or affect any right of access to records and documents that the Authority would have in the absence of such provision.

PA Internal Audit staff and their consultants/contractors performing Contract Review and Compliance audits shall be required to sign PA Non-Disclosure Agreement/Acknowledgments.

1.4 Pass Thru Equipment

1.4.1 IBM, Lenovo and Cisco Procurements

Should the Port Authority require Xerox to purchase IBM, Lenovo, and Cisco equipment for the Lane and ECH upgrades under the agreements between those firms and the Authority, Xerox's liability shall be limited as Xerox will be procuring these items as a purchasing agent for the PANYNJ under the PANYNJ contracts. Under this scenario, Xerox will place the order with IBM, Lenovo, and Cisco under PANYNJ's contracts, and PANYNJ will pay Xerox invoice for said equipment on a pass-thru basis per the terms of the existing contract, which is Net -30 days. PANYNJ will accept title immediately from IBM, Lenovo, and Cisco under PANYNJ's contract terms and conditions with these vendors.

Hardware Requirements

All installed equipment furnished and installed under this Change Order shall utilize new, field-proven, commercial off-the-shelf (COTS) components and equipment. The Contractor shall furnish detailed documentation on the design, production and testing of any non-COTS units at the time of the Detailed Design Document submittal described in Section 4.1 below. To the maximum extent practical, equipment and components shall be widely available generic items. They shall be of a type, model, or family currently recommended for new installations by their manufacturers and in quantity production by manufacturers of such components. Multi-sourced components that provide the desired characteristics and performance shall be utilized whenever practicable.

All new components shall be suitable for installation and use in the existing Port Authority toll facility environment as defined below:

1.5 Non-environmentally Controlled Locations

All System components installed in all toll plaza booths, tunnels, mezzanines, and canopies: all basement areas of the toll plaza building, and all exterior locations exposed to weather shall meet the following performance requirements when operated inside their closed/locked enclosures:

- Temperature: Minus 25 to 140 degrees Fahrenheit
- Relative Humidity: 5 to 95 percent
- Salt Fog: Salt atmosphere with 5 percent salinity

1.6 Environmentally Controlled Interior Locations

All System components installed in air-conditioned areas of the toll plaza buildings other than toll plaza booths, tunnels, mezzanines, and canopies shall meet all performance requirements specified for the following ambient conditions when operated inside their closed/locked enclosures:

- Temperature - components installed in:
  - Heated areas shall meet performance requirements for temperatures between 32 and 120 degrees Fahrenheit
  - Unheated areas shall meet performance requirements for temperatures between zero and 120 degrees Fahrenheit
- Relative Humidity: 5 to 95 percent

The Contractor shall provide manufacturers' data sheets (hereafter Catalog Cuts) demonstrating each component's suitability at the time of the Detailed Design Document submittal.

2 System Requirements

The Contractor shall provide all necessary equipment, materials, personnel, vehicles, tools, services and support for the Work described in this section, including, but not limited to:

- Project management
- Software support for analysis
- Professional Engineering Services
- Removal and Disposal of Equipment
- Lane Decommissioning
- Testing, inspection, and demonstration
- Equipment installation services
- Software Quality Assurance
- Testing, Test Plans and results for all tests
- Commissioning
- Documentation (Including but not limited to: Detail Design Documentation, detail design and shop drawings, manuals, training materials and other documentation identified in Section 4 of this Change Order.)
- Spares as noted in Section 6 Maintenance and Spares.

2.1 Lane Controller Hardware and Equipment

Remove and replace existing Lane Controllers and Lane Equipment hardware including new computer hardware and modifications or replacements to the Lane Electronics Cabinets (hereafter LECs). Work shall include but not be limited to:

1. Remove and dispose of existing Lane Controller PC and peripherals.
2. Furnish and install Lane Controller computer.
3. Furnish and install Lane Controller Peripherals.
4. Modify, as necessary, mounting, electrical, and communications hardware to accept new Lane Controller PC and peripherals.
5. Furnish and Install replacement LEC and Automatic Vehicle Identification (AVI) enclosures at the Goethals Bridge only.
    a. Remove and dispose existing cabinets, conduits, junction boxes and furnish and install new components.
    b. Furnish and install new LEC cabinets as NEMA 4X, 304 SS enclosures with #4, non-directional finish per Technical Specification (TS) 05080, 2.01.
    c. Furnish and install new LEC back panel assemblies.
    d. Furnish and install new stainless steel AVI enclosure. Standard stainless steel material grade and finish offered by the AVI manufacturer is acceptable.
6. Integrate loops and treadles with existing and other new lane components provided herein.
7. Except for the Lanes identified in item 2.13.2 Relocation of Holland Tunnel Treadles below, provide a status report of all existing loops, treadles and cabling by performing a visual inspection, electrical test and auditing of data from the lanes prior to performing any Work.

The Contractor shall provide a Bill of Materials with pricing for Section 2.1 Lane Controller hardware and installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

2.2 Lane Controller Software

The existing Lane Controller operating system and software shall be modified to work with the new Lane Controller hardware. The existing Authority lane code shall be migrated to the current version of Red Hat Linux Enterprise operating system that shall be installed on each new Lane Controller. The code shall be modified as described below to interface to the new lane devices, address existing performance issues as applicable and implement lane business rule changes. Work shall include, but not be limited to:

1. Replace UnixWare Operating System with Red Hat Linux Enterprise Operating System on all Lane Controllers and integrate existing drivers, scripts, batch processes, and all utility software with Red Hat Linux Operating System as needed to support real time processes.
2. Implement software modifications needed to change from timer to event based logic, including:
    a. Modify the traditional lane software to generate E-ZPass or Flush (configurable) transactions for tag reads that remain in the queue for more than a configurable number of milliseconds when all 3 lane loops are low for more than a configurable number of milliseconds.
    b. Modify the traditional lane software to generate a Flush transaction for vehicles that remain in the queue for more than a configurable number of milliseconds when all 3 lane loops are low for more than a configurable number of milliseconds.
3. Migrate existing Smart Serial I/O (SSIO) real time software to the new Phoenix DIO Controller.
4. Modify the Lane software, configuration setup, network, and VES trigger point setup.
5. Modify existing Lane code for VES triggering and frame capture.
6. Modify process for VES image transfer.
7. Modify process for VES image association.
8. Perform requirements analysis to identify specific scenarios and sequences for the changes to each lane configuration including, but not limited to:
    a. Mapping of TOM Overhead Laser Scanner (OLS) classifications to the new SICK OLS
        i. Mapping new scanner data to existing Authority vehicle classes
        ii. Correlate degraded mode rules between TOMS provided classes and SICK provided geometric attributes (L/W/H, number of units)
        iii. Combine treadle data with SICK for proper classification
    b. Design of online failure detection, diagnostics, Maintenance Operations Manager (MOM) alarms and alarm priorities
    c. Identification of event scenarios and potential vehicle processing anomalies.
9. Implement necessary changes and enhancements to the software based on above analysis.
10. Modify the Lane Controller software to remove the TOMS data from speed processing and incorporate the Exit and VES loop data for speed reporting. **NOTE:** There are no performance requirements for speed detection.
11. Migrate the OLS software and interface to the Lane Controller software.
12. Develop and test the interface for LMS 511 to the new Lane Controller.

The modified lane software shall implement a method of guaranteed message transmission compatible with the new ECH platform in Section 2.11.

To summarize, the Contractor shall determine, through joint discovery with the Authority, changes to Lane Business Rules to be implemented in software that encompass :

1. Correlation of classifications (TOMS to SICK to PANYNJ classification)
2. Alarms (SICK, Phoenix DIO Controller, VES, Redundant Controllers)
3. Failover processing (automated or manual)
4. Support for Video Toll transactions
5. A new "Dedicated/AET" mode in which all transactions not associated with a valid E-ZPass tag shall be "Video Toll" transactions for both conventional and ORT lanes. There shall be no AET (i.e., Video Toll) requirements for staffed mode (i.e., lanes accepting both cash and E-ZPass).
6. Remote command changes
7. Lane mode processing and maintenance utilities
8. Potential driver feedback sign modifications to support AET modes
9. Configurable messages for the new LMS (see also Section 2.8 below).
10. Toll rate processing changes to support video tolling.

NOTE: Any changes to or from the AET modes are via remote commands or lane utilities and no changes shall be made to key switch logic or hardware. Lanes shall be able to support a default mode of either Dedicated or Dedicated/AET and use of the key switch shall cause the lane to open in the configured default mode.

The Contractor shall provide a Bill of Materials with pricing for Section 2.2 Lane Controller software effort in Attachment 2 – Bill of Materials and Pricing Templates.

2.3 Violation Enforcement System

Remove and replace the existing violation cameras, illumination and associated cabling and conduit. The replacement shall be the JAI Pulnix All-In-One Violation Enforcement System (VES). The work to be completed includes:

1. Remove and dispose of the existing VES equipment and modify mounting and electrical hardware to accept new VES equipment.
2. Furnish and install a 5 foot stanchion/transformer base and VES camera so as to achieve optimal performance.
3. Furnish and install all cabling and conduit to connect VES cameras and lighting to applicable equipment in the LEC.
4. All conduits for the VES cameras shall be new. The existing concrete island shall be trenched for the new conduit and patched to match the existing toll island surface[1].

[1] The concrete pouring season is from April 15th to October 15th, except for concrete patching, which can be performed at anytime provided that the patching is performed within the manufacturer's specifications for the product being used.

5. Comply with Attachment 6 - Applicable Authority Technical Specifications including, but not limited, to:
    a. 02073 Cutting, Patching and Removal
    b. 03602 Grouting (Non-Metallic)
    c. 16115 Underground Conduit Systems

The Contractor shall provide a Bill of Materials with pricing for Section 2.3 VES hardware and the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

2.4 Overhead Laser Scanner

Remove and dispose of the existing TOMS Overhead Laser Scanner (OLS). Furnish and install a SICK LMS 511 OLS, which shall include but not be limited to all hardware and modifications required to integrate the new SICK OLS to the new Lane Controller.

1. Remove and dispose of the existing TOMS OLS equipment.
2. Modify as necessary the mounting and electrical hardware to install the new SICK OLS equipment.
3. Furnish and install the OLS hardware.
4. Furnish and install all cabling and conduit to connect the OLS to the applicable equipment in the LEC.
5. Install the OLS utilizing the existing TOM OLS mounting brackets. Adjust as needed for an optimal operation and performance.
6. If required, repair the canopy fascia as required and approved by the Engineer based on the approved method, materials and finishes submitted in Shop Drawings and Samples. Provide special colors as selected by the Engineer.

The Contractor shall provide a Bill of Materials with pricing for Section 2.4 OLS hardware and the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

2.5 Network

Provide new network switches for connectivity between the Plaza Network Rack and the Lane Equipment Cabinets to increase the available bandwidth from 10Mbps to 1 Gbps. Attachment 3 – Network Diagrams provides additional high-level details on system connectivity for each facility.

The Contractor shall comply with requirements of Technical Specifications 16126 Fiber Optic Cable and 16127 Control/Signal Transmission Media. Work to be performed shall include, but not be limited to:

1. Remove and dispose of the existing network equipment.
2. Modify mounting, electrical, and communication hardware to accept new network equipment.
3. Furnish and install the network hardware including the components listed in Table 3-1 below.
4. Perform the following tasks:
    a. Remove and dispose of all existing ITCS network switches and repeaters at the locations and in the quantities noted under column heading “Existing Equipment To Be Removed and Disposed” in Table 3-1 below.

b. Furnish and install replacement Cisco 3850 fiber and copper Ethernet switches at the locations and quantities noted under column heading "Replacement Equipment" in Table 3-1 below.
c. Furnish and install all cabling and conduit to connect new network components to Lane Systems.
d. Furnish and install all connectors, fiber patch panels and replacement patch cables required to re-terminate all the existing multi-mode and single mode connections for this network.
e. Furnish and install a new Ethernet switch with fiber optic uplink capability in each Lane Electronics Cabinet and route to the new Cisco fiber switch using the existing network.
f. Furnish and install four (4) new single-mode fiber optic cables at each of the ITCS network connection points to PAWANET to provide redundant connectivity. The new single-mode fiber optic cables shall each contain a minimum of four (4) strands in a single sheath (i.e., 2 active strands for ITCS + spares) and shall be terminated at both ends with appropriate connectors to the new Cisco Catalyst 3850 and the redundant PAWANET Ethernet switches at each location. The other two (2) single-mode fiber optic cables shall be pulled as dark fiber along the same routes and left unterminated with a 10' coil at each end for future use. The locations that require redundant single-mode fiber connectivity to PAWANET include:
    i. The George Washington Bridge Lower Level, Holland Tunnel, Lincoln Tunnel, Goethals Bridge and Outerbridge Crossing ITCS network racks
    ii. The ITCS network equipment at both the primary and backup ECH locations at TeleCenter and PATC respectively.

The Contractor shall perform the physical connection for these new cables to the new ITCS Ethernet switches and TSD shall perform the physical connection for these new cables to the respective PAWANET Ethernet switches.

5. Install switches and cabling in the same cabinet as the existing equipment.
    a. Fiber optic cable terminations and installation shall be performed by a licensed electrician qualified to perform fiber optic network cabling installation as described in Section 1.05-E of Technical Specification 16126 Fiber Optic Cable.
6. Test all network connections end to end.
    a. Fiber optic testing shall be performed by a licensed electrician trained and qualified to perform Optical Time Domain Reflectometer (OTDR) testing to the requirements of 3.05-C, items 2 through 5 of Technical Specification 16126 Fiber Optic Cable. The Contractor shall supply a copy of training credentials and prior experience for the person performing the tests.
7. The Contractor shall provide a list of equipment requiring new IP addresses to the Authority for assignment

Location	Existing Equipment To Be Removed and Disposed		Replacement Equipment	
	DEC 90FL	DEC 90T	Cisco Switch 24 Ports Fiber	Cisco 3850 24 Ports Copper
HT	3	1	1	1
LT	4	1	1	1
GB	3	1	1	1
OBX	2	1	1	1
GWBPIP	0	0	0	1
GWB Upper	0	0	0	1
GWB Lower	4	1	3	1
Training	0	1	0	1
PATC	0	1	0	2
TeleCenter	0	1	0	2
Total	**14**	**8**	**7**	**12**

Table 3-1: ITCS Network Equipment to be Replaced

The Contractor shall provide a Bill of Materials with pricing for Section 2.5 Network hardware, materials and the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

2.6 Outerbridge Crossing (OBX) Open Road Tolling (ORT)

Provide a complete replacement of hardware and related components for the ORT Lanes at the OBX to implement a new ORT solution with redundant HOT standby zone controllers, automatic failover capabilities and new VES subsystem capabilities. This work shall include but not be limited to:

1. Remove and dispose of existing ORT equipment and modify as necessary hardware mounting and electrical terminations to accept new ORT equipment.
    a. The existing Idris System, including loops, detectors and associated equipment shall be reused.
2. Furnish and install new ORT hardware.
3. Furnish and install all cabling, conduit and labor to connect the VES to applicable equipment in the Zone Controller and LEC.

The Contractor shall provide a Bill of Materials with pricing for Section 2.6 OBX ORT hardware and the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

2.7 Close-up Lane Observation Camera Equipment

Furnish and install a new in-lane video camera in all lanes to view and monitor traffic in the toll lanes. The work shall include but not be limited to:

1. Furnish and install the required hardware.
2. Install cameras on the VES stanchions discussed in Section 2.3.2 above.

3. Furnish and install all cabling, conduit to route video equipment feeds to Authority designated DVR/NVRs.

The Contractor shall provide a Bill of Materials with pricing for Section 2.7 Close-up Lane Observation Camera equipment and the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

2.8 Lane Mode Sign

The Contractor shall furnish and install new Lane Mode Sign (LMS) to replace existing signs at the locations and in the quantities listed in Table 3-2 below. After removing the existing LMS signs, the Contractors shall attach new LMS signs to the existing canopy mounting and electrical infrastructure in accordance with approved Shop Drawings. The new LMS signs shall be centered over the lane.

OBX	GB	GWBP	GWBL	GWBU	HT	LT
5 *Excludes the Express Lane*	8	7	11 *Includes Lane 66*	12	9	13 *Excludes the Express Bus Lane (XBL)*

Table 3-2: LMS Sign Location and Quantities

The new LMS signs shall employ a full-color LED matrix large enough to display two lines of 12” text and be able to display fully variable text and graphics on either line or both. The page to page change rate shall not exceed 3.5 seconds. The sign shall have a brightness of at least 9,000 Candelas/m2 and be equipped with a light sensor-controlled dimmer circuit to adjust the luminance level automatically. The message shall be viewable at horizontal angle of 70 degrees and a vertical angle of 30 degrees.

Table 3-3 following shows the LMS messages that are to be furnished and installed under this Change Order for all signs except Lane 66 which shall display message C1 only and, for which, the Contractor may provide an alternative configurable message solution that does not necessarily require a Lane Controller.

Message No.	VMS Header	VMS Detail
A1	*White logo on Pantone 259 background or equivalent*	ONLY (flashing)
A3		BUSES ONLY
A4		TRUCKS ONLY
A5		NO TRUCKS
A6		NO CARS
A7		5 MPH
A8		25 MPH
A9		Future AET 1
A10		Future AET 2
B1	CASH *White text on Pantone 342C background or equivalent*	E-ZPASS
B2		ONLY (flashing)
C1	-BLANK-	LANE CLOSED
C5		-BLANK-
C6		ALL OTHERS

Table 3-3: Lane Mode Sign Message Library

The work shall include, but is not limited to:

1. Removal and disposal of existing LMS equipment.
2. Modify as necessary the existing LMS sign canopy structure to accept the new LMS sign.
3. Furnish and install the new LMS signs.
4. Furnish and install all cabling and conduit to connect the LMS to associated equipment in the LEC.

NOTES:

1) To support the use of the Cars Only restriction as All Others, modify all ITCS screens and reports where "Cars Only" is shown to instead indicate "All Others".
2) The Authority has discussed the 120^0 F upper limit on the operating temperature of the proposed LMS sign with the manufacturer and accepts a waiver from the 140^0 F requirement in Section 1.5 above.
3) Existing Canopy Lights, Driver Feedback Signs and Static Signs (in 25MPH E-ZPass lanes) shall remain.

The Contractor shall provide a Bill of Materials with pricing for Section 2.8 LMS hardware and the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

2.9 Replacement ITCS Supervisor and Deposit Workstations and Interface

Furnish and install ITCS Deposit and Supervisor Workstations and interfaces as required to integrate with the existing ITCS and in conformance to Section 6.3.5 Standard Workstation Hardware Configurations in

Attachment 8 – Technology Services Department (TSD) Standards & Guidelines for Port Authority Technology. The work shall include but not be limited to:

1. Remove and dispose of existing Deposit and Supervisor Workstations and associated equipment.
2. Furnish and install Supervisor and Deposit Workstations, Monitors and Deposit printers in the quantities listed in Table 3-4 below.
3. Integrate the existing Proximity Card Readers to the Deposit Workstations.
4. Disable all excess CD drives and USB ports on ITCS Deposit and Supervisor Workstations.

Description	Qty
Plaza Supervisor Stations	16
Plaza Supervisor Monitors	16
Receipt Printer	30
Drop Terminals & Monitors	30
Printer paper (50 rolls per case)	8
Terminal Emulator	46

Table 3-4: Workstation and Printer Replacements

The Contractor shall provide a Bill of Materials with pricing for Section 2.9 Replacement ITCS Supervisor and Deposit Workstations with the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

NOTE: The Authority acknowledges that the Vector function that allows the Toll Supervisor to monitor key touches on the Toll Collector touch screens will not be available under this Change Order due to the fact that this function is not compatible with the legacy touch screen devices being retained.

2.10 ECH/CSC Interface (CSC CO #103)

The Contractor shall furnish and install all necessary materials to implement the interface defined in CO#103 with all applicable systems in this Change Order. The work shall include, but not be limited to:

1. Change in number of violation images and image resolution.
2. Calculation of tolls due by ITCS.

   NOTE: The Authority acknowledges that the lane controller will not be able to distinguish between vehicles associated with registered video toll accounts and unregistered video toll accounts, if applicable. Accordingly, video toll transactions at the lane will only use a single set of toll rates for the appropriate vehicle classification in AET mode.

3. Modifications of file specifications for files exchanged between the CSC and the ITCS.
4. Accept Egregious Violator File by sending required acknowledgement file with no further action.
5. Revise and submit updated design, ICDs and any other relevant documentation reflecting the changes above.
6. Utilization of file name extensions for ITCS that are unique and distinct from those in CO#103 so as not to conflict with Replacement Toll Collection System (RTCS) filename extensions.

7. Storage of new CO#103 reconciliation codes in the ECH database for querying purposes.
8. Change transaction mapping so that REJTRANS and REJVIDEO both reconcile back with a type REJECTED.

2.11 ECH Re-platform and Upgrade

The Contractor shall furnish and install Xerox Vector 4G Toll Host software on new IBM servers to replace the existing production and backup ECH hardware and software at the TeleCenter and Port Authority Technical Center (PATC), respectively.

The new ECH software shall be provided through a modified version of the latest Vector software and shall include all of the current functionality provided by the new Vector software and the existing ECH functionality, PowerBuilder software, interfaces, internal and external reports currently available to ITCS users. The new Vector software shall be configured to fully accommodate the Authority's Plazas, Lanes and existing configurations.

NOTE: No Automatic License Plate Recognition (ALPR) shall be provided for the ECH with this Change Order.

Functional requirements for this Work are contained in this section and in the following documents:

- Attachment 1 - CSC CO #103
- Attachment 4 - Xerox Response to Authority Questions on ECH Upgrade and ECH to VECTOR Transaction Detail Mapping
- Attachment 9 – ECH to VECTOR Transition Plan
- Attachment 10 – Revenue Accounting Reconciliation and Toll Collector Audit Processes
- Attachment 11 – ITRACS Algorithm Calculations

Clarifications and changes jointly developed during requirement review and discovery meetings at the time of Project Kickoff and thereafter, shall be incorporated into Detail Design Documentation by the Contractor.

The Contractor shall provide a Bill of Materials with pricing for all hardware, software, development, installation and engineering support scope items for Sections 2.10 and 2.11 and all its subsections in Attachment 2 – Bill of Materials and Pricing Templates.

2.11.1 General Hardware & Software Requirements for ECH Re-platform and Upgrade

All 3rd Party hardware and software shall be provided with five (5) years of 24 X 7 manufacturer support that can be extended for an additional two (2) years for a total of seven (7) years.

The storage solution to be installed as part of the ECH Re-platform and Upgrade shall be sized to meet or exceed the initial storage requirements defined in Section 3.11.8 below. In addition, it shall be capable of being upgraded to support storage and on-line retrieval requirements of a full AET implementation at all Authority facilities with nothing more than the addition of cabinets, manufacturer's software and hard drives.

2.11.2 Transition Plan & Data Migration

The Contractor's Transition Plan shall provide for data migration from the existing ECH database to the new ECH database. As part of the design process, the Contractor shall meet with the Authority to review the data mapping requirement. The Contractor shall update Attachment 9 – ECH to VECTOR Transition Plan with a description of the process steps for moving, validating and cutover to the new database developed during those design meetings.

Approval by the TB&T Project Manager is required prior to performing any data migration work.

2.11.3 Revenue Audit Function

The Audit function in Vector shall be modified to accommodate the Authority's processes and flows for Toll Collector auditing as described in Attachment 10 – Revenue Accounting Reconciliation and Toll Collector Audit Processes and including the incorporation of ITRACS algorithms included in Attachment 11 – ITRACS Algorithm Calculations.

The Contractor shall supply optional pricing for Service Organization Compliance (SOC) levels 1 and 2 in Attachment 2 – Bill of Materials and Pricing Templates.

2.11.4 Reports

The new Vector Host System shall provide the reports listed below [reference Xerox document "Port Authority of New York and New Jersey Response to Question – ECH Upgrade, v4.0" included as Attachment 4].

Standard VECTOR 4G Reports

1. **Collector Reports**
   - 1.1. HOST0002A Segment of Duty.
   - 1.2. HOST0053U Collector TOD excluding E-Z Pass without Adjustments
   - 1.3. HOST0053A Collector TOD excluding E-Z Pass with Adjustments
   - 1.4. HOST0052 Employee TOD History
   - 1.5. HOST0004C Attendant Performance Standard Class Mismatch
   - 1.6. HOST0004D Attendant Performance Standard- Daily
   - 1.7. HOST0004M Attendant Performance Standard- Monthly
   - 1.8. HOST0067 Attendant Scheduling
2. **Revenue Reports**
   - 2.1. HOST0015 Deposits by Bank Deposit Date
   - 2.2. HOST0035- Plaza Deposit Record by Bank Revenue Date
   - 2.3. HOST0049 Plaza Deposit Record by TCS Revenue Date
   - 2.4. HOST0014 Deposits by Bank Revenue Date
   - 2.5. HOST0034 - Central Cash Accounting Plaza Return
   - 2.6. HOST0013 Revenue
   - 2.7. HOST0017 - No Funds
   - 2.8. HOST0070A TOD for E-ZPass with Adjustments

2.9. HOST0070U TOD for E-ZPass without Adjustments
2.10. HOST0069A ACM TOD with Adjustments
2.11 HOST0069U ACM TOD without Adjustments

3. E-ZPass Reports

3.1. HOST0061 E-ZPass Reconciliation Summary
3.2. HOST0062 ORT Reconciliation Summary
3.3. HOST0057 Home/Away E-ZPass Transaction
3.4. HOST0022 E-ZPass File Transfer
3.5. HOST0068 Transponder File Transmission

4. Audit Reports

4.1. HOST0042- Final Audit
4.2. HOST0047- Adjustment Summary
4.3. HOST0001- Initial Audit
4.4. HOST0030 Bank Adjustment
4.5. HOST0020 Bag Discrepancy Audit
4.6. HOST0048 ACM Bag Assignments Message Log
4.7. HOST0031 Bank Deposit Piece Count
4.8. HOST0019 Moneybag Manifest
4.9. HOST0026 Employee List by Plaza
4.10.HOST0064 Axle Dollar Variance
4.11.HOST0065 Retail Sales Detail
4.12.HOST0066 Retail Sales by Plaza

5. Traffic Reports

5.1. HOST0039 Daily Traffic Overview
5.2. HOST0060 Hourly Traffic by Lane
5.3. HOST0009 Traffic by Lane
5.4. HOST0058 Hourly Method of Payment

6. Traffic and Revenue

6.1. HOST0036 Traffic and Revenue Summary
6.2. HOST0010 Ranking of Traffic
6.3. HOST0032 Integrity - Lane vs. Host - Lane Only
6.4. HOST0033 Ranking Revenue

7. Daily Plaza Reports

7.1. HOST0005A Plaza Events
7.2. HOST0046 Transaction Detail

8. Excel Reports

8.1. HOST0031X Bank Deposit Piece Count
8.2. HOST0057x E-ZPass Home and Away
8.3. HOST0046x Transaction Detail
8.4. HOST0039x Daily Traffic Overview
8.5. HOST0036x Traffic and Revenue

8.6. HOST0058x Hourly Method of Payment
8.7. HOST0060x Hourly Traffic By Lane
8.8. HOST0032x Integrity

ITCS PowerBuilder Reports

9. Facility Traffic

9.1. Revenue
9.2. Class
9.3. Lane
9.4 Lane Mode

10. Transaction

10.1. All Details
10.2. Single Detail
10.3. Lane Mismatch
10.4. Detail with Summary

11. Reconciliation Toll Collector

11.1. Tour of Duty
11.2. Cash Discrepancy
11.3. Performance
11.4. Mismatch with Images
11.5. Tour Summary
11.6. Tour of Duty – Management
11.7. Tour of Duty – Detail
11.8. Tour of Duty – Detail – Collector
11.9. Unregistered Transaction Analyst
11.10. Transaction Type
11.11. Unusual Activity
11.12. Transaction Rates
11.13. Violation Details

12. TB&T Traffic

12.1. Calendar Detail
12.2. Record Traffic Detail
12.3. Traffic Forecast
12.4. Monthly Events Detail
12.5. Incomplete Traffic Detail
12.6. Weekly Traffic
12.7. Monthly Traffic

13. Miscellaneous

13.1. Data Transfer
13.2 Lane Messages
13.3. Toll Lane Availability

13.4. Lane Check
13.5. Bad ID Authorization
13.6. Tours for Toll Collectors

14. Manual Logon Activity with Toll Collector Info

14.1. Unusual Activity New

15. Security Reports

15.1. Employees
15.2. Modules
15.3. Groups
15.4. Toll Schedules

16. Validation

16.1. Plazas
16.2. Lanes
16.3. Plan Types
16.4. Exceptions
16.5. Revenue Types
16.6. Toll Classes
16.7. Error Codes
16.8. Message Thresholds
16.9. Terminal Definitions
16.10. Agencies
16.11. IAG Class
16.12. Violations Codes

17. Engineering Reports

17.1. Reconciled Rejected Violations Report
17.2. Rejected Violation Review
17.3. Uncollectable Violation Report with Review
17.4. Rejected Violations by Status – Statistics
17.5. Lane Hardware Errors
17.6. Query By Example

18. System Administration

18.1. Security
18.2. Employees
18.3. Modules
18.4. Groups
18.5. Toll Schedules
18.6. Validations

ITCS Batch Reports

CHECK_TAG_FILE
CHECK_VIOL_REJ

CHECK_CROSS_LANE
CHECK_RECON
CHECK_SPEED
CHECK_AXLES
CHECK_FLUSH
CHECK_UNREG
CHECK_VIOL
CHECK_DROPPED_AXLES
CHECK_VIOL_REJ_DETAIL
CHECK_AVI_PERF
CHECK_AXLES_AM
MONTHLY_VIOL_REJ_DAMAGES

2.11.5 Video Tolling Transaction

The Contractor shall modify ECH software to support:

1. A new Video Toll Transaction revenue type
2. Incorporate Dedicated/AET lane mode into Plaza Supervisor control and displays
3. Update ECH Reports to incorporate lane video tolling transactions

2.11.6 Image Review Process

The Contractor shall provide an image review process that provides the same capabilities and functionality as currently exists for Authority users.

2.11.7 Abusing Tags Management

The new ECH shall provide screens and reports to allow authorized staff to:

1. Maintain the abusing tags list used by the System to adjust charged class
2. Maintain the exception tags list used by the LOAD_MISMATCHERS batch job/report.

The LOAD_MISMATCHERS and MISMATCHER_DETAILS jobs shall be modified to use the same abusing tags list as used by the system to adjust charged class.

The system shall track the difference in toll between the original calculated toll and the recalculated toll based on the application of the abusing tags logic and shall provide reports to monitor this toll differential and its effectiveness.

2.11.8 ECH Storage Requirements

Furnish and install a new IBM-based image and database server with storage array to handle the following storage requirements:

1. 13 months of on-line storage for VES images with increased resolution as noted in Table 3-5 below.
2. Increase the current capability for 13 months of rolling transaction details storage to seven (7) years of transaction details storage.

NOTE: The combined VES images for front and rear for one vehicle, when compressed are approximately 1.25MB in size. Estimated network bandwidth requirements for the VES are based on five (5) images for conventional lanes and four (4) images for OBX ORT Lanes.

Data Type	Number of Months	Estimated Number of Transactions
Violations/Video Tolls	12	3,000,000
ETC Mismatches	3	750,000
Collector Mismatches	12	410,000
BB Video Tolls (current Cash transactions)	12	405,000
GWBP Overnight Video Toll Increase (est.)	12	31,000
GWBL Overnight Video Toll Increase (est.)	12	141,000
Total Image Sets		**4,737,000**
Total Storage Capacity Required		**6.22TB** *(Based on 4.737M image sets X 1.25MB per image set + 5% OH)*

Table 3-5: ECH VES Image Storage Requirements

The Contractor shall furnish and install all materials needed to expand the storage array as noted above. Work shall include, but not be limited to:

1. Furnish and install all hardware including new Red Hat Linux based server(s), storage arrays and tape backup units needed to expand the current storage capacity in this Change Order.
2. Migrate 13 months of the VES data from the existing image storage system to the new image storage system.
3. Verify proper migration of the image data and report the results to the Authority.
4. Update file transfer software to comply with CO#103 requirements.

As part of the Detail Design, the Contractor shall define and document a solution for the storage and transfer of all required files to/from the legacy ECH, the new ECH and the VECTOR CSC/Back Office systems during and after the transition such that transfers are executed at regular intervals using Secure File Transfer (SFTP) .

2.11.9 Off-line Storage

Offline storage retention requirements for the ECH shall remain the same as required in the Contract. The existing ECH database backup functionality shall be retained until the system is decommissioned. New data backup capability is required for the ECH to protect image data stored on the server.

2.12 Training

The Contractor shall conduct four (4) types of training programs under this Change Order, as follows:

1. Toll Collector and Toll Supervisor Training incorporating any screen or process changes associated with the new devices to be installed under 3.9 above [hereafter Course 1].
2. A comprehensive course on hardware and software architecture, operations and maintenance of the new Vector ECH system [hereafter Course 2].
3. A comprehensive course on system reports [hereafter Course 3].
4. A comprehensive course on Revenue Accounting features of the new system [hereafter Course 4].

Course 1 shall be delivered by the Contractor to the Authority's trainers (approximately 2 to 5 people) at the Port Authority Technical Center as a Train the Trainer program. Authority trainers will subsequently train tolls staff.

Course 2 for 12 Authority staff, shall be delivered by the Contractor at an Authority facility To Be Determined.

Course 3 shall be presented to multiple groups of up to 10 Authority staff (maximum of 60 Authority staff in total) at an Authority facility To Be Determined.

Course 4 for 12 Authority staff, shall be delivered by the Contractor at an Authority facility To Be Determined.

Prior to the actual training for each course, the Contractor shall conduct a pilot session for each course to elicit Authority comments and feedback on training materials and class content. Scheduling for the pilot session shall be coordinated early enough in the program such that the Contractor has adequate time to make the necessary modifications to course content and materials for the remaining courses.

The Contractor shall provide a Bill of Materials with pricing for all training scope items under Section 2.12 and all its subsections in Attachment 2 – Bill of Materials and Pricing Templates including optional pricing for one (1) additional training session for each course as an ad hoc session on an independent schedule.

2.12.1 Training Manuals and Materials

The Contractor shall provide all course materials, presentation materials, handouts and student manuals for all courses including electronic copies in Word and PowerPoint, as well as two (2) copy-ready sets of the final version for all courses - one (1) in color and one (1) in black & white.

2.13 Lane Installation

As noted throughout this section, the Contractor is required to provide equipment with turnkey installation and test at each location. In addition, the Contractor shall include the following special installation services in 2.13.1 and 2.13.2 below:

2.13.1 Decommissioning of Lane 66 ITCS Equipment at GWB Lower Level

The Contractor shall decommission lane 66 ITCS equipment at the GWB Lower Level. The task shall include but not be limited to:

- Disconnecting the Lane Controller from the canopy traffic light and restore manual canopy traffic light control.
- Powering down the Lane Controller and removing the Lane Controller from the Host Table.
- AVI antenna and cabling will remain connected and the AVI Reader shall be set in "guard mode".

NOTE: As noted in Section 2.8 above, the Contractor shall replace the existing Vultron LMS with a new LMS sign with the ability to display a configurable message set to C1: LANE CLOSED.

2.13.2 Relocation of Holland Tunnel Treadles

The Contractor shall modify ITCS lane equipment locations at the Holland Tunnel to eliminate existing inconsistencies in lane geometry at Lanes 3, 4, 5, 6, and 7. The following Scope of Work shall be completed, at a minimum, to modify the treadle locations in these lanes:

1. Remove the existing loops, treadle and treadle frame.
2. Furnish and install a new treadle frame, of the same type removed, to a location as noted in approved Detail Design and/or Shop Drawings.
3. Connect the new frame to the existing treadle drain and existing conduit infrastructure.
4. Furnish, install and terminate a new treadle, of the same type removed in the newly installed treadle frame.
5. Cut, install, and terminate new loops in compliance with revised lane geometry.
6. Patch and repair roadway and island to match existing conditions. All concrete repairs shall comply with Attachment 6 - Applicable Authority Technical Specifications including, but not limited, to:
    a. 02073 Cutting, Patching and Removal
    b. 03602 Grouting (Non-Metallic)
    c. 15410 Plumbing Piping and Appurtenances
    d. 15430 Plumbing Specialties

The Contractor shall observe the Authority's concrete pouring season from April 15th to October 15th, as well as, manufacturer recommendations for concrete patching, which can be performed at anytime provided that the patching is performed within the manufacturer's specifications for the product being used.

The Contractor shall provide pricing for a turnkey installation effort at each location in Attachment 2 – Bill of Materials and Pricing Templates.

3 Schedule and Management

3.1 Kickoff Meeting

The Contractor will schedule a round of Kickoff & Initial Discovery Meetings with the Authority within 10 business days of execution of the Change Order. Topics to be discussed during this round of meetings include but are not limited to the following:

- Introduction of project team
  - Organizational charts for the Xerox ITCS implementation and maintenance team
  - Staffing list with titles and contact information – please indicate full-time or part-time (i.e., shared with other projects) status
  - Staffing list with role and contact information – please indicated full-time or part-time status (i.e., shared with other projects).
- Project communications
  - Use of Milestone Review templates for technical clarifications or Requests for Information (RFI)
  - Document reviews
  - Format for Monthly Management Report
- System Design Review Meeting organization and scheduling (sample topics below / Contractor to propose alternate groupings)
  - Requirements Review items identified in Section 2.2, bullet #8 above.
  - Lane SW Design
  - ECH SW Design
  - Integration of ITRACS
  - Training
  - Transition
  - Schedule
    - Site Surveys
    - Updates and Tracking
    - Planning for FAT

3.2 System Design Review Meetings

The Contractor shall schedule and conduct System Design Review Meetings during the system design period for the purpose of clarifying design requirements as applicable and refining proposed design solutions to Change Order requirements. The System Design Review Meetings will include Contractor project and design staff along with appropriate TB&T staff and will be held at an Authority location. The Contractor shall prepare and distribute an agenda for each meeting and minutes of the previous meeting to all participants expected to attend the meetings five (5) days prior to the scheduled meeting. Topics to be discussed include, but are not limited to:

- Review, amendment and acceptance of minutes from prior meetings

- Analyze work accomplished since previous meetings, including: design status, RFIs, problems arising from proposed changes, and other circumstances which might affect progress of the work
- System design clarifications and proposed solutions as identified by the Contractor
- Schedule review.

The design refinements achieved and agreements reached during the System Design Review Meetings shall be incorporated into the applicable Detailed Design Documents as defined in Section 5.1.

3.3 Project Schedule

Within 30 calendar days of execution of the Change Order, provide a Baseline Project schedule in the latest version of Primavera P6 scheduling software. The schedule shall detail all proposed activities with predecessor and successor links except the Change Order Start and Change Order Completion milestones. Other schedule requirements are detailed in Section 33 of Attachment 7 - Division 1 General Provisions.

3.4 Project Monthly Progress Report

The Contractor shall provide monthly progress reports that include:

- Project Schedule updates
- Action Item Log identifying open issues identified in correspondence, Design Review and other meetings. Each action item in the log shall contain:
    - Item Number
    - Description
    - Requesting Party
    - Assigned Party
    - Status (open / closed / in progress / deferred / etc.);
    - Date Opened
    - Date Closed
    - Progress Notes.

The report shall detail the previous month's progress, issues that have been encountered and need resolution, and the planned work for the upcoming month.

4 Documentation

All documentation required under this Change Order shall be provided by the Contractor for the Authority's review and approval prior to implementation or start of field work, as appropriate. The Contractor shall update those documents in accordance with the Authority's comments and instructions, and according to the project schedule accepted by the Authority.

In addition, the Contractor shall update all Detail Design Documents and any other documents where changes occurred and were approved by the Authority in conjunction with the System Design Review process in 3.2 above and in accordance with the actual installation.

The Contractor shall deliver the updated documents according to the Project Schedule agreed upon by both parties in Section 3.3 above.

4.1 Detailed Design Documents (DDD)

The Contractor shall update the following original ITCS Detail Design Documents, which shall include but is not limited to complete functional line and block diagrams, catalog cuts, and product literature as well as comprehensive and detailed technical information describing the hardware, software, and communications:

- Computer HW Documentation
- Equipment Support Document
- Software Design Document
- System Documentation

The Contractor shall include the ECH/CSC Interface Design and Interface Control Document (ICD) as a new document section or volume.

Ten (10) hard copies of the DDD shall be delivered to the Authority along with one (1) electronic copy in Microsoft Word (original with Track Changes on) and one (1) electronic copy as a PDF of the print copy.

4.2 Implementation Plan

The Contractor shall provide an Implementation Plan, for review by the Authority as per the schedule. The Implementation Plan shall provide detailed instructions to field personnel on the sequence and method by which each removal, construction, installation, and testing task is to be performed. The Contractor shall adhere to the hours of work and staging as designated in Sections 11and 11 below.

A Site Safety Program compliant to Section 17 - Safety Provisions of the Division 1 General Provisions shall be included in the Implementation Plan.

4.2.1 Work Sequence

The Implementation Plan shall include but not be limited to a detailed work sequence for all removal, construction, installation, testing, training, and transition tasks, and their relationships to one another, for all System components shown below or in the most efficient order considered by the Contractor:

1. Network
2. Lane level
3. Plaza level
4. ECH level (primary and backup)
5. Training Academy

All ECH, Networking, Plaza, toll booth, toll island, and toll lane modifications and dependencies shall be called out in this work sequence.

4.2.2 Checklists for Completeness of On-site Work

The Implementation Plan shall include but not be limited to checklists for completeness of all on-site work. These checklists shall include but not be limited to items required for the installation crew to complete modifications, installation, transition, removal, and disposal work tasks.

A copy of the respective checklist shall be attested to by the Contractor and provided to the Authority after the completion of lane installation.

Each checklist shall include but not be limited to:

- A complete listing of all affected System (hardware and software) switch settings
- A complete listing of any other hardware and software configuration parameters
- Software installation, configuration, and initialization instructions.

4.3 Detail Design Drawings, Shop Drawings, Catalog Cuts and Samples

The Contractor shall comply with design submittal requirements defined in Section 1.1 above and listed in Section 8 Detail Design Drawings, Shop Drawings, Catalog Cuts and Samples of Attachment 7 - Division 1 General Provisions which the Contractor shall refer to in its entirety and shall include:

1. Inspection and structural analysis of the existing OLS mounts, mounting HW and modifications required to install new OLS equipment.
2. Inspection and structural analysis of the existing LMS mounts, mounting HW and modifications required to install new LMS equipment.
3. A description of their methodology for repair of canopy fascia when required, including material specifications, fastening methods, finish material product data, and special colors, as required, to match existing.
4. A description of means & methods

4.3.1 Submittal Schedule

The Contractor shall submit a general “Submittal Schedule” for the Engineer’s review and approval listing the planned transmittal date and estimated number in each specification section category of Shop

Drawings, Catalog Cuts, pages of calculations and samples within 30 calendar days after execution of the Change Order. A more detailed schedule shall be submitted no less than 30 calendar days prior to the actual date of any submittal.

The Contractor shall submit Detailed Design and Shop Drawings, signed and sealed by a Professional Engineer, for the architectural, plumbing, civil, electrical, structural, maintenance of traffic and environmental requirements of the site design for replacement equipment as per the schedule.

4.3.2 Submittal Format

The format for Shop Drawings prepared by the Contractor shall be as noted in Division 1, Section 8 requirements except that, in addition, the Contractor shall provide seven (7) PDF files containing the respective location Detail Design and Shop drawings that can be printed on 11 in. x 17 in. paper; i.e., a separate PDF file for each location for the initial submittal..

4.4 Manuals

The Contractor shall include the submittal schedule for manuals in the Project Schedule.

4.4.1 System Administration Manual

The Contractor shall update the existing or create a new ITCS System Administrator Manual, which shall include but is not limited to comprehensive and detailed technical information describing the hardware, software, and communications changes to the ITCS. The information provided in the updates shall be consistent with the original intended purpose of the document. The Contractor shall also provide new ECH manuals covering the new Vector software and hardware.

4.4.2 Operations Manual

The Contractor shall update the existing or create a new ITCS Operations Manual, which shall include but is not limited to information required by Authority personnel in day-to-day operations including descriptions of the various system components and processes for which it identifies specific incidents that can occur together with the required responses/solutions. The information provided in the updates shall be consistent with the original document.

4.4.3 Maintenance and Service Manual

The Contractor shall update the existing or create a new ITCS Maintenance and Service Manual, which shall include but is not limited to comprehensive and detailed technical information describing the hardware, software, and communications changes to the ITCS. The information provided in the updates shall be consistent with the original document.

4.4.4 Toll Collector Operating Manual

The Contractor shall update the existing or create a new ITCS Toll Collector Operating Manual, which shall include but is not limited to comprehensive and detailed technical information describing the hardware, software, and communications changes to the ITCS. The information provided in the updates shall be consistent with the original intended purpose of the document.

4.4.5 Toll Supervisor's Operating Manual

The Contractor shall update the existing or create a new ITCS Toll Supervisor Manual, which shall include but is not limited to comprehensive and detailed technical information describing the hardware, software, and communications changes to the ITCS. The information provided in the updates shall be consistent with the original intended purpose of the document.

4.4.6 ECH Re-platform Training Manuals

The Contractor shall provide a complete set of Training Manuals covering the depth and breadth of the new Vector software, hardware, external programs, batch processes, interfaces, reports and any new or refreshed functionality provided as part of the re-platform effort. Training Manuals shall include, but are not limited to, comprehensive and detailed technical information describing the hardware, software, and communications changes to the ITCS. The information provided in the updates shall be consistent with the original intended purpose of the document.

4.5 Disaster Recovery Plan

The Contractor is responsible for submitting a Disaster Recovery plan that addresses recovery operations for both the existing or "legacy" ITCS systems and new ITCS systems in this Change Order. The Disaster Recovery Plan, Revision 3.0, dated October 2013 is currently under review by the Authority for the current ITCS system. The Contractor shall update the Revision 3.0 document to reflect the system modifications implemented in this Change Order and to ensure compliance with TSD standards including the following updates, at a minimum:

1. Address existing Authority comments provided for the 3.0 document.
2. Develop Disaster Severity Definitions to define the level of potential disaster based on impact to critical functions.
3. Identification and addition of disaster cases and recovery procedures that address the interim situation when a legacy ECH and a new ECH are operating in tandem.
4. Identification and addition of disaster cases and recovery procedures that address the final situation when the ITCS Change Order is completed and the identified legacy equipment has been decommissioned.
5. Establish disaster recovery preparatory procedures to incorporate CSC personnel and reflect all new ITCS devices.
6. Include lists, Bills of Material and/or other technical documents in the Disaster Recovery Plan that identify:
    - System Components- a copy of all essential office equipment and records shall be stored off-site. Specify any special computer hardware, software, databases, networks or other technology.
    - Hardware
        - Hardware inventory for system in operation
        - Desktop Workstations (In Office)

        - Desktop Workstation location
        - Desktop Workstations (Offsite including at home users)
        - Laptops
    - Software
        - Software inventory of the system in operation
        - Systems, Applications and Network Software
        - Communications
        - Operations
    - Off-Site Inventory.
    - Supplemental Hardware/Software Inventory.

7. Define Disaster Recovery Plan update procedures and responsibilities

4.6 Documentation Review and Approval Cycle

The Authority will review and comment on each document and drawing submitted by the Contractor. The Authority will make every effort to complete its review within the following timeframes:

- Review cycles for engineering submittals (i.e., design drawings, shop drawings, catalog cuts and calculations, Implementation Plan) are as specified in Division 1 Guidelines, Section 8 [table reproduced below for reference].

No. of Drawings Submitted Within 5 Business Days for Each Discipline(*)	No. of Business Days for Engineer to Review Detail Design and Shop Drawings
Up to 50	10
51 to 75	15
More than 75	20
* Disciplines shall be defined as follows: Structural, Architectural, Civil, Geotechnical, Mechanical, Electrical, Traffic and Environmental.	

- Review cycles for TB&T submittals - all other documents

No. of Changed or New Pages in a Single Document	No. of Business Days for Review
Up to 50	15
51 to 100	20
100 > n < 250	25
> 250	30
+ 10 business days for 2 documents submitted within 5 consecutive days + 20 business days for 3 documents submitted within 5 consecutive days + 30 business days for 4 documents submitted within 5 consecutive days	

The Contractor shall incorporate all Authority comments received on all documents and drawings. The Contractor shall resubmit all such documents or drawings for one (1) additional review and comment cycle by the Authority.

5 Testing

The Contractor shall conduct the tests described in this section to verify functionality and to demonstrate to the Authority the readiness of ITCS for production. There are three Authority witnessed tests: The Factory Acceptance Test (FAT), On-site First Installation Test (OFIT), and Field Check Out Test (FCOT) to be conducted, reported upon and approved by the Authority.

The Authority will, at its own expense, provide personnel and consultants to witness FAT, OFIT and FCOT testing.

The sequence of events and deliverables are presented below. The Contractor shall deliver the updated documents according to the Project Schedule agreed upon by both parties in Section 3.2.

FAT:

1. The Contractor prepares the Factory Acceptance Test (FAT) Plan and submits it to the Authority for approval as scheduled.
2. The Authority will review the FAT and approve or return with comments, if not approved. The Contractor shall resubmit the FAT with the Authority comments incorporated for additional reviews.
3. Upon approval, the Contractor shall perform the FAT and provide a Report explaining the results, identifying open issues, and providing an action plan for resolution of open issues as required.
4. The Authority will review and return the report with comments within the timeframes listed in 4.6 above, as appropriate, and provide approval of the action plan or comments for changes if needed. The Authority will limit its review and comment cycle to a maximum of two (2) rounds.
5. Upon approval from the Authority, the Contractor shall implement their action plan to resolve open issues and provide a final report to the Authority.
6. Once reviewed by the Authority, if no further issues remain, and the Authority approves the FAT Plan, the Contractor may proceed with installation of the first lane and the ECH in accordance with the approved schedule.

OFIT:

1. The Contractor prepares the On-Site First Installation Test (OFIT) Plan to the Authority for approval as scheduled.
2. The Authority will review the OFIT and approve or return with comments, if not approved. The Contractor shall resubmit the OFIT with the Authority comments incorporated for additional review. The Authority shall limit its review and comment cycles to a maximum of two (2) rounds.
3. Upon approval, the Contractor shall install the required equipment in the first lane and perform the OFIT. After completing the OFIT, the Contractor shall provide a Report explaining the results, identifying open issues, and providing an action plan for resolution of open issues as required.
4. The Authority will review and return the report with comments as necessary and provide approval of the action plan or comments for changes if needed. The Authority will limit to one its review and comment cycle.

5. Upon approval from the Authority, the Contractor shall implement their action plan to resolve open issues and provide a final report to the Authority.
6. Once reviewed by the Authority, if no further issues remain, and the Authority provides approval, the Contractor may proceed with installation of the subsequent Staffed/Dedicated lanes.

FCOT:

1. The Contractor shall provide a Field Checkout Test (FCOT) Plan specific to the lane type, to the Authority for approval as scheduled.
2. The Authority will review the FCOT Plan and approve or return with comments, if not approved. The Authority shall limit its review and comment cycles to a maximum of two (2) rounds.
3. Upon approval, and as lanes are installed, the Contractor shall perform the approved FCOT for each approved lane type without further submittals and provide a report explaining the results, identifying open issues, and providing an action plan for resolution of open issues as required.
4. The Authority will review and return the report with comments as necessary and provide approval of the action plan or comments for changes if needed. The Authority will limit to one its review and comment cycle.
5. Upon approval from the Authority, the Contractor shall implement their action plan to resolve open issues and provide a final report to the Authority.
6. Once reviewed by the Authority, if no further issues remain, and the Authority provides approval, the Contractor may place the lane into production and proceed with installation of subsequent lanes.

5.1 Factory Acceptance Test

A FAT shall be performed to demonstrate the functionality, to the Authority, of all proposed modifications required by this SOW including the ECH/CSC interface. For all Lane changes, the FAT shall be performed at the Contractor's facility in Crofton MD. For the ECH, the Contractor shall provide a suitable facility capable of accommodating the required tests. The test shall include every functional item in this SOW as well as regression testing for the ITCS functions.

The Contractor shall provide a FAT Plan describing their approach to testing. For the lane and plaza changes, at least one unit of every hardware and software component provided in this SOW shall be fully integrated with ITCS and demonstrated. All new and modified ECH functionality shall be demonstrated to show successful operation of the ECH on its new platform. The Contractor may use existing Contract spare parts inventory that will not be replaced as part of this Change Order such as Manual Lane Terminals (MLT), receipt printers, proximity card readers, etc. to perform the FAT. The Contractor may also purchase such parts for the FAT and return the same in good working order to spares inventory after the test. All other components provided for the FAT shall be new and unused. Upon completion of the FAT, those components will be un-installed from the Crofton, MD test site and the ECH test site, and installed at the Authority's facilities.

The Contractor shall provide any vehicles and drivers necessary to simulate Authority traffic conditions.

The Contractor shall demonstrate that the hardware and software is fully integrated and satisfies all of the requirements of this SOW. Testing shall demonstrate end to end connectivity and full functionality of all components.

The Contractor shall design and conduct a representative stress test for FAT that simulates heavy traffic in conjunction with system access and reporting requests from 25 simultaneous users.

5.2 On-Site First Installation Test (OFIT)

5.2.1 Lane OFIT

An OFIT shall be performed at an Authority selected conventional lane and witnessed by the Authority. The OFIT is intended to verify that the individual lanes are ready to be placed into service with live traffic.

The OFIT shall be a pre-approved subset of the FAT to determine that changes made to ITCS are production ready. Once the changes have been installed and determined by the Contractor to be ready for test, the lane shall remain closed for OFIT and test vehicles shall be used to execute the scripted tests.

Upon completion, an OFIT Report shall be submitted to the Authority, open issues shall be resolved and with the approval of the Authority, the lane shall be opened to live traffic. The OFIT shall be performed once for a fully equipped conventional Staffed/Dedicated Lane.

Once the OFIT is approved by the Authority in the designated conventional lane, the remaining conventional lanes may be installed and commissioned with a Field Checkout Test as approved by the Authority and as described below.

5.2.2 ECH OFIT

A derivative of the FAT shall be performed as the OFIT test for the primary and backup ECH to demonstrate all hardware, networking, software, interfaces and backup are ready for live operation.

A test of manual failover for the ECH shall be performed after both ECH platforms have successfully completed their individual FCOT.

Upon completion, an OFIT Report shall be submitted to the Authority, open issues shall be resolved and with the approval of the Authority, the ECH will be authorized to support lanes opening to live traffic..

5.3 Field Checkout Test (FCOT)

The FCOT is an Authority witnessed commissioning test. Two (2) FCOT types are required with this Change Order, as follows:

5.3.1 Conventional Lane FCOT

For conventional lanes, the FCOT is derived from the OFIT and represents the key tests, as approved by the Authority, needed to prove the lane's readiness for production.

5.3.2 OBX Express Lane FCOT

For the OBX Express Lanes, the FCOT is derived from the FAT and, likewise, represents the key tests, as approved by the Authority, needed to provide the lane's readiness for production.

When completed for each lane, the FCOT Report shall be submitted to the Authority for approval. Any issues on the Report shall be resolved by the Contractor and re-submitted for approval prior to placing the lane into revenue service.

6 Maintenance and Spares

The Contractor shall provide a one-year Warranty on all parts, including software, installed under this Change Order except as specified for the ECH in 2.11.1.

The Contractor shall integrate all newly installed components into the existing Contract, and shall be responsible for preventive, corrective, and emergency maintenance of all installed equipment through December 31, 2015 with no modification to the Contract term or price. The Authority will address additional extensions for ITCS maintenance in a separate process.

The Contractor shall be responsible for maintenance of newly installed ITCS network switches and related network equipment. The Authority will maintain PAWANET switches and network equipment.

Spare parts shall be included for the newly installed equipment for the first year of operation. The Bill of Materials will include a separate listing for the quantities of spares specified.

The Authority has an existing inventory of 39 XAI treadle cards which it will continue to make available to Xerox at no cost for use in the lanes.

7 Maintenance of Traffic

The Contractor shall comply with Section 37, Division 1 Maintenance of Traffic and Work Area Protection specifications in Attachment 7 - Division 1 General Provisions and 24 Attachment 12 – MOT Reference Drawings

8 Milestone Payments

Table 9-1 following provides a schedule of Milestone Payments.

Item	Description	% of TCV	Cumulative Total
1	Approval of Project Schedule	5%	5%
2	Approval of Detail Design Documentation	5%	10%
3	Completion of Factory Acceptance Test (FAT)	10%	20%
4	Installation and commissioning of First Site	5%	25%
5	Commissioning per lane (67 lanes)	1.0% per lane or 67%	92%
6	Project Acceptance	8%	100%

Table 9-1: Milestone Payment Schedule

9 Assumptions By Contractor

The following assumptions made by the Contractor in prior correspondence with the Authority, are acceptable to the Authority.

1. There are no special noise abatement treatments required in the performance of this SOW.
2. The scope assumes that the new LMS sign will be installed and tested within the same timeframes as the other modifications in the scope of work.
3. Per agreement between the Authority and the Contractor, the SLA and associated liquidated damages for allowable image rejection rates will be reduced for each toll facility during the 90 day period following conversion to the new toll equipment at that facility. After the 90 day conversion period expires, the SLA for each facility will be modified to be more stringent reflecting the improved image reject performance to be delivered with the upgraded equipment. The revised SLA values for image reject performance are shown in Section 1.2.1 above.
4. All requirements of CO #103 are necessary as a complement to this Change Order. However, all references to Central Toll Host (CTH) in CO #103 shall be replaced by Electronic Toll Host (ECH).
5. No performance or payment bond is included for this scope of work.
6. No asbestos or lead abatement work is included.
7. Contaminated soil testing, excavation, and disposals are excluded.
8. No permits or fees are included.
9. No Division of Community Affairs (DCA) permits or inspections for the State of New Jersey are included.
10. The Contractor grants the Authority a continued perpetual license to existing software and modifications made under this Change Order.
11. Pricing for this Change Order reflects tax exemption terms and conditions identified in the Contract.
12. Title to equipment delivered under this Change Order transfers to the Authority in accordance with terms and conditions of the Contract.

10 Hours of Work

1. Subject to all requirements stated elsewhere herein, the Work shall be performed only during the following restricted hours of Work.
2. Unless otherwise stated herein, Work may be performed in the lanes closed and taken out of service only when a Construction Engineer is on site during the hours 7:00 AM to 3:00 PM and 10:00 PM to 6:00 AM the following morning, Monday through Friday unless otherwise directed by the Engineer.

   The Authority understands that the Contractor may desire additional hours of work for special circumstances and will endeavor to review and accommodate, to the best of its ability, requests for extended Construction Engineering support with 48-hour written notice to the Engineer.
3. Unless otherwise stated herein, Work may be performed at the Telecenter and Port Authority Technical Center Monday thru Friday from the hours of 8:15 AM to 4:15 PM.
4. Unless otherwise stated herein, work to be performed outside of the toll lanes may be performed Monday through Friday between the hours of 7:00 AM. to 3:00 PM daily.
5. Work requiring the closure of an adjacent lane (i.e., a 2nd lane when one lane in the plaza is out of service or a 3rd lane when two lanes in the plaza are out of service) shall only be conducted between the hours 11:00 p.m. to 5:00 a.m. the following morning, Monday through Friday.
6. The Contractor shall submit to the Authority, at least three (3) weeks in advance, its schedule hours of Work for the next two (2) weeks (e.g., Look-Ahead Plan). The scheduled hours of work shall include any lane closures required during that period.
7. Notwithstanding anything to the contrary above, for the duration of this Change Order, no closure of any traffic/toll lanes is permitted during the following periods:

   a. <u>All Plazas</u>
      i. Memorial Day weekend (5:00 AM Friday through 5:00 AM Tuesday).
      ii. Independence Day weekend (5:00 AM Friday through 5:00 AM Tuesday if the holiday falls on a Saturday, Sunday or Monday; 5:00 AM Thursday through 5:00 AM Monday if the holiday falls on a Friday; and 5:00 AM the day before to 5:00 AM the day after if the holiday falls during the week).
      iii. Labor Day weekend (5:00 AM Friday through 5:00 AM Tuesday).
      iv. Mother's Day and Father's Day weekends (5:00 AM Friday through 5:00 AM Monday).
      v. Thanksgiving weekend (5:00 AM Friday through 5:00 AM Monday after the holiday).
      vi. Christmas through New Year (5:00 AM December 23 through 5:00 AM January 2).
      vii. Easter weekend (5:00 AM Friday through 5:00 AM Monday).
      viii. From 5:00 AM the day before to 5:00 AM the day after the start of Rosh Hashanah, Yom Kippur, Passover and Hanukkah.
      ix. Columbus Day weekend (5:00 AM Friday through 5:00 AM Tuesday).
      x. From 5:00 AM the day before to 5:00 AM the day after Veteran's Day.

   b. <u>Additionally</u>, at the Lincoln Tunnel:
      i. Lincoln Tunnel Fun Run Weekend (5:00 AM Friday through 5:00 AM Monday).
      ii. MS Bike Tour Weekend (5:00 AM Friday through 5:00 AM Monday).

8. The Outerbridge Crossing has peak traffic volumes from Memorial Day thru Labor Day. No work shall be performed at the Outerbridge Crossing from 5:00 AM before Memorial Day to 5:00 PM the Tuesday after Labor Day.
9. Do not perform Work at the construction site outside of the times allowed above or on Federal Legal holidays or a holiday of the State(s) in which the Work is being performed, unless otherwise permitted by the Engineer.

11 Staging

The Contractor shall submit to the Engineer for approval, its proposed staging schedule based on the following requirements.

1. Toll Lane Construction Staging Restrictions

   The construction staging of the facilities shall have the following restrictions:

   a. In general, the Contractor shall be permitted to perform the Work of the Change Order at a maximum of two toll plazas at a time with the following exceptions:
      i. Toll lanes shall not be taken out of service at the George Washington Bridge Upper Level, Lower Level or PIP plazas simultaneously.
      ii. Toll lanes shall not be taken out of service at the Goethals Bridge and Outerbridge Crossing simultaneously.

   b. Construction at the Lincoln Tunnel XBL shall only be performed from 10:00 PM to 5:30 AM with the lane open to vehicular traffic by 5:00 AM daily; i.e., the Lincoln Tunnel XBL Lane system shall remain functional throughout construction during operational hours.

   c. As each lane is taken out of service, according to the staging plan below, it shall remain out of service until work is completed and the Contractor returns the lane to service.

   d. The Authority will allow the Contractor to close an adjacent lane as specified in Section 11 Hours of Work above.

2. Plaza Construction Staging

   a. Goethals Bridge (SIB)
      i. Toll Lane 16
      ii. Toll Lanes 14 & 6
      iii. Toll Lanes 12 & 8
      iv. Toll Lane 10
      v. Toll Lanes 2 & 4

   b. Outerbridge Crossing (SIB)
      i. Toll Lane 16
      ii. Toll Lanes 12 & 14
      iii. Toll Lanes 8 &10
      iv. Toll Lanes 2 & 4

   c. George Washington Bridge Upper Level
      i. Toll Lanes 24 & 18
      ii. Toll Lanes 22 & 16
      iii. Toll Lanes 20 & 14

iv. Toll Lanes 12 & 10
v. Toll Lanes 8 & 6
vi. Toll Lanes 4 & 2

d. George Washington Bridge Lower Level

i. Toll Lanes 74 & 72
ii. Toll Lanes 70 & 68
iii. Toll Lanes 64 & 54
iv. Toll Lanes 62 & 58
v. Toll Lanes 60 & 56

e. George Washington Bridge PIP approach

i. Toll Lane 42
ii. Toll Lanes 46 & 38
iii. Toll Lanes 44 & 40
iv. Toll Lanes 36 & 34

f. Lincoln Tunnel

i. Toll Lanes 3 & 23
ii. Toll Lanes 4 & 12
iii. Toll Lanes 5 & 11
iv. Toll Lanes 6 & 10
v. Toll Lanes 9 & 7
vi. Toll Lanes 8
vii. Toll Lanes 1, 2 & XBL

NOTE: XBL cannot be closed throughout 2014 or until the completion of Westbound Helix construction, whichever comes last.

g. Holland Tunnel

i. Toll Lanes 1 & 6
ii. Toll Lanes 2 & 5
iii. Toll Lanes 3 & 7
iv. Toll Lanes 4 & 8
v. Toll Lanes 9

NOTE: Notwithstanding the information provided in Sections 11 and 12 above, <u>all</u> work hours are subject to change based on the operational needs of the facility and must be coordinated in advance during the Construction period.

-THIS PAGE INTENTIONALLY LEFT BLANK-

12 Attachment 1 - CSC CO #103

-THIS PAGE INTENTIONALLY LEFT BLANK-

Change Order #103

Port Authority Replacement Toll Collection System

Revision 2.2

June 27th, 2012

Xerox Corporation
Transportation Central & Local Government, TCLG

Revision History

Revisions of this document are listed in chronological order. There is no relationship between the document release number and the software release number.

Version Date	Changes Highlighted	Version #
9/2011	Initial version based upon Port Authority CSC Functional Requirements and Technical Parameters documentation	1.0
10/25/11	Track Changes	1.1
11/23/11	Track Changes	1.2
11/28/11	Track Changes	1.3
5/16/12	Accepted Track Changes	2.0
5/16/12	Xerox Branding	2.1
6/27/12	Track Changes	2.2

Document Ownership

Owner	Germantown Project Management
Author	Germantown Project Management and the Port Authority of NY and NJ

Important: This document has been through a formal review process. To the best of our knowledge, it is accurate. Xerox reserves the right to make further modifications as necessary

This material contains proprietary information of Xerox Transportation Central and Local Government, TCLG. Disclosure to others; use or copying without express written authorization of Xerox Transportation Central and Local Government (TCLG), is strictly prohibited.

Trademarks

All trademarks mentioned herein are the property of their respective holders.

©2012 Affiliated Computer Services (Xerox) A Xerox Company, Transportation Central and Local Government, TCLG

Table of Contents

1. INTRODUCTION 5

1.1 OVERVIEW 5
1.2 TRANSITION 5
1.3 SCOPE 6
1.3.1 Methodology 6
1.4 ASSUMPTIONS 7

2. VECTOR CSC SUBSYSTEM REQUIREMENTS 8

2.1 CSC INTERFACE FILE PROCESSING: AGENCY TAG STATUS FILE 8
2.2 CTH INTERFACE FILE PROCESSING: AGENCY TAG STATUS FILE 8

3. VECTOR TRANSACTION PROCESSING REQUIREMENTS 9

3.1 CTH INTERFACE FILE PROCESSING: AGENCY TRANSACTION FILE 9
3.2 CSC INTERFACE FILE PROCESSING: AGENCY TRANSACTION FILE 10
3.3 E-ZPASS TRANSACTIONS 11
3.4 TOLL EVASION VIOLATION TRANSACTIONS 11

4. VECTOR VIOLATIONS SUBSYSTEM REQUIREMENTS 12

4.1 CTH INTERFACE FILE PROCESSING: AGENCY IMAGE ZIP FILE 12
4.2 CSC INTERFACE FILE PROCESSING: AGENCY IMAGE ZIP FILE 12
4.3 TOLL EVASION IMAGE REVIEW 13
4.4 EGREGIOUS VIOLATOR LIST 14
4.5 CSC INTERFACE FILE PROCESSING: HOT LIST FILE 15
4.6 CTH INTERFACE FILE PROCESSING: HOT LIST FILE 15
4.7 SPEED NOTICING 15

5. VECTOR RECONCILIATION SUBSYSTEM REQUIREMENTS 16

5.1 CSC INTERFACE FILE PROCESSING: AGENCY RECONCILIATION FILE 16
5.2 CTH INTERFACE FILE PROCESSING: AGENCY RECONCILIATION FILE 16

6. BI-DIRECTIONAL INTERFACE EXCHANGE 17

7. RECIPROCITY 18

8. REPORTS 18

9. PERFORMANCE STANDARDS....18
APPENDIX A: AGENCY TAG STATUS FILE....20
APPENDIX B: AGENCY TRANSACTION FILE....22
APPENDIX C: AGENCY IMAGE CONTROL FILE....30
APPENDIX D: AGENCY RECONCILIATION FILE....30
APPENDIX E: AGENCY HOT LIST FILE....34
APPENDIX F: ACK FILE....36
APPENDIX G: LANE COMMISSIONING SCHEDULE PROVIDED BY PANYNJ....37
REVISION DETAILS....40

1. Introduction

1.1 Overview

The purpose of this document is to specify the software and operational requirements for Change Order 103, Port Authority Replacement Toll Collection System (RTCS). Xerox has reviewed the Technical Parameters (TP-01) and CSC Functional Requirements written by the Port Authority which provided guidance on the expected impact of the Replacement Toll Collection System (RTCS) to VECTOR and NYCSC processing. As specified in the Port Authority's original proposal, the Authority is in the process of replacing its existing toll system and associated software in all lanes at all Authority toll plazas and all other locations with new lane level, facility level and central level hardware and software (herein referred to as the Replacement Toll Collection System or RTCS).

The replacement of the Authority's toll system will necessitate some corresponding changes by the New York E-ZPass Customer Service Center (CSC). These changes include:

- Change in number of violation images and their resolution
- Usage of Automatic License Plate Recognition (ALPR) in RTCS and the passing of this data to/from the CSC
- The Calculation of tolls due will be in the RTCS system only (not in the CSC)
- Modifications to the file specifications for files exchanged between the CSC and RTCS
- Communications with both the legacy ECH and the new Central Toll Host (CTH) system (comprised of both a primary and a secondary system at two distinct data centers)
- New Egregious Violator List functionality

1.2 Transition

The RTCS deployment will be staged by lane and by facility in accordance to the schedule provided by the PANYNJ in Appendix G . During the course of the deployment, the Authority anticipates that it will operate with both the legacy ECH and the RTCS Central Toll Host (CTH) System – both primary and secondary. The CSC shall continue to exchange all legacy data with the legacy ECH utilizing existing legacy formats as well as establishing communication with and exchanging all data with the new CTH when the new CTH goes on line utilizing the new data formats as detailed in the RFP and as they may be modified during system design. On the CSC end, all data received from or sent to both the legacy ECH and new CTH should be treated equally. Reconciliation data should be returned to the host from which it was received. Any outstanding data which must be reconciled with the legacy ECH after that host has been eliminated shall be reconciled with the new CTH

1.3 Scope

The following E-ZPass New York Home Agencies are participating in this Change Order:

- ✓ PANYNJ
- MTA B&T
- NYSTA

Private, Business, Commercial and Non Revenue Accounts and Plans are in scope for this Change Order.

The following VECTOR Software Subsystems are affected by this Change Order:

- ✓ CSC
- ✓ VIOLATIONS
- ✓ RECONCILIATION
- ✓ TRANSACTION PROCESSING (TPMS)
- ✓ REPORTS
- ✓ RECIPROCITY
- ✓ FINANCIAL PROCESSING (FPMS)
- ✓ HOST
- WEB

1.3.1 Methodology

1. The Port Authority will notify Xerox of any implementation schedule changes that would delay development to be performed by Xerox.
2. Xerox will provide the Port Authority with a test plan for approval. The plan will clearly delineate the scope of testing. The Port Authority will review the test plan, participate in testing, and notify Xerox of any dependencies to work being completed on the CTH that would affect the Xerox testing effort.
3. The RTCS contractor will coordinate with Xerox during all phases of testing and implementation. Additionally, the RTCS contractor will provide Xerox with the proper access and provisioning to implement a bi-directional interface for secure file exchange.
4. Xerox will provide the Port Authority with a cost proposal that includes an estimate for end to end testing. Additionally, Xerox will provide the Port Authority with an estimate for each additional occurrence of end to end re-testing with the RTCS contractor.
5. As specified in the Port Authority proposal, during transition, the NYCSC shall continue to exchange all legacy data with the legacy ECH utilizing existing legacy formats as well as establishing communication with and exchanging all data with the new CTH when the new CTH goes on line utilizing the new data formats. On the NYCSC end, all data received from

or sent to both the legacy ECH and new CTH should be treated equally. Reconciliation data should be returned to the host from which it was received. Any outstanding data which must be reconciled with the legacy ECH after that host has been eliminated shall be reconciled with the new CTH.

1.4 Assumptions

1. Xerox will comply with all contract data retention requirements for toll evasion under this change order.
2. Xerox will not perform toll rate calculation for transactions received from the CTH.
3. The Port Authority will provide Xerox with updated file formats for all Appendices if necessary after each revision of the requirements document. Xerox has assumed that all file formats are final in this document. Should changes be required, Xerox will provide impact to cost and or schedule.
4. The Port Authority will coordinate with Xerox to determine the values required for all features designed into VECTOR which are suggested as "configurable" in this document.
5. Xerox will transmit the Hot List file to the CTH on a daily basis. The Port Authority will notify Xerox if more frequent transmissions are required.
6. The IAG 1.51g Inter-CSC file specification will be updated by the Port Authority to include new PA special classes as detailed in the Agency Transaction File.
7. The CSC shall continue to determine the number of trips taken for SIB plan members and calculate charges for unused commuter trips.
8. The Port Authority will notify Xerox of any changes to the file formats contained in this document. Xerox has assumed that all file formats are final in this document. Should changes be required, Xerox will provide impact to cost and or schedule.
9. The Port Authority will advise Xerox of any other CTH return codes that are required for interface file exchange.
10. The RTCS upgrade (i.e. CTH) will follow a parallel implementation. The Port Authority will operate with both the legacy ECH and new CTH.
11. The Port Authority has provided Xerox with projected image size and transaction volume. This data will be used by Xerox to ensure optimum hardware and software performance for the image review system at the NYCSC.
    a. An image resolution of approximately 1600 x 480 pixels is expected. Images with a region of interest (ROI) will have a lower resolution (if provided). Regular images will have an average file size of 70KB while ROI images will have an average size of 10KB. There is expected to be six (6) regular images and two (2) ROI images per image set sent to the CSC.
    b. In terms of image volume, it is expected that the number of violations would not change under the new toll system.

2. VECTOR CSC Subsystem Requirements

2.1 CSC Interface File Processing: Agency Tag Status File

1. Xerox shall ensure that the Agency Tag Status Zip File sent to the CTH conforms to the file format in Appendix A.
2. The NYCSC shall check for an ACK file from CTH. If an ACK file is not received or received with code indicating a problem, the NYCSC shall generate an appropriate alert and/or e-mails to a distribution list of preapproved personnel
3. VECTOR shall create a single compressed Agency Tag Status Zip File and transmit it to the CTH. The Agency Tag Status Zip File shall provide the status of each tag associated with an account held by a reciprocal CSC, as well as any discount plans associated with each tag.
    a. The Agency Tag Status Zip File shall be a compilation of the most recent ITAG files received by the NYCSC from all reciprocal CSCs as well as the ITAG file created by the NYCSC for all 004, 005, 008 and 013 tags. Individual ITAG files in the Agency Tag Status File shall be in ASCII format.
    b. The Agency Tag Status Zip File name shall be:
    CSC_005_YYYYMMDDHHMMSS_ATAG.zip.
    Convention: {FROM_AGENCY_ID}_YYYYMMDDHHMMSS.ITAG
    Example: 006_20111201001015.ITAG Pennsylvania Turnpike Commission tag status file created on 00:10:15 on 12/01/2011
4. VECTOR shall perform sanity checks on each individual Agency ITAG File prior to transmission in the Agency Tag Status File. Sanity checks include:
    a. Unusual growth (**by 0.1%**) in the number of tags from previous version
    b. Unusual reduction (**by 0.1%**) in number of tags from the previous version
    c. Unusual change (by 0.1%) in number of tags with a particular tag status.
    d. Duplicate tags in a single Agency ITAG file or across Agency ITAG files.
    e. In the event that VECTOR detects an anomaly as a result of sanity checking, Xerox will transmit the most recent ITAG file to the CTH.
    f. The individual agency level ITAG files contained in the ZIP file may not all be from the same calendar date. VECTOR shall ensure that any individual agency level ITAG files received are not older than the most recent individual agency ITAG file already received for the given agency. If an older file is received, VECTOR shall reject the individual agency ITAG file and notify the originator of the ITAG via the Acknowledgement File. However, other agency ITAG files contained in the ZIP file that pass all validations shall be used. VECTOR shall replace the rejected agency ITAG file with the most recent valid file received for the given agency

2.2 CTH Interface File Processing: Agency Tag Status File

1. The CTH shall verify that the Tag Status Zip File contains an ITAG file for each CSC.

a. In the event that an ITAG file is missing or corrupt, the CTH shall utilize the most recent ITAG file received for the missing CSC.

b. In the event that an invalid header record is encountered (e.g., character data in a numeric field, etc.), the CTH shall reject the individual Agency ITAG file and notify the NYCSC via the Acknowledgement File. However, other agency ITAG files contained in the ZIP file that pass all validations shall be used. The CTH shall replace the rejected agency ITAG file with the most recent valid file received for the given agency.

c. In the event that an invalid detail record is encountered (e.g., inappropriate TAG_STATUS, etc.), the CTH shall reject the individual Agency file and notify the NYCSC via the Acknowledgement File. However, other agency ITAG files contained in the ZIP file that pass all validations shall be used. The System shall replace the rejected agency ITAG file with the most recent valid file received for the given agency.

d. In the event of any invalid header and/or detail records, the CTH shall log the details of all invalid records found in a manner that would allow the file to be manually examined and the invalid data found and examined for debugging purposes.

2. The CTH should generate appropriate Acknowledgement File for the NYCSC and trigger appropriate alerts and/or e-mails to a distribution list of preapproved personnel.

3. VECTOR Transaction Processing Requirements

3.1 CTH Interface File Processing: Agency Transaction File

1. The CTH shall create the Agency Transaction File and transmit it to the NYCSC.

   a. The Agency Transaction File shall contain all E-ZPass, Violation and Video Toll transactions occurring at Authority facilities.

   b. The Agency Transaction File name shall be: 005_CSC_20111201001015.ATRN Convention: {FROM_ENTITY}_{TO_ENTITY}_YYYYMMDDHHMMSS.ATRN Example: 005_CSC_20111201001015.ATRN PANYNJ transactions to NYCSC created on 00:10:15 on 12/01/2011.

   c. The CTH shall determine the optimal ALPR data (state, number and plate type) based on vehicle class and front and rear ALPR data. Only the optimal ALPR data shall be sent to the CSC in the Agency Transaction File.

   d. Xerox shall use the confidence values provided in the Transaction File by the CTH.

   e. The AG_OVER_SPEED flag shall be populated as shown in Appendix B. The System shall employ a configurable table with two speed thresholds per lane. If a vehicle is detected as being below the first threshold, the flag shall be set to “N”. If a vehicle exceeds the first threshold but not the second, the flag shall be set to “Y”. If a vehicle exceeds the second threshold, the flag shall the set to “S”.

   f. The CTH shall pass to the NYCSC toll rates associated with the class charged as

shown in Appendix B.

3.2 CSC Interface File Processing: Agency Transaction File

1. The NYCSC shall receive the Agency Transaction File from the CTH using the file format in Appendix B.
2. The NYCSC shall generate and transmit an ACK file for all Agency Transaction Files it receives. The NYCSC shall also generate an appropriate alert and/or e-mail if a transaction file is not received for a given day by a set cutoff time.
3. The combination of FROM_ENTITY and ATRN_FILE_NUM in the Agency Transaction File name forms a unique sequential key which will be used by the NYCSC to verify that each Agency Transaction File was received without any gaps.
    a. If the ATRN_FILE_NUM of the current Agency Transaction File does not equal the prior ATRN_FILE_NUM received from that FROM_ENTITY plus one (1), the Acknowledgement File will contain a RETURN_CODE of '06' to signify that a gap in sequence numbers was found. However, the current Agency Transaction File would still be processed by VECTOR.
    b. If the ATRN_FILE_NUM of the current Agency Transaction File is equal to the ATRN_FILE_NUM of a previous Agency Transaction File, the Acknowledgement File will contain a RETURN_CODE of '05' and the current Agency Transaction File would not be processed by VECTOR.

3.3 E-ZPass Transactions

1. VECTOR Transaction Processing shall separately process all incoming transactions from the CTH. Existing logic for processing transactions from the ECH is unaffected.
2. VECTOR Transaction Processing shall comply with the toll rates provided in the Agency Transaction File.
3. VECTOR Transaction Processing shall process E-ZPass and discounted E-ZPass transactions (AG_TRX_TYPE=E) using the AG_EZPASS_AMOUNT field.
    a. AG_EZPASS_AMOUNT_DIS1 and AG_EZPASS_AMOUNT_DIS2 fields are unused for E-ZPass transactions. The CTH shall automatically calculate any appropriate discounts due, based upon receipt of plan bits in the Agency Tag Status File.
4. VECTOR Transaction Processing shall use the AG_PLAN_CHARGED field for trip tracking, statement noticing and/or reconciliation.
5. VECTOR Transaction Processing shall use the value provided in the AG_VIDEO_AMOUNT field, if posting as a violation transaction.

3.4 Toll Evasion Violation Transactions

1. For Violation Transactions (where AG_TRX_TYPE = “V” – meaning a toll evasion transaction) that have an associated tag with an AG_VALIDATION_STATUS = “3” (negative balance), VECTOR Transaction Processing shall post (VTOL) transactions (AG_TRX_TYPE=V) using AG_EZPASS_AMOUNT.
2. VECTOR Transaction Processing shall use the AG_PLAN_CHARGED field for trip tracking, statement noticing and/or reconciliation for toll evasion VTOL transactions.
3. VECTOR Transaction Processing shall process toll evasion (ITOL) transactions based upon the presence of the PA discount plan or vehicle classes 1, 7, and 11 with the PASI plan at the Bayonne Bridge (BB), Outerbridge Crossing (OBX), and Goethals Bridge (GB), using AG_EZPASS_AMOUNT_DIS1.
4. VECTOR Transaction Processing shall process all other ITOLs using AG_EZPASS_AMOUNT, unless the account has a non revenue plan.
5. VECTOR Transaction Processing shall post all Port Authority non revenue plan toll evasion (ITOL) transactions at the $0 dollar rate.
6. VECTOR shall send away agency toll evasion (ITOL) transactions (AG_TRX_TYPE=V) using the value from the AG_EZPASS_AMOUNT field.
7. VECTOR shall route any failed toll evasion ITOL and VTOL posting to the violations module (AG_TRX_TYPE=V) using AG_VIDEO_AMOUNT.

4. VECTOR Violations Subsystem Requirements

4.1 CTH Interface File Processing: Agency Image Zip File

1. The CTH shall create an Agency Image Zip file which will contain all the images associated with a single transaction and transmit it to the NYCSC.
    a. The CTH shall combine all the images into a single compressed "zip" file.
    b. Convention: PPPPLLYYYYMMDDHHMMSS_NNNNNNNNNNNN.zip
    PPPP = Plaza ID (padded with trailing '_' for plaza IDs less than 4 characters)
    LL = Lane ID (with leading zeros)
    YYYYMMDD = Associated Transaction Date (8 chars)
    HHMMSS = Associated Transaction Time (6 chars)
    NNNNNNNNNNNN = Associated lane sequence number (12 chars)
    c. Example: OBX_0420100907182000_000000000012.zip. Zip file of all images taken at OBX lane 04 on 09/07/2010 at 18:20:00 with a transaction sequence number of 12.
1. On a nightly basis, the CTH shall create an Agency Image Zip File for each plaza which shall be comprised of all the Transaction Image Zip Files for the given plaza that have not previously been combined into an Agency Image Zip File.
    a. Convention: PPPPYYYYMMDDHHMMSS.ZIP
    PPPP = Plaza ID (padded with trailing '_' for plaza IDs less than 4 characters)
    YYYYMMDD = Date the CSC Image File was created (8 chars)
    HHMMSS = Time the CSC Image File was created (6 chars)
2. Upon creation of the Agency Image File, the CTH shall create an Agency Image Control File for each Agency Image File. The Agency Image Control File will be used by the NYCSC to verify that the Agency Image File is complete.
    a. Convention:{FROM_ENTITY}_{TO_ENTITY}_PPPPYYYYMMDDHHMMSS.ACTL
    b. Example: 005_CSC_OBX_20111201001015.ACTL. PANYNJ Image Control File to NYCSC created on 00:10:15 on 12/01/2011

4.2 CSC Interface File Processing: Agency Image Zip File

1. VECTOR shall receive the Agency Image Control file using the file format in Appendix C.
2. VECTOR shall process the Agency Image Zip file and the Agency Image Control File from the CTH.
    a. In the event a control file is missing, no images shall be processed and an appropriate ACK shall be returned to the CTH.
    b. In the event that the number of images indicated in the control file does not equal the number of image sets actually found, the images shall not be processed and an appropriate ACK shall be returned to the CTH.
    c. In the event a corrupt image set (zip file that cannot be opened, etc.) is found, the

remaining image sets shall continue to be processed and used. An appropriate ACK code shall be returned to the CTH and a report/log should be made available to the Authority detailing all corrupt image sets (file name, etc.).

4.3 Toll Evasion Image Review

1. Xerox shall modify the image review system to process image sets generated from ALPR.
2. At the initiation of the RTCS, all images shall be reviewed by a NYCSC image review clerk. When a plate has been viewed X number of times (a programmable variable) and determined that the ALPR result has been correct, then the configurable confidence threshold shall be utilized to determine if it is viewed henceforth.
3. VECTOR shall support a single confidence threshold that is "configurable" for each state jurisdiction. The confidence threshold shall be the value at which ALPR images bypass image review.
4. VECTOR shall process image sets such that an ALPR result at or surpassing the "configurable confidence threshold", shall bypass image review and instead utilize the ALPR result transmitted by the CTH for processing.
    a. Xerox shall ensure that images with an ALPR result below a predetermined confidence level are reviewed by an image review clerk. The image review clerk shall either confirm the displayed ALPR result (plate number, plate type, issuing jurisdiction) or input the correct license plate information.
    b. If the CSC enters new plate information, said information shall be transmitted back to the RTCS via the reconciliation file with a clear indication as to which image was used to extract the license plate information.

4.4 Egregious Violator List

1. The Authority is implementing an Egregious Violator List (Hot List) flagging system at its facilities which applies to all toll evasion transactions on PA crossings only.
2. Xerox shall develop an automated Egregious Violator List (Hot List) to be transmitted to the CTH for inclusion in the Port Authority flagging system.
3. Xerox shall program the Hot list to be transmitted to the CTH based upon whether a plate owes over a "configurable amount" in Port Authority tolls and/or fees.
4. Xerox shall develop two Egregious Violator List categories:
    a. The Oustanding Violations Amount category shall include license plates associated with accounts that have an outstanding Authority violation amount due (fees and/or toll amounts) in excess of X amount (where X is a table driven value for violation tolls due, violation fees due and/or violation tolls and fees due) shall appear in the Agency Egregious Violator List File.
    b. The DMV Retrieval Problem category shall include license plates associated with DMV requests that have been returned in excess of X times (where X is a table driven value for the number of times the DMV retrieval failed) as a no hit and/or have other DMV retrieval issues shall appear in the Agency Egregious Violator List File.

c. Future categories shall be table driven to allow modification without system programming.

5. Xerox shall design a feature to exclude specific license plates or all license plates associated with specific accounts (E-ZPass or Violation) from the Hot List.

4.5 CSC Interface File Processing: Hot List File

1. Xerox shall create and transmit the Hot List File to the CTH on a daily basis based upon the processing requirements contained in this section, and using the file format in Appendix E. The Hot List File is transmitted to inform the CTH of all license plates that are to generate Hot List Alerts:
   a. Convention: {FROM_ENTITY}_{TO_ENTITY}_YYYYMMDDHHMMSS.AHOT
   b. Example: 005_CSC_20111201001015.AHOT CSC Hot List to PANYNJ created on 00:10:15 on 12/01/2011
2. The NYCSC shall check for an ACK file from CTH for the Hot List File. If an ACK file is not received or not or received with code indicating a problem, the NYCSC shall generate an appropriate alert and/or e-mails to a distribution list of preapproved personnel
3. VECTOR shall perform sanity checks on each Hot List File prior to transmission the CTH. Sanity checks include:
   a. Unusual growth (by **X%**) in the number of records from previous version
   b. Unusual reduction (by **X%**) in number of records from the previous version
   c. Duplication of license plates in the file.

4.6 CTH Interface File Processing: Hot List File

1. The CTH shall process the Hot List File.
   a. In the event that an invalid header record is encountered (e.g., character data in a numeric field, etc.), the System shall reject the file and notify the Xerox via the Acknowledgement File.
   b. In the event that an invalid detail record is encountered (e.g., inappropriate HOT_REASON, etc.), the System shall reject the file and notify Xerox via the Acknowledgement File.
   c. In the event of any invalid header and/or detail records, the CTH shall log the details of all invalid records found in a manner that would allow the file to be manually examined and the invalid data found and examined for debugging purposes.

4.7 Speed Noticing

1. The RTCS will include a flag in every transaction to indicate whether or not a transaction represents a vehicle traveling in excess of the lane speed threshold.
2. Xerox shall modify the speed noticing process to utilize the value provided by the CTH in the AG_OVER_SPEED field, to determine whether or not speed notices are issued.

AG_OVER_SPEED shall indicate either below threshold, above base speed threshold and eligible for notices, and speed escalations or auto-suspend.

5. VECTOR Reconciliation Subsystem Requirements

5.1 CSC Interface File Processing: Agency Reconciliation File

1. Xerox shall transmit the Agency Reconciliation File to the CTH based upon the results on transaction processing and using the file format in Appendix D.
2. The NYCSC shall check for an ACK file from CTH for the Agency Reconciliation File. If an ACK file is not received or not or received with code indicating a problem, the NYCSC shall generate an appropriate alert and/or e-mails to a distribution list of preapproved personnel
3. Xerox shall transmit interim reconcilitation codes in the Agency Reconciliation File as IAG codes or internal CSC codes as appropriate.`
4. Xerox shall ensure that any outstanding reconcilitation data left over after the ECH is decommissioned is reconciled with the new CTH.Any fields that are unique to the CTH not available on the ECH will be defaulted to asterisks (*).

5.2 CTH Interface File Processing: Agency Reconciliation File

1. The CTH shall incorporate the data received from the NYCSC in the recognition, reporting and reconciliation of revenues. Multiple Agency Reconciliation Files can be received for a given Agency Transaction File but each Agency Reconciliation File will only contain transactions related to a single Agency Transaction File
    a. In the event that an invalid header record is encountered (e.g., character data in a numeric field, etc.), the System shall reject the file and notify the NYCSC via the Acknowledgement File.
    b. In the event that an invalid detail record is encountered (e.g., inappropriate codes, invalid transaction identifier, attempt to reconcile a transaction that has already been reconciled as final, etc.), the System shall reject the file and notify the NYCSC via the Acknowledgement File.
    c. In the event of any invalid header and/or detail records, the System shall log the details of all invalid records found in a manner that would allow the file to be manually examined and the invalid data found and examined for debugging purposes.
    d. The Port Authority will provide a log to Xerox from the CTH if invalid records are encountered.
    e. The CTH shall utilize the returned license plate data in the reconciliation file for ALPR accuracy reporting.

6. Bi-Directional Interface Exchange

1. All file exchanges with the CTH shall be via secure FTP.
2. Xerox and the Port Authority shall conform to the Acknowledge File file format contained in Appendix F.
3. Xerox and the Port Authority shall acknowledge the receipt of an interface file to inform the originator of that file that the file was received in its entirety.
    a. This file shall contain a single record only. For each file received by the Receiving Entity, the Receiving Entity shall generate an Acknowledgement File and transmit the file back to the Sending Entity.
    b. The FILE_DATE and FILE_TIME fields shall be used by the Receiving Entity as the acknowledgement date/time of the transmitted file.
    c. The Receiving Entity shall generate a report showing any detail records that were skipped due to invalid data (RETURN_CODE = '02') and shall have this report available for the to Sending Entity if needed.
    d. The CTH shall generate appropriate alerts and/or e-mails for Acknowledgement Files received with non-zero RETURN_CODE values and/or for the failure to receive an Acknowledgement File within a defined time period.
4. Xerox and the Port Authority shall ensure that an Acknowledgement File is sent for each of the files contained in this document.
    a. Convention:{FROM_ENTITY}_{FILE_NAME}_{FILE_TYPE}.ACK
    b. Example: 005_CSC_20111201041015_ATAG.ACK. Acknowledgement file from PA in response to the Agency Tag Status File created on 04:10:15 on 12/01/2011.
5. Xerox shall produce an email report/log for Port Authority staff that includes all anomalies detected in any file it receives from the Authority including all invalid records, corrupt images sets.
    a. Record count does not match number of records in file
    b. Gap in sequence numbering
    c. No file received by the cutoff time
    d. No ACK file received
    e. ACK codes indicating invalid data
    f. Invalid header found
    g. Invalid details found

7. Reciprocity

1. The VECTOR Create ICTX and ITXC corrections process shall be modified for the PA special classes.

8. Reports

1. Up to 4 new reports will be developed as needed. The Port Authority will provide Xerox with the full descriptions of each new report to be developed.
2. All existing reports should be modified to include the new fees, as needed.
3. Xerox shall provide a new summary report for the Egregious Violator list. The Port Authority will provide the required fields.
4. Xerox shall provide existing reports for the verification of toll rates used with the ECH and CTH. These reports will be run to cross check plan postings to Port Authority expected amounts.
    a. The Q8M Casual Use Report shall be reviewed to verify that it displays posted ECH and CTH transactions by plaza Agency, by class and posted/collection date.
    b. The Q4P Tolls by Lane/Plaza report shall be reviewed to confirm that it correctly reports on the posted and full fare toll amounts for each PA plaza by posted/collection date.
5. Xerox shall modify the Q8M to include the new Port Authority class codes.
6. Xerox shall modify the following reports as required:
    a. Violations Count by Date Worked Report - VIOL0702
    b. Image Batch Statistics - VIOL0701
    c. Violations Processed by Operator - VIOL0703
    d. Image Review Performance Report - VIOL706

9. Performance Standards

1. The established Performance Standards shall apply to the interfaces with both the old and new Central Hosts.
2. The established Performance Standards shall apply to image review of transactions without ALPR data or where the ALPR confidence level is below the established threshold.
3. Performance Standards for transactions with an ALPR confidence level at or above the

established threshold are TBD. Xerox did not assume this additional performance standard or risk in the price proposal. Should this be later requested by the PANYNJ, a change order will be required.

4. The established Performance Standards that currently apply to the Tag Status File shall also apply to Initial Egregious Violator List file. The impact that the Violator List file has in production is much lower than that of the tag status file. Xerox does not agree with following the tag status file performance standard methodology for calculation of penalty. Xerox did not assume this new standard in the price proposal.

Appendix A: Agency Tag Status File

Agency Tag Status File – Header Structure		
Field Name	**Type/Size**	**Description/Valid Values**
FILE_TYPE	CHAR(4)	Value: ITAG
FROM_AGENCY_ID	CHAR(3)	Standard agency ID code of the Home Agency/CSC.
FILE_DATE	CHAR(8)	Date file created. Format: YYYYMMDD
FILE_TIME	CHAR(6)	Time file created. Format: HHMMSS
RECORD_COUNT	CHAR(8)	Count of all tags in file. Does not include header record. Values: 00000000 – 99999999
COUNT_STAT1	CHAR(8)	Count of all tags with status code 1. Values: 00000000 – 99999999
COUNT_STAT2	CHAR(8)	Count of all tags with status code 2. Values: 00000000 – 99999999
COUNT_STAT3	CHAR(8)	Count of all tags with status code 3. Values: 00000000 – 99999999
COUNT_STAT4	CHAR(8)	Count of all tags with status code 4. Values: 00000000 – 99999999
DELIMITER	CHAR(1)	LF

Agency Tag Status File – Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
TAG_AGENCY_ID	CHAR(3)	Tag agency ID. Values: 000 – 127
TAG_SERIAL_NUMBER	CHAR(8)	Tag serial number. Values: 00000001 – 16777215
TAG_STATUS	CHAR(1)	The status of the tag. Values: 1 – Valid 2 – Low Balance 3 – Invalid/Negative Balance. 4 – Lost/Stolen/Inventory.
TAG_ACCT_INFO	CHAR(6)	A string of 24 bits (3 characters) converted to Hex-ASCII format (6 characters). The 24 bits represent the following: Bit 1 (rightmost bit): Unused (can be 1 or 0) Bit 2 – 24: Discount bits 1 – Tag has associated discount plan 0 – Tag does not have associated plan Plan bits are defined as follows: Bit 2: PANYNJ Staten Island Bridges Bit 3: PANYNJ Green Discount Bit 4: PANYNJ Carpool Bit 5: PANYNJ Non-revenue Bits 6 – 24: Unused (can be 1 or 0)
DELIMITER	CHAR(1)	LF

Appendix B: Agency Transaction File

Agency Transaction File – Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
AG_TRX_SERIAL_NUM	CHAR(12)	The unique key of a transaction assigned by the System. Values: 000000000000 – 999999999999
AG_REVENUE_DATE	CHAR(8)	The revenue date of the transaction as determined by the System. Format: YYYYMMDD
AG_FAC_AGENCY	CHAR(3)	Value: 005
AG_TRX_TYPE	CHAR(1)	This field is used to denote the type of transaction. Values: E – E-ZPass V – Violation I – Video Toll
AG_TRX_DATE	CHAR(8)	Transaction date. Format: YYYYMMDD
AG_TRX_TIME	CHAR(6)	Transaction time. Format: HHMMSS
AG_TRX_PLAZA	CHAR(4)	Plaza identifier. Values: BB – Bayonne Bridge GB – Goethals Bridge GWBL – GWB Lower Level GWBP – GWB Palisades GWBU – GWB Upper Level HT – Holland Tunnel LT – Lincoln Tunnel OBX – Outerbridge Crossing
AG_TRX_LANE	CHAR(3)	Lane identifier.

Agency Transaction File – Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
AG_TRX_LANE_SEQ	CHAR(10)	Lane sequence number. Values: 0000000000 – 9999999999
AG_TAG_AGENCY	CHAR(3)	Standard agency ID read from the tag. Values: 000 – 127 *** for untagged transactions
AG_TAG_SERIAL_NUMBER	CHAR(8)	Tag serial number read from the tag. Values: 00000001 – 16777215 ******** for untagged transactions
AG_READ_PERFORMANCE	CHAR(2)	The total number of times the tag was read while in the capture zone. Obtained from the AVI Reader. Values: 00 – 99 ** if data is unavailable
AG_WRITE_PERF	CHAR(2)	The total number of times the tag was written to while in the capture zone. Obtained from the AVI Reader. Values: 00 – 99 ** if data is unavailable
AG_READ_TYPE	CHAR(1)	The AVI read type. Values: R – Real time B – Buffered * if data is unavailable
AG_TAG_PGM_STATUS	CHAR(1)	The result of the AVI tag program cycle. Obtained from the AVI reader. Values: S – Success U – Unverified F – Failed * if data is unavailable

Agency Transaction File – Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
AG_LANE_MODE	CHAR(1)	The mode the lane was operating in at the time of the transaction. Values: E – E-ZPass Only (Dedicated or Express) M – Manned/E-Zpass V – E-ZPass/Video Toll (Dedicated) I – Manned/E-ZPass/Video Toll
AG_VALIDATION_STATUS	CHAR(1)	The tag status from the Tag Status File at the time of the transaction. Values: 1 – Good 2 – Low Balance 3 – Negative Balance 4 – Invalid * if data is unavailable
AG_LIC_STATE	CHAR(2)	License plate state for Violation/Video Toll. ** for E-ZPass transaction.
AG_LIC_NUMBER	CHAR(10)	License plate number for Violation/Video Toll. ********** for E-ZPass.transaction.
AG_LIC_TYPE	CHAR(2)	License plate type for Violation/Video Toll. ** for E-ZPass transaction or if not applicable/available.
AG_CONFIDENCE	CHAR(4)	License plate confidence level. **** for E-ZPass transaction.

Agency Transaction File – Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
AG_TAG_CLASS	CHAR(3)	The Class read from the tag. The contents of this field are left justified and padded with trailing blanks as needed. Values: 1 – Class 1 2 – Class 2 3 – Class 3 4 – Class 4 5 – Class 5 6 – Class 6 7 – Class 7 8 – Class 8 9 – Class 9 11 – Class 11 *** if data is unavailable
AG_TAG_EXTRA_ AXLES	CHAR(2)	The number of extra axles associated with the tag class. Values: 00 – 99

Agency Transaction File – Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
AG_AVC_CLASS	CHAR(3)	The Class detected by AVC. The contents of this field are left justified and padded with trailing blanks as needed. Values: 1 – Class 1 2 – Class 2 3 – Class 3 4 – Class 4 5 – Class 5 6 – Class 6 7 – Class 7 8 – Class 8 9 – Class 9 11 – Class 11 *** if data is unavailable
AG_AVC_EXTRA_AXLES	CHAR(2)	The number of extra axles associated with the AVC class. Values: 00 – 99
AG_MISMATCH	CHAR(1)	Unused

Agency Transaction File – Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
AG_CLASS_CHARGED	CHAR(3)	The Class used to determine the toll. The contents of this field are left justified and padded with trailing blanks as needed. Values: 1 – Class 1 2 – Class 2 2S – Class 2 Special 2E – Class 2 Special w/Escort 3 – Class 3 3S – Class 3 Special 3E – Class 3 Special w/Escort 4 – Class 4 4S – Class 4 Special 4E – Class 4 Special w/Escort 5 – Class 5 5S – Class 5 Special 5E – Class 5 Special w/Escort 6 – Class 6 6S – Class 6 Special 6E – Class 6 Special w/Escort 7 – Class 7 8 – Class 8 9 – Class 9 11 – Class 11
AG_CHARGED_EXTRA_AXLES	CHAR(2)	The number of extra axles associated with the class charged. Values: 00 – 99

Agency Transaction File – Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
AG_PLAN_CHARGED	CHAR(3)	The E-ZPass discount plan associated with the transaction. The contents of this field are left justified and padded with trailing blanks as needed. Values: CP – Carpool Discount SIB – Staten Island Bridges Discount GRN – Green Discount NR – Non-Revenue Discount *** - No discount used
AG_EXIT_SPEED	CHAR(3)	The speed in MPH of the vehicle as it exited the facility. Values: 000 – 999
AG_OVER_SPEED	CHAR(1)	An indicator of whether or not the speed reported in AG_EXIT_SPEED was over the allowable threshold for that plaza/lane. Values: N – Speed is not over threshold Y – Speed is over threshold – Warning S – Speed is over threshold – Auto-Suspend
AG_EZPASS_AMOUNT	CHAR(5)	The E-ZPass toll due as calculated by the System. Values: 00000 ($000.00) – 99999 ($999.99)

Agency Transaction File – Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
AG_EZPASS_AMOUNT_DIS1	CHAR(5)	The E-ZPass discounted toll due as calculated by the System for discount plan 1 (currently defined as the SIB Discount). Values: 00000 ($000.00) – 99999 ($999.99)
AG_EZPASS_AMOUNT_DIS2	CHAR(5)	The E-ZPass discounted toll due as calculated by the System for discount plan 2 (currently undefined). Values: 00000 ($000.00) – 99999 ($999.99)
AG_VIDEO_AMOUNT	CHAR(5)	The Violation/Video toll due as calculated by the System. Values: 00000 ($000.00) – 99999 ($999.99)
DELIMITER	CHAR(1)	LF

Appendix C: Agency Image Control File

Agency Image Control File Structure		
Field Name	**Type/Size**	**Description/Valid Values**
CTL_ZIP_NAME	CHAR(50)	Name of the associate CSC Image File
CTL_RECORD_COUNT	CHAR(8)	A count of the number of distinct zip files in the CSC Image File. Values: 00000000 – 99999999
DELIMITER	CHAR(1)	LF

Appendix D: Agency Reconciliation File

Agency Reconciliation File – Header Structure		
Field Name	**Type/Size**	**Description/Valid Values**
FILE_TYPE	CHAR(4)	Value: AREC
FROM_ENTITY	CHAR(3)	Value: CSC
TO_ENTITY	CHAR(3)	Value: 005
FILE_DATE	CHAR(8)	Date file created. Format: YYYYMMDD Date shall match the date in the File Name.
FILE_TIME	CHAR(6)	Time file created. Format: HHMMSS Time shall match the time in the File Name.
ATRN_FILE_NUM	CHAR(8)	The Agency Transaction File number to which this reconciliation file corresponds. Values: 00000001 – 99999999. Shall match the file number in the File Name.
RECORD_COUNT	CHAR(8)	Count of records in the file. Does not include header record. Values: 00000000 – 99999999
DELIMITER	CHAR(1)	LF

Agency Reconciliation File – Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
AG_TRX_SERIAL_NUM	CHAR(12)	The unique key of a transaction assigned by the System. Values: 000000000000 – 999999999999
AG_RECON_TYPE	CHAR(12)	The type of reconciliation. Values: POSTED – Transaction posted to an E-ZPass account PAID – Violation/Video toll was paid DISMISSED – Violation/Video toll was dismissed. No payment or other action was taken. REJTRANS – E-ZPass transaction was rejected and is not processable. REJVIDEO – Violation/Video transaction was rejected and is not processable. INTERIM – Reconciliation is an interim code
AG_AGENCY	CHAR(3)	The agency associated with the transaction. For POSTED, REJTRANS and INTERIM reconciliation types this would be the three digit code associated with the agency. For PAID, DISMISSED, REJVIDEO reconciliation types this would be 005.
AG_RECON_CODE	CHAR(12)	Reconciliation code. For POSTED and REJTRANS reconciliation types this would be the IAG defined ETC_POST_STATUS (e.g., POST, PPST, INSU, OLD1, etc.) or, if an

Agency Reconciliation File – Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
		internal NYCSC reject code applies, the actual NYCSC reject code value would appear. For the INTERIM reconciliation type this would indicate the stage of the transaction at the NYCSC. Values to be determined during the design phase. For the PAID reconciliation type this would indicate how payment was made and if payment included fees. For the REJVIDEO reconciliation type this would indicate the reason that the Violation/Video transaction was rejected. For the DISMISSED reconciliation type this would indicate the reason the Violation/Video transaction was dismissed.
AG_PLAN_TYPE	CHAR(12)	The plan type associated with the posted transaction. Values: STANDARD PAGREEN PASI PANRPL PANREP PANRPA PANROF PACP
AG_TOLL_PAID	CHAR(5)	The toll amount posted/paid. Values: 00000 ($000.00) – 99999 ($999.99)
AG_FEE_PAID	CHAR(5)	The fee amount posted/paid.

Agency Reconciliation File – Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
		Values: 00000 ($000.00) – 99999 ($999.99)
AG_REPORT_DATE	CHAR(8)	The date the transaction will appear on settlement or deposit reports at the NYCSC. Will be used by the System to generate corresponding settlement/deposit reconciliation reports.
AG_CSC_LIC_STATE	CHAR(2)	License plate state entered by the CSC. ** if CSC did not modify the plate data (state, number or type).
AG_CSC_LIC_NUMBER	CHAR(10)	License plate number entered by the CSC. ********** if CSC did not modify the plate data (state, number or type).
AG_CSC_LIC_TYPE	CHAR(2)	License plate type entered by the CSC. ** if CSC did not modify the plate data (state, number or type).
AG_IMAGE_USED	CHAR(2)	The number of the image file used to extract the license plate data by the image reviewer. Left padded with leading zeroes.
DELIMITER	CHAR(1)	LF

Appendix E: Agency Hot List File

Agency Hot List File: Header Structure		
Field Name	**Type/Size**	**Description/Valid Values**
FILE_TYPE	CHAR(4)	Value: AHOT
FROM_ENTITY	CHAR(3)	Value: CSC
TO_ENTITY	CHAR(3)	Value: 005
FILE_DATE	CHAR(8)	Date file created. Format: YYYYMMDD Date shall match the date in the File Name.
FILE_TIME	CHAR(6)	Time file created. Format: HHMMSS Time shall match the time in the File Name.
RECORD_COUNT	CHAR(8)	Count of records in the file. Does not include header record. Values: 00000000 – 99999999
DELIMITER	CHAR(1)	LF

Agency Hot List File: Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
HOT_PLATE_STATE	CHAR(2)	License plate state.
HOT_PLATE_NUMBER	CHAR(8)	License plate number.
HOT_REASON	CHAR(1)	Hot list reason code used to indicate the type of hot list entry. Values: V – Outstanding Violation Amounts D – DMV Retrieval Problem
HOT_VALUE1	CHAR(10)	Used to indicate specific value information to the System. Contents will depend on the HOT_REASON value. For records with a HOT_REASON of value of "V", this field will contain the count of outstanding violations with values of: 0000000000 – 9999999999 For records with a HOT_REASON of value of "D", this field will contain the count of video toll transactions associated with the plate with values of: 0000000000 – 9999999999 ********** if not used or not applicable.
HOT_VALUE2	CHAR(10)	Used to indicate specific value information to the System. Contents will depend on the HOT_REASON value. For records with a HOT_REASON of value of "V", this field will contain the dollar value of outstanding violations with values of: 0000000.00 – 9999999.99 For records with a HOT_REASON of value of "D", this field will contain the dollar value of video toll transactions associated with the plate with values of: 0000000.00 – 9999999.99 ********** if not used or not applicable.

Appendix F: ACK File

Acknowledgement File: Detail Structure		
Field Name	**Type/Size**	**Description/Valid Values**
FILE_TYPE	CHAR(4)	Value: ACK
FROM_ENTITY	CHAR(3)	Values: 005 for Acknowledgement Files created by the System. CSC for Acknowledgement File created by the NYCSC.
TO_ENTITY	CHAR(3)	Values: CSC for Acknowledgement Files created by the System. 005 for Acknowledgement File created by the NYCSC.
ORIG_FILE_NAME_TYPE	CHAR(50)	The name and type of the file being acknowledged as received from the To Entity. Format: FILE_NAME.FILE_TYPE where FILE_NAME is the name of the file being acknowledged and FILE_TYPE is the type of the file being acknowledged.
FILE_DATE	CHAR(8)	Date ACK file created. Format: YYYYMMDD This is to be used by the recipient of the Acknowledgement File as the acknowledgement date. This date shall match the date used in the file name.
FILE_TIME	CHAR(6)	Time ACK file created. Format: HHMMSS This is to be used by the recipient of the Acknowledgement File as the acknowledgement time. This time shall match the time used in the file name.
RETURN_CODE	CHAR(2)	A code indicating the status of the file being acknowledged. Values: 00 – File was successfully received and verified. 01 – Header record count does not match the number of detail records found in the file. 02 – Detail record(s) found with invalid data. 05 – Duplicate file sequence number. 06 – Gap in sequence number. 07 - Invalid ZIP file or other file structure defect
DELIMITER	CHAR(1)	LF

Appendix G: Lane Commissioning Schedule provided by PANYNJ

		2013		2014												2015				
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Goethals Bridge																				
	GB16	1																		
	GB14		1																	
	GB12			1																
	GB10				1															
	GB08			1																
	GB06		1																	
	GB04					1														
	GB02					1														
Outerbridge Crossing																				
	OBX16												1							
	OBX14													1						
	OBX12													1						
	OBX10														1					
	OBX08														1					
	OBX04															1				
	OBX02															1				
Bayonne Bridge																				
	BB08																1			
	BB06																	1		
	BB04																		1	
	BB02 (Decommissioned)																			
GWB Upper Level																				
	GWBU24		1																	
	GWBU22			1																
	GWBU20				1															
	GWBU18		1																	
	GWBU16			1																
	GWBU14				1															
	GWBU12					1														
	GWBU10					1														
	GWBU08					1														
	GWBU06					1														
	GWBU04						1													
	GWBU02						1													

GWB Lower Level																				
	GWBL74							1												
	GWBL72							1												
	GWBL70								1											
	GWBL68								1											
	GWBL66								1											
	GWBL64								1											
	GWBL62									1										
	GWBL60									1										
	GWBL58										1									
	GWBL56										1									
	GWBL54											1								
GWB PIP																				
	GWBP46												1							
	GWBP44													1						
	GWBP42											1								
	GWBP40													1						
	GWBP36 (Decommissioned)																			
	GWBP34 (Decommissioned)																			
Lincoln Tunnel																				
	LT23						1													
	LT14 XBL											1								
	LT12							1												
	LT11								1											
	LT10								1											
	LT09									1										
	LT08										1									
	LT07									1										
	LT06								1											
	LT05							1												
	LT04							1												
	LT03						1													
	LT02 (Decommissioned)																			
	LT01 (Decommissioned)																			
Holland Tunnel																				
	HT09																		1	
	HT08																		1	
	HT07																	1		
	HT06															1				
	HT05																1			
	HT04																		1	
	HT03																	1		
	HT02																1			
	HT01															1				

Monthly Totals:	1	4	4	3	6	4	5	7	4	3	3	2	4	2	4	3	3	4	0
																	Total RTCS Lanes		
																	66		

Revision Details

Editor	Date	Sections	Details
Xerox-TSS	9/19/2011	All	Initial version for review with all contributors and stakeholders.
Xerox-TSS	10/14/2011	Track Changes	Revisions from Agency Conference Call held on 10/3/11.
Xerox-TSS	10/25/2011	Track Changes	Incorporated latest material provided by the Port Authority.
Xerox-TSS	11/23/2011	Track Changes	Incorporated changes. Pending final requirements review.
Xerox-TSS	11/28/2011	Track Changes	Changes from final requirements review with the Port Authority.
Xerox-TSS	5/16/2012	Accepted Track Changes	Changes from final requirements review with the Port Authority.
Xerox-CSC	5/16/2012	Xerox Branding	Changes from ACS to Xerox Branding
Xerox – CSC	6/27/12	Track Changes	Changes removing remaining class mismatch references; addition of the lane commissioning schedule; modification of performance standard assumptions; and other minor edits.

13 Attachment 2 – Bill of Materials and Pricing Templates

-THIS PAGE INTENTIONALLY LEFT BLANK-

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

3.1	**Lane Controller Hardware and Equipment**	$ 812,951
3.2	**Lane Controller Software**	$ 570,083
3.3	**Violation Enforcement System (VES) Equipment**	$ 2,116,751
3.4	**Overhead Laser Scanner (OLS) Equipment**	$ 1,098,117
3.5	**Network Equipment**	$ 186,537
3.6	**OBX Open Road Tolling (ORT) Equipment**	$ 599,221
3.7	**Close-up Lane Observation Camera Equipment**	$ 87,185
3.8	**Lane Mode Sign Equipment**	$ 1,548,613
3.9	**ITCS Supervisor and Deposit Workstation Equipment**	$ 126,702
3.10	**ECH / CSC Interface (CO #103)**	$ 353,264
3.11	**ECH Re-platform and Upgrade**	$ 3,375,602
3.12	**Training**	$ 77,774
3.13	**Lane Installation**	$ 6,885,087
4.0	**Project Management**	$ 949,747
5.0	**Documentation**	$ 476,987
6.0	**Testing**	$ 327,731
7.0	**Spares**	$ 274,588
8.0	**Fiber Runs & ITRACS**	$ 103,922
	Total ITCS Strategic Investment	$ 19,970,861

OPTIONS

3.11.1	**Additional Train the Trainer Class**	$ 27,772
3.11.2	**Additional ECH/Vector Architecture/O&M Class**	$ 2,778
3.11.3	**Additional Reports Class**	$ 2,778
3.11.4	**Additional Revenue Accounting Class**	$ 2,778
A	**Supplemental Labor**	$ -
B1	**Service Organization Control (SOC) 1 Compliance**	$ 26,519
B2	**Service Organization Control (SOC) 2 Compliance**	$ 26,519

Date _____

Proposer _____

Signature _____

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 3.1 - Lane Controller Hardware and Equipment

Item	Description	OBX Qty	GB Qty	GWBP Qty	GWBL Qty	GWBU Qty	HT Qty	LT Qty	Tot Qty	Unit $	Extd $
Lane Controller Hardware and Equipment											
1	RK-415B Rack mount System (19"W x 21"D x 7"H) Short 5" Depth vs RK-416	5	8	7	10	12	9	14	65	$4,955	322,049
2	PCI-14S Backplane	5	8	7	10	12	9	14	65	incl line 1	
3	400W/400W Redundant Hot-Swappable Power supply with Fixed Fans	5	8	7	10	12	9	14	65	incl line 1	
4	Q77P6 i3/i5/i7 Quad Core SBC with VGA & Cooling Fan	5	8	7	10	12	9	14	65	incl line 1	
5	Intel i5-2400 Quad Core 3.1GHz CPU	5	8	7	10	12	9	14	65	incl line 1	
6	Raid 0,1,10 controller	5	8	7	10	12	9	14	65	incl line 1	
7	16GB Memory	5	8	7	10	12	9	14	65	incl line 1	
8	EZ Raid DD4 Dual Hot Swap + DD4-DZRDPK	5	8	7	10	12	9	14	65	incl line 1	
9	SATA HD Enclosure with Raid 0, 1	5	8	7	10	12	9	14	65	incl line 1	
10	2 x 1TB SATA HD	5	8	7	10	12	9	14	65	incl line 1	
11	DVD Burner	5	8	7	10	12	9	14	65	incl line 1	
12	Mouse	5	8	7	10	12	9	14	65	incl line 1	
13	KB-104 Keyboard	5	8	7	10	12	9	14	65	incl line 1	
14	Comtrol RocketPort 30129-5 PCIe 8 Port DB25M RS232/422/485 Express Octa	5	8	7	10	12	9	14	65	$350	22,719
15	Phoenix Assy, ILC 130 ETH, SNMP, 4-Output, 8-Input	5	8	7	10	12	9	14	65	$1,585	103,012
16	EDI Loop Detector 4C LMD304 , Solid State Output and Cable Assembly	5	8	7	10	12	9	14	65	$550	35,724
17	48H X 37 375W X 12D SS304 Cabinets with 48H x 36W Back Panel	0	8	0	0	0	0	0	8	$1,608	12,865
18	18H x 18W Piggy Back Box	0	8	0	0	0	0	0	8	$395	3,158
19											
20											
Implementation Tasks											
21	Xerox labor								1	$19,319	19,319
22											0
23											0
24											
25	Professional Engineering Services								1	$294,105	294,105
Section 3.1 - Lane Controller Hardware and Equipment Total of Items 1 through 25											812,951
Also Entered on Pricing Summary - Item 3.1											

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 3.2 - Lane Controller Software

Item	Description	OBX Qty	GB Qty	GWBP Qty	GWBL Qty	GWBU Qty	HT Qty	LT Qty	Tot Qty	Unit $	Extd $
Lane Controller Software											
1	Red Hat Linux MCT0988 SW	5	8	7	10	12	9	14	65	$0	$0
2									0	$0	$0
3									0	$0	$0
4									0	$0	$0
5									0	$0	$0
6									0	$0	$0
7									0	$0	$0
8									0	$0	$0
9									0	$0	$0
10									0	$0	$0
11									0	$0	$0
12									0	$0	$0
13									0	$0	$0
14									0	$0	$0
15									0	$0	$0
16									0	$0	$0
17									0	$0	$0
18									0	$0	$0
19									0	$0	$0
20	Lump Sum of Lane SW								1	$28,443	$28,443
Implementation Tasks											
21	Xerox Vector SW								1	$541,640	$541,640
22											$0
23									0	$0	$0
24									0	$0	$0
25									0	$0	$0
Section 3.2 - Lane Controller Software Total of Items 1 through 25											$570,083
Also Entered on Pricing Summary - Item 3.2											

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 3.3 - Violation Enforcement System (VES) Equipment

Item	Description	OBX Qty	GB Qty	GWBP Qty	GWBL Qty	GWBU Qty	HT Qty	LT Qty	Tot Qty	Unit $	Extd $
Violation Enforcement System (VES) Equipment											
1	JAI VIS-CAM-1000-AIO, 31015856	10	16	14	20	24	18	28	130	$10,413	$1,353,625
2											
3	JAI VIS Junc ion Panel, VJP-300, 31014201	5	8	7	10	12	9	14	65	$665	$43,225
4	JAI AC Power Supply Unit, 10010162	5	8	7	10	12	9	14	65	$560	$36,400
5	JAI VIS-CAM-1000 Cable, 10010171	10	16	14	20	24	18	28	130	$350	$45,500
6	FAB 5ft Stanchion w/Transformer Base	10	16	14	20	24	18	28	130	$259	$33,670
7	Mounting Hardware, Concrete Wedge Anchors	40	64	56	80	96	72	112	520	$7	$3,508
8	Mounting Hardware, Anchor Spacers	40	64	56	80	96	72	112	520	$0.34	$179
9									0	$0	$0
10									0	$0	$0
11									0	$0	$0
12									0	$0	$0
13									0	$0	$0
14									0	$0	$0
15									0	$0	$0
16									0	$0	$0
17									0	$0	$0
18									0	$0	$0
19									0	$0	$0
20											
Implementation Tasks											
21	Xerox Vector Software/Labor								1	$453,591	$453,591
22											$0
23											$0
24	Professional Engineering Services								1	$147,052	$147,052
25											$0
Section 3.3 - Violation Enforcement System (VES) Equipment Total of Items 1 through 25											$2,116,751
Also Entered on Pricing Summary - Item 3.3											

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 3.4 - Overhead Laser Scanner (OLS) Equipment

Item	Description	OBX Qty	GB Qty	GWBP Qty	GWBL Qty	GWBU Qty	HT Qty	LT Qty	Tot Qty	Unit $	Extd $
Overhead Laser Scanner (OLS) Equipment											
1	Sick LMS511 Laser Sensor, 1046135	5	8	7	10	12	9	14	65	$9,052	$588,365
2	Sick LMS511 Laser Dust Cover, 2063050	5	8	7	10	12	9	14	65	$362	$23,542
3	Sick LMS511 Laser Power Cable, 6036161	5	8	7	10	12	9	14	65	$136	$8,813
4	Sick LMS511 Laser Communication Cable, 6036158	5	8	7	10	12	9	14	65	$218	$14,196
5	Sick LMS511 Laser Mounting Set Quick, 2018304	5	8	7	10	12	9	14	65	$62	$4,022
6	Traco Power Supply, TSP360-124	5	8	7	10	12	9	14	65	$174	$11,284
7	Misc. Mounting Hardware	5	8	7	10	12	9	14	65	$70	$4,550
8									0	$0	$0
9									0	$0	$0
10									0	$0	$0
11									0	$0	$0
12									0	$0	$0
13									0	$0	$0
14									0	$0	$0
15									0	$0	$0
16									0	$0	$0
17									0	$0	$0
18									0	$0	$0
19									0	$0	$0
20											
Implementation Tasks											
21	Xerox Vector Software/Engineering								1	$149,240	$149,240
22											$0
23	Professional Engineering Services								1	$294,105	$294,105
24											$0
25									0	$0	$0
Section 3.4 - Overhead Laser Scanner (OLS) Equipment Total of Items 1 through 25											$1,098,117
Also Entered on Pricing Summary - Item 3.4											

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 3.5 - Network Equipment

Item	Description	OBX Qty	GB Qty	GWBP Qty	GWBL Qty	GWBU Qty	HT Qty	LT Qty	Training Qty	PATC Qty	TeleCenter Qty	Tot Qty	Unit $	Extd $
Network Equipment														
1	Cisco Catalyst 3750X Fiber Switch - WS-C3750x-24S-S	1	1	0	3	0	1	1	0	0	0	7	$9,300	$65,100
2	Cisco Catalyst 3850 Copper Switch - WS-C3850-24T-S	1	1	1	1	1	1	1	1	2	2	12	$3,800	$45,600
3	Copper Patch cables	*As needed - priced as one (1) lot*										1	$0	$0
4	Fiber connectors (ST to LC on existing fiber, SC to LC on new fiber)	*As needed - priced as one (1) lot*										1	$0	$0
5	Fiber Patch cables	*As needed - priced as one (1) lot*										1	$2,992	$2,992
6	CISCO 1000BSX SFP TRANSCEIVER MODULE MMF 850NM DOM, GLC-SX-MMD=											65	$233	$15,145
7	CISCO 1000BLX SFP TRANSCEIVER MODULE SMF 1310NM DOM, GLC-LH-SMD=											5	$463	$2,313
8	SMARTNET 24X7X4 Catalyst 3750V2 24 100BASE-FX ports + 2, CON-SNTP-37524FSS											12	$300	$3,604
9	SMARTNET 24X7X4 Catalyst 3750V2 24 100BASE-FX ports + 2, CON-SNT-C375X24S											6	$1,501	$9,006
10	Comtrol, RocketLinx Fast Ethernet Media Converter MC7001											10	$175	$1,750
11	Comtrol, RocketLinx PS1020 24V 24W 24V DIN Rail Power Supply											10	$76	$756
12	Comtrol Unmanaged Industrial E hernet switch, eight full Gigabit Ethernet ports											65	$370	$24,024
13	Comtrol 32021-0 RocketLinx Fast Ethernet Media Converter MC7001											65	$175	$11,375
14	Comtrol RocketLinx PS1020 24V 24W 24V DIN Rail Power Supply											65	$75	$4,872
15														$0
16														$0
17														$0
18														$0
19														$0
20														
Implementation Tasks														
21	Xerox Vector Software/Engineering											1	$0	$0
22														$0
23														$0
24														$0
25														$0
Section 3.5 - Network Equipment Total of Items 1 through 25														$186,537
Also Entered on Pricing Summary - Item 3.5														

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 3.6 - OBX Open Road Tolling (ORT) Equipment

Item	Description	OBX Qty	Unit $	Extd $
OBX ORT LEC				
1	WTI, 8-Port Remote Power Manager	1	$886	$886
2	Arise/ACI, KVM Switch, 15", 8 ports with cables	1	$1,641	$1,641
3	Arise Lane Controller	2	$4,955	$9,909
4	Red Hat Linux MCT0988 SW	2	$0	$0
5	Intel PRO/1000 GT Desktop Adapter - Network Adapter	4	$56	$224
6	JAI, VIS Junction Panel, VJP-300, 31014201	2	$665	$1,330
7	Traco 24VDC 15A Power Supply	1	$364	$364
8	Comtrol, DeviceMaster Pro, 8-Port Serial Port Server	3	$1,067	$3,200
9			$0	$0
10			$0	$0
OBX ORT VES Cameras				
11	JAI VIS-CAM-1000-AIO, 31015856	4	$10,412	$41,647
12	JAI Flash Unit TNF-31	4	$2,850	$11,402
13	JAI AC Power Supply Unit, 10010162	2	$560	$1,120
14	JAI VIS-CAM-1000 Cable, 10010171	4	$350	$1,400
15	JAI TLS-300 Cable, 10008879	0	$0	$0
16	JAI TLS Quick Disconnect Cable Kit, 20004921	4	$0	$0
17	Mounting Hardware	4	$1,894	$7,575
18			$0	$0
19			$0	$0
20				
Implementation Tasks				
21	Xerox Vector Software/Engineering	1	$224,418	$224,418
22				$0
23	Professional Engineering Services	1	$294,105	$294,105
24				$0
25				$0
Section 3.6 - OBX Open Road Tolling (ORT) Equipment Total of Items 1 through 25				$599,221
Also Entered on Pricing Summary - Item 3.6				

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 3.7 - Close-up Lane Observation Camera Equipment

Item	Description	OBX Qty	GB Qty	GWBP Qty	GWBL Qty	GWBU Qty	HT Qty	LT Qty	Tot Qty	Unit $	Extd $
Close-up Lane Observation Camera Equipment											
1	Sony CCTV Camera SSCG113A	5	8	7	10	12	9	14	65	$333	$21,658
2	Pelco housing	5	8	7	10	12	9	14	65	$174	$11,284
3	Pelco mount	5	8	7	10	12	9	14	65	$83	$5,364
4	Geovison GS-POS Text Inserter	5	8	7	10	12	9	14	65	$413	$26,845
5	MeanWell, Power Supply DR-30-5	5	8	7	10	12	9	14	65	$39	$2,505
6	Misc. equipment, cable	5	8	7	10	12	9	14	65	$78	$5,096
7									0	$0	$0
8									0	$0	$0
9									0	$0	$0
10									0	$0	$0
11									0	$0	$0
12									0	$0	$0
13									0	$0	$0
14									0	$0	$0
15									0	$0	$0
16									0	$0	$0
17									0	$0	$0
18									0	$0	$0
19									0	$0	$0
20											
Implementation Tasks											
21	Xerox Vector Software/Engineering								1	$14,432	$14,432
22											$0
23											$0
24											$0
25											$0
Section 3.7 - Close-up Lane Observation Camera Equipment Total of Items 1 through 25											$87,185
Also Entered on Pricing Summary - Item 3.7											

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 3.8 - Lane Mode Sign Equipment

Item	Description	OBX Qty	GB Qty	GWBP Qty	GWBL Qty	GWBU Qty	HT Qty	LT Qty	Tot Qty	Unit $	Extd $
Lane Mode Sign Equipment											
1	Daktronics AF-Galaxy 20mm RGB Outdoor LED Matrix	5	8	7	11	12	9	13	65	$15,875	$1,031,906
2											$0
3											$0
4											$0
5											$0
6											$0
7											$0
8											$0
9											$0
10											$0
11											$0
12											$0
13											$0
14											$0
15											$0
16											$0
17											$0
18											$0
19											$0
20											
Implementation Tasks											
21	Xerox Vector Software/Engineering								1	$16,728	$16,728
22											$0
23	Professional Engineering Services								1	$499,978	$499,978
24											$0
25											$0
Section 3.8 - Lane Mode Sign Equipment Total of Items 1 through 25											$1,548,613
Also Entered on Pricing Summary - Item 3.8											

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 3.9 - ITCS Supervisor and Deposit Workstation Equipment

Item	Description	OBX Qty	GB Qty	GWBP Qty	GWBL Qty	GWBU Qty	HT Qty	LT Qty	Training Qty	PATC Qty	TeleCenter Qty	Tot Qty	Unit $	Extd $
1	Plaza Supervisor Stations	1	1	1	1	3	1	1	7	0	0	16	$675	$10,800
2	Plaza Supervisor Monitors	1	1	1	1	3	1	1	7	0	0	16	$441	$7,056
3	Printer - Thermal Printer Epson tm-t88v E hernet	3	3	3	5	5	3	6	2	0	0	30	$333	$9,996
4	Plaza Drop Workstations	3	3	3	5	5	3	6	2	0	0	30	$675	$20,250
5	Plaza Drop Station Monitors	3	3	3	5	5	3	6	2	0	0	30	$441	$13,230
6	Printer paper - Case of 50 #T318-230	1	1	1	1	1	1	1	1	0	0	8	$74	$594
7	HP Neoware TeemTalk Terminal Emulator for Windows PCs or Servers - (v. 7)	4	4	4	6	8	4	7	9	0	0	46	$196	$9,016
8														$0
9														$0
10														$0
11														$0
12														$0
13														$0
14														$0
15														$0
16														$0
17														$0
18														$0
19														$0
20														
Implementation Tasks														
21	Xerox Vector Software/Engineering											1	$55,760	$55,760
22														$0
23														$0
24														$0
25														$0
Section 3.9 - ITCS Supervisor and Deposit Workstation Equipment Total of Items 1 through 25														$126,702
Also Entered on Pricing Summary - Item 3.9														

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 3.10 - ECH / CSC Interface (CO #103)

Item	Description	Primary ECH Qty	Backup ECH Qty	Tot Qty	Unit $	Extd $
ECH Hardware and Software						
1	Lumpsum					$0
2						$0
3						$0
4						$0
5						$0
6						$0
7						$0
8						$0
9						$0
10						$0
11						$0
12						$0
13						$0
14						$0
15						$0
16						$0
17						$0
18						$0
19						$0
20	Lump Sum of the above items					$0
ECH COTS Software						
21						$0
22						$0
23						$0
24						$0
25						$0
26						$0
27						$0
28						$0
29						$0
30						$0
Labor Effort						
31	Development	1		1	$353,264	$353,264
32	Testing	1		1	$0	$0
33	Engineering Support	1		1	$0	$0
34	ECH Installation & Onsite Testing - Primary	1		1	$0	$0
35	ECH Installation & Onsite Testing - Backup					$0
36						$0
37						$0
38						$0
39						$0
40						$0
ECH / CSC Interface (CO #103), Total of Items 1 through 40						$353,264
Also Entered on Pricing Summary - Item 3.10						

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 3.11 - ECH Re-platform and Upgrade

						Updated 6/20
Item	**Description**	**Primary ECH Qty**	**Backup ECH Qty**	**Tot Qty**	**Unit $**	**Extd $**
ECH Hardware and Software - ***See IBM quote submitted separately for config detail***						
1	0	0	0	0	$0	$0
2	0	0	0	0	$0	$0
3	0	0	0	0	$0	$0
4	x3650 M4, Xeon 4C E5-2637v2 130W 3.5GHz/1866MHz/15MB, 1x8GB, O/Bay HS 2.5in SAS/SATA, SR M5110e, 900W p/s, Rack	0	0	9	$7,717	$69,449
5	IBM ServicePac On-Site Repair - Extended service agreement - parts and labor - 5 years - on-site - 24x7 - response time: 4 h	0	0	9	$1,485	$13,365
6	0	0	0	0	$0	$0
7	Express IBM System Storage SAN24B-4	0	0	2	$2,833	$5,667
8	SFP 8 Gbps SW 8-Pack	0	0	4	$394	$1,575
9	8-Port Activation	0	0	2	$2,109	$4,219
10	0	0	0	0	$0	$0
11	TS3100 Tape Library Model L2U Driveless	0	0	2	$2,202	$4,404
12	LTO Ultrium 5 Half High Fibre Drive Sled	0	0	2	$2,495	$4,989
13	3573 Rack Mount Kit	0	0	2	$185	$370
14	0	0	0	0	$0	$0
15	V5000 SFF Control #1	0	0	1	$48,487	$48,487
16	V5000 LFF Expansion #1	0	0	1	$24,237	$24,237
17	years 1-3 24x7 hardware warranty for 2078-24C		0	1	$2,723	$2,723
18	years 4 and 5 24x7 hardware warranty for 2078-24C		0	1	$5,989	$5,989
19	years 1-3 24x7 hardware warranty for 2078-12E		0	1	$806	$806
20	years 4 and 5 24x7 hardware warranty for 2078-12E		0	1	$1,871	$1,871
21	years 4 and 5 software maintenance for 2078-24C		0	1	$11,611	$11,611
22	years 4 and 5 software maintenance for 2078-12E		0	1	$2,444	$2,444
23	0	0	0	0	$0	$0
24	0	0	0	0	$0	$0
25	V5000 SFF Control #1 - DR	0	0	1	$48,487	$48,487
26	V5000 LFF Expansion #1 - DR	0	0	1	$24,237	$24,237
27	years 1-3 24x7 hardware warranty for 2078-24C		0	1	$2,723	$2,723
28	years 4 and 5 24x7 hardware warranty for 2078-24C		0	1	$5,989	$5,989
29	years 1-3 24x7 hardware warranty for 2078-12E		0	1	$806	$806
30	years 4 and 5 24x7 hardware warranty for 2078-12E		0	1	$1,871	$1,871
31	years 4 and 5 software maintenance for 2078-24C		0	1	$11,611	$11,611
32	years 4 and 5 software maintenance for 2078-12E		0	1	$2,444	$2,444
33	0	0	0	0	$0	$0
34	0	0	0	0	$0	$0
35	0	0	0	0	$0	$0
36	0	0	0	0	$0	$0
37	0	0	0	0	$0	$0
38	0	0	0	0	$0	$0
39	0	0	0	0	$0	$0
40	0	0	0	0	$0	$0
41	0	0	0	0	$0	$0
42				0	$0	$0
43	0	0	0	0	$0	$0
44				0	$0	
ECH COTS Software						
45	WebSphere Base license - IBM - Application Server (Network deployment)	0	0	2	$48,866	$97,733
46	Annual Maintenance	0	0	2	$8,796	$17,591
47	Oracle EE (CPU License) - 2 quad cores x primary x secondary	0	0	12	$15,153	$181,830
48	Annual Maintenance - 2 quad cores x primary x secondary	0	0	12	$3,031	$36,366
49	Oracle ADG (CPU License)	0	0	12	$3,669	$44,022
50	Annual Maintenance	0	0	12	$734	$8,804
51	Oracle PART (CPU License)	0	0	12	$3,669	$44,022
52	Annual Maintenance	0	0	12	$734	$8,804
53	Crystal Reports - Business Objects - 20 concuurent users (4 X 5 concurrent user license)	0	0	4	$8,714	$34,857
54	Annual Maintenance	0	0	4	$1,656	$6,623
55	Crystal Reports Designer.	0	0	1	$863	$863
56	Linux Enterprise Server - Redhat -	0	0	5	$1,975	$9,875
57	Annual License	0	0	5	$1,975	$9,875
58	Report Server OS licenses	0	0	2	$2,175	$4,350
59	Image Server OS licenses	0	0	2	$2,175	$4,350
60						$0
61						$0
Labor Effort						
65	Development	1		1	$1,381,960	$1,381,960
66	Testing	1		1	$201,243	$201,243
67	Engineering Support	1		1	$50,020	$50,020
68	ECH Installation & Onsite Testing - Primary	1		1	$210,715	$210,715
69	ECH Installation & Onsite Testing - Backup			1	$210,715	$210,715
70	Warranty Period Support	1		1	$510,611	$510,611
71						$0
72						$0
73						$0
74						$0
ECH Re-platform and Upgrade, Total of Items 1 through 74						$3,375,602
Also Entered on Pricing Summary - Item 3.11						

Port Authority of NY and NJ

ITCS Strategic Investment Change Order

Section 3.12 - Training

Item	Description	Qty	Unit $	Extd $
Cost to Perform Training Classes				
1	Pilot Courses 1 through 4	1	$13,886	$13,886
2	Course 1 - Train the Trainers	1	$27,772	$27,772
3	Course 2 - Vector ECH HW/SW Architecture, Operations & Maintenance	5	$2,778	$13,891
4	Course 3 - Reports	6	$2,778	$16,669
5	Course 4 - Revenue Accounting	2	$2,778	$5,556
6				$0
7				$0
8				$0
9				$0
10				$0
11				$0
12				$0
13				$0
14				$0
15				$0
16				$0
17				$0
18				$0
19				$0
20				$0
Implementation Tasks				
21				$0
22				$0
23				$0
24				$0
25				$0
Section 3.12 - Training Total of Items 1 through 25				$77,774
Also Entered on Pricing Summary - Item 3.12				

Port Authority of NY and NJ

ITCS Strategic Investment Change Order

Section 3.13 - Lane Installation

Item	Description	Qty	Unit $	Extd $
Outerbridge Crossing (7 lanes)				
1	ORT Lanes 2 / 4	2	94,113.58	188,227.16
2	Conventional Lanes 8 / 10 / 12 / 14 / 16	5	98,426.84	492,134.22
Goethals Bridge (8 lanes)				
3	Conventional Lanes 2 / 4 / 6 / 8 / 10 / 12 / 14 / 16	8	98,426.84	787,414.75
George Washington Bridge - Palisades Parkway (7 lanes)				
4	Conventional Lanes 34 / 36 / 38 / 40 / 42 / 44 / 46	7	98,426.84	688,987.91
George Washington Bridge - Lower Level (10 lanes)				
5	Conventional Lanes 54 / 56 / 58 / 60 / 62 / 64 / 68 / 70 / 72 / 74	10	98,426.84	984,268.44
6	Decommission Lane 66	1	15,809.74	15,809.74
George Washington Bridge - Upper Level (12 lanes)				
7	Conventional Lanes 2 / 4 / 6 / 8 / 10 / 12 / 14 / 16 / 18 / 20 / 22 / 24	12	98,426.84	1,181,122.13
Holland Tunnel (9 lanes)				
8	Conventional Lanes 1 / 2 / 4 / 6 / 8	5	98,426.84	492,134.22
9	Conventional Lanes with treadle relocation 3 / 5 / 7 / 9	4	157,030.04	628,120.17
Lincoln Tunnel (14 lanes)				
10	Conventional Lanes 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10 / 11 / 12 / 23	13	98,426.84	1,279,548.97
11	Conventional XBL Lane 14	1	75,788.67	75,788.67
12				
13				
14				0.00
15				0.00
16				0.00
17				0.00
18				0.00
19	Xrx Deployment Labor - Lump sum	1	71,530.24	71,530.24
20				0.00
Section 3.13 - Lane Installation Total of Items 1 through 20				$6,885,086.62
Also Entered on Pricing Summary - Item 3.13				

Port Authority of NY and NJ

ITCS Strategic Investment Change Order

Section 4 - Project Management

Item	Description	Qty	Unit $	Extd $
1	Project Management/Controls	1	$949,747	$949,747
2				$0
3				$0
4				$0
5				$0
6				$0
7				$0
8				$0
9				$0
10				$0
Section 4 - Project Management Total of Items 1 through 10				$949,747
Also Entered on Pricing Summary - Item 4				

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 5 - Documentation

Item	Description	Qty	Unit $	Extd $
Documentation				
1	Detailed Design Document	1	$0	$0
2	Implementation Plan	1	$0	$0
3	Shop Drawings	65	$0	$0
4				$0
5	Lumpsum Documentation	1	$223,771	$223,771
Manuals				
6	System Administration Manual	1	$0	$0
7	Operations Manual	1	$0	$0
8	Maintenance and Service Manual	1	$0	$0
9	Toll Collector Operating Manual	1	$0	$0
10	Toll Supervisor's Operating Manual	1	$0	$0
11	Lumpsum Manuals	1	$134,480	$134,480
Other				
12	ECH Re-platform Training Manuals	1	$0	$0
13	Disaster Recovery Plan	1	$0	$0
14				$0
15				$0
16	Lumpsum Other	1	$118,736	$118,736
Section 5 - Documentation Total of Items 1 through 16				$476,987
Also Entered on Pricing Summary - Item 5				

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 6 - Testing

Item	Description	Qty	Unit $	Extd $
1	Factory Acceptance Test (FAT)	1	160,877.44	160,877.44
2	On-Site First Installation Test (OFIT) - Lane	1	65,829.60	65,829.60
3	On-Site First Installation Test (OFIT) - ECH	1	32,800.00	32,800.00
4	Field Checkout and Test (FCOT) - Conventional Lane	1	0.00	0.00
5	Field Checkout and Test (FCOT) - ORT Lane	2	0.00	0.00
6	Field Checkout and Test (FCOT) - Other Conventional Lanes	64	0.00	0.00
7	FCOT Lumpsum (includes 3 lines above)	1	68,224.00	68,224.00
8				0.00
9				0.00
10				0.00
Implementation Tasks				
11				0.00
12				0.00
13				0.00
14				0.00
15				0.00
Section 6 - Testing Total of Items 1 through 15				$327,731.04
Also Entered on Pricing Summary - Item 6				

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 7 - Spares

Item	Description	Quantity	Unit $	Extd $
Arise PC				
1	RK-415B Rack mount System (19"W x 21"D x 7"H) Short 5" Depth vs RK-416	4	0.00	0.00
2	PCI-14S Backplane	4	0.00	0.00
3	400W/400W Redundant Hot-Swappable Power supply with Fixed Fans	4	0.00	0.00
4	Q77P6 i3/i5/i7 Quad Core SBC with VGA & Cooling Fan	4	0.00	0.00
5	Intel i5-2400 Quad Core 3.1GHz CPU	4	0.00	0.00
6	Raid 0,1,10 controller	4	0.00	0.00
7	16GB Memory	4	0.00	0.00
8	EZ Raid DD4 Dual Hot Swap + DD4-DZRDPK	4	0.00	0.00
9	SATA HD Enclosure wi h Raid 0, 1	4	0.00	0.00
10	2 x 1TB SATA HD	4	0.00	0.00
11	DVD Burner	4	0.00	0.00
12	Mouse	4	0.00	0.00
13	KB-104 Keyboard	4	0.00	0.00
14	Comtrol RocketPort 30129-5 PCIe 8 Port DB25M RS232/422/485 Express Octa	4	0.00	0.00
15				0.00
LEC Panel				
16	Phoenix Assy, ILC 130 ETH, SNMP, 4-Output, 8-Input	4	0.00	0.00
17	EDI Loop Detector 4C LMD304 , Solid State Output and Cable Assembly	4	0.00	0.00
18				0.00
19				0.00
20				0.00
VES Equipment				
21	JAI VIS-CAM-1000-AIO, 31015856	7	0.00	0.00
22	JAI Dynamic Traffic Light Sensor TLS-300, 31014203	2	0.00	0.00
23	JAI VIS Junc ion Panel, VJP-300, 31014201	4	0.00	0.00
24	JAI AC Power Supply Unit, 10010162	4	0.00	0.00
25	FAB 5ft Stanchion w/Transformer Base	7	0.00	0.00
26				0.00
27				0.00
28				0.00
29				0.00
30				0.00
OLS Equipment				
31	Sick LMS511 Laser Sensor, 1046135	4	0.00	0.00
32	Sick LMS511 Laser Dust Cover, 2063050	4	0.00	0.00
33	Sick LMS511 Laser Power Cable, 6036161	4	0.00	0.00
34	Sick LMS511 Laser Communication Cable, 6036158	4	0.00	0.00
35	Sick LMS511 Laser Mounting Set Quick, 2018304	4	0.00	0.00
36	Traco Power Supply, TSP360-124	4	0.00	0.00
37				0.00
38				0.00
39				0.00
40				0.00
OBX ORT LEC Equipment				
41	Lane Controller	1	0.00	0.00
42	Intel PRO/1000 GT Desktop Adapter - Network Adapter	1	0.00	0.00
43	VIS Junction Panel	1	0.00	0.00
44	8-Port Remote Power Manager	1	0.00	0.00
45	DeviceMaster Pro, 8-Port Serial Port Server	1	0.00	0.00
46	RS-422 / RS-485 protection module	1	0.00	0.00
47	RS-232 protection module	1	0.00	0.00
48				0.00
49				0.00
50				0.00
OBX ORT Gantry, Laser Scanner				
51	Sick LMS511 Laser Sensor, 1046135	1	0.00	0.00
52	Sick LMS511 Laser Dust Cover, 2063050	1	0.00	0.00
53	Traco Power Supply, TSP360-124	1	0.00	0.00
54				0.00
55				0.00
OBX ORT VES Cameras				
56	JAI VIS-CAM-1000-AIO, 31015856	1	0.00	0.00
57	JAI Flash Unit TNF-31	1	0.00	0.00
58	JAI AC Power Supply Unit, 10010162	1	0.00	0.00
59				0.00
60				0.00
LEC Switches				
61	Comtrol Unmanaged Industrial E hernet switch, eight full Gigabit E hernet ports	4	0.00	0.00
62	Comtrol 32021-0 RocketLinx Fast Ethernet Media Converter MC7001	4	0.00	0.00

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 7 - Spares

Item	Description	Quantity	Unit $	Extd $
63	RocketLinx PS1020 24V 24W 24V DIN Rail Power Supply	4	0.00	0.00
64				0.00
65				0.00
Cisco/Other Plaza Switches				
66	Catalyst 3850 24 port Fiber Switch	1	0.00	0.00
67	SMARTNET 24X7X4 Catalyst 3850 24 port Fiber Switch	1	0.00	0.00
68	Catalyst 3850 24 port Copper Switch	1	0.00	0.00
69	SMARTNET 24X7X4 Catalyst 3850 24 port Copper Switch	1	0.00	0.00
70	Comtrol, RocketLinx Fast Ethernet Media Converter MC7001	1	0.00	0.00
71	Comtrol, RocketLinx PS1020 24V 24W 24V DIN Rail Power Supply	1	0.00	0.00
72				0.00
73				0.00
74				0.00
75				0.00
LMS Equipment				
76	Daktronics Sign, Single Face, 3'10" x 8'10" x 8" LED LMS	4	0.00	0.00
77				0.00
Close Up Lane Observation Equipment				
78	Sony CCTV Camera SSCG113A	4	0.00	0.00
79	Pelco housing	4	0.00	0.00
80	Pelco mount	4	0.00	0.00
81	Geovison GS-POS Text Inserter	4	0.00	0.00
82	MeanWell, Power Supply DR-30-5	4	0.00	0.00
83				0.00
84				0.00
85				0.00
ITCS Terminals				
86	Plaza Supervisor Stations	1	0.00	0.00
87	Plaza Supervisor Monitors	1	0.00	0.00
88	Printer - Thermal Printer Epson tm-t88v Ethernet	2	0.00	0.00
89	Plaza Drop Worksta ions	2	0.00	0.00
90	Plaza Drop Station Monitors	2	0.00	0.00
91				0.00
92				0.00
93				0.00
94				0.00
95				0.00
Replacement Spares for One (1) Year of Revenue Service, Total of Items 1 - 95				$274,587.60
Also Entered on Pricing Summary - Item 7				

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Section 8 - Fiber Runs & ITRACS

Item	Description	Tot Qty	Unit $	Extd $
Fiber Runs				
1	CISCO 1000BLX SFP TRANSCEIVER MODULE SMF 1310NM DOM, GLC-LH-SMD=	7	$463	$3,241
2	Fiber, SM 6 Strands pre-terminated 500ft	2	$404	$809
3	Fiber Termination Box, Wall mount, FIS Mini Wall Mount Black	4	$69	$274
4	Additional Fiber Runs - Daidone Labor	2	$14,285	$28,570
5		0	$0	$0
6		0	$0	$0
7		0	$0	$0
8		0	$0	$0
ITRACS				
9	ITRACS - Development / Test	1	$71,028	$71,028
		0	$0	$0
		0	$0	$0
		0	$0	$0
		0	$0	$0
		0	$0	$0
		0	$0	$0
		0	$0	$0
		0	$0	$0
		0	$0	$0
		0	$0	$0
		0	$0	$0
		0	$0	$0
		0	$0	$0
		0	$0	$0
				$0
				$0
Also Entered on Pricing Summary - Item 8.0				$103,922

Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Option A - Supplemental Labor

Hourly rates for additional services after Change Order award (not included in total price)

Item	Description	All-Inclusive Extra Work Hourly Billing Rates	Annual Escalation
Optional Contract Labor, Hourly Rates			
1	Project Principal	$ 148.53	Per Contract
2	Project Manager	$ 116.70	Per Contract
3	Quality Assurance Manager	$ 116.70	Per Contract
4	Technical (Software) Manager	$ 116.70	Per Contract
5	System Administrator	$ 116.70	Per Contract
6	Database Administrator	$ 116.70	Per Contract
7	System Analyst	$ 90.18	Per Contract
8	Software Architect	$ 116.70	Per Contract
9	Software Development Engineer	$ 90.18	Per Contract
10	System Testing Specialist	$ 90.18	Per Contract
11	System Documentation Specialist	$ 68.96	Per Contract
12	Certified Training Professional	$ 84.87	Per Contract
13	Administrative Assistant	$ 90.18	Per Contract
14			Per Contract
15		$ -	Per Contract
16		$ -	Per Contract
17		$ -	Per Contract
18		$ -	Per Contract
19		$ -	Per Contract
20		$ -	Per Contract
21		$ -	Per Contract
22		$ -	Per Contract
23		$ -	Per Contract
24		$ -	Per Contract
25		$ -	Per Contract

The above Extra Work personnel rates inserted by the Contractor shall be for additional Software Design, Development, Testing and Deployment tasks if ordered by the Authority. These rates are for Extra Work tasks and are separate and distinct from the personnel rates presented in Exhibits E through H of the Contract.

Wage rates shall be all-inclusive including overhead, taxes, tolls, travel time, cost of vehicle use and profit.

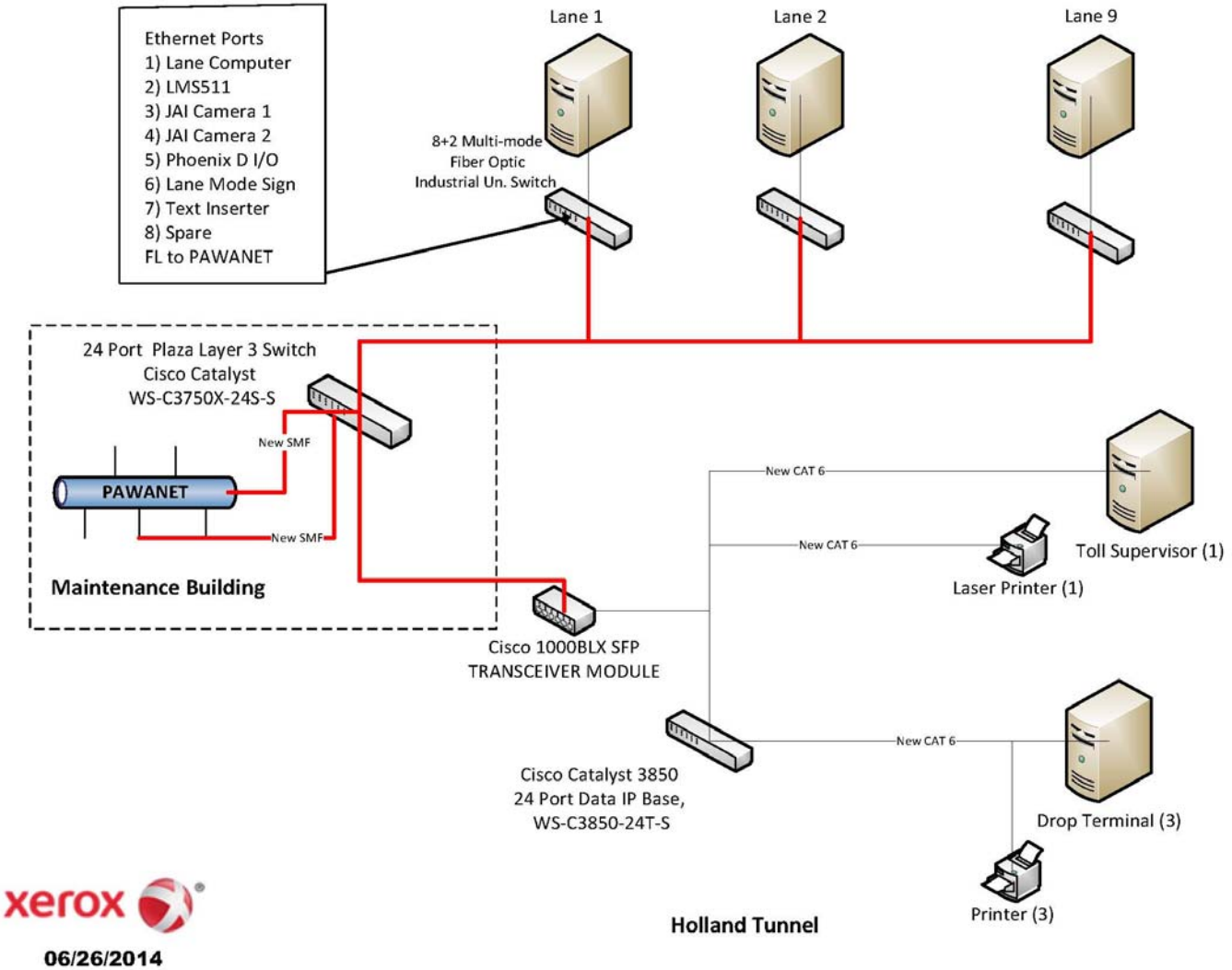
Port Authority of NY and NJ
ITCS Strategic Investment Change Order

Option B - Service Organization Control (SOC) Compliance

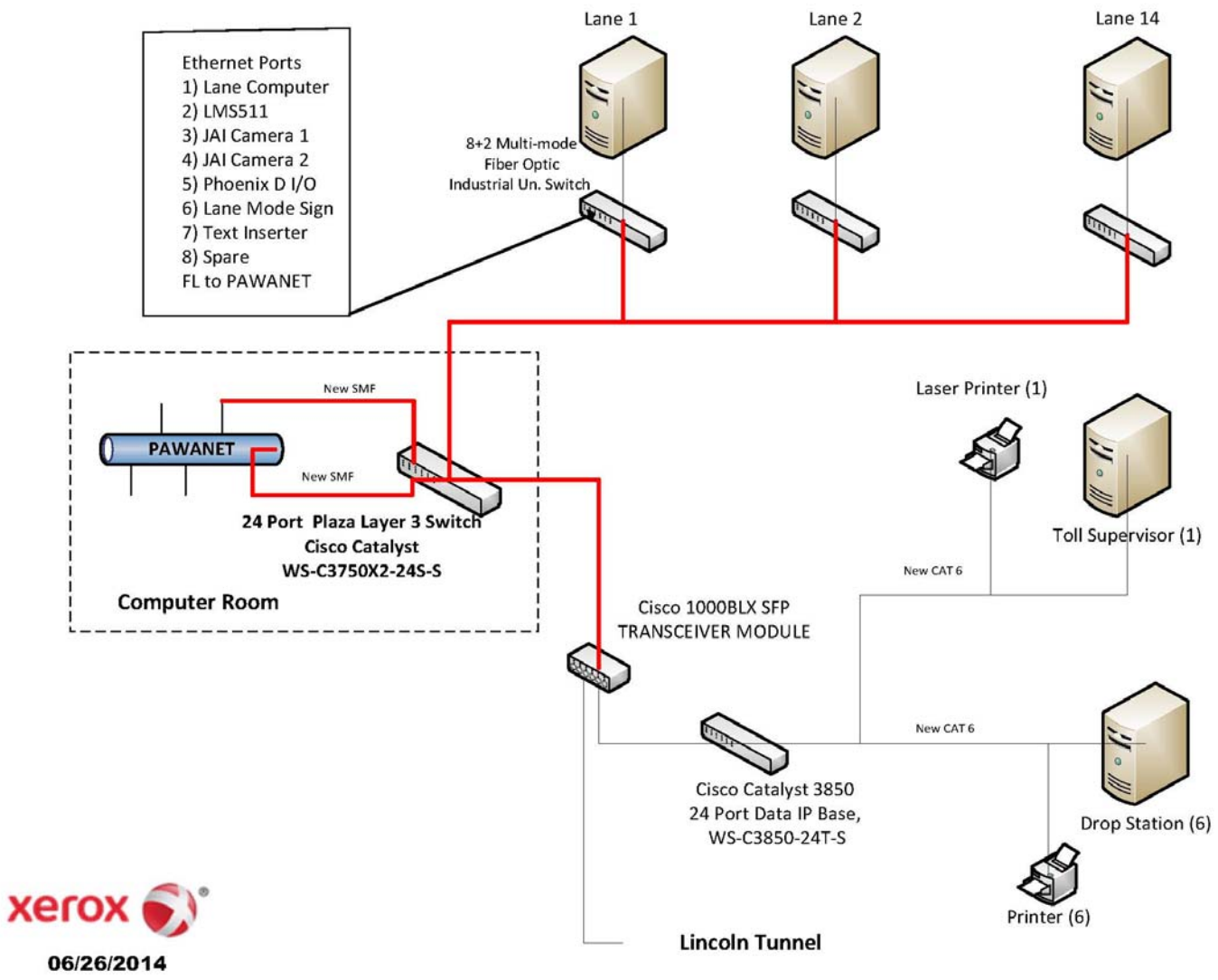
Item	Description	UOM	Extd
SOC 1			
1	Annual SOC 1 Audit	2	$26,519
2			$0
3			$0
4			$0
5			$0
6			$0
7			$0
8			$0
9			$0
10			$0
		Total SOC 1	$26,519
SOC 2			
11	Annual SOC 2 Audit	2	$26,519
12			$0
13			$0
14			$0
15			$0
16			$0
17			$0
18			$0
19			$0
20			$0
		Total SOC 2	$26,519

14 Attachment 3 – Network Diagrams

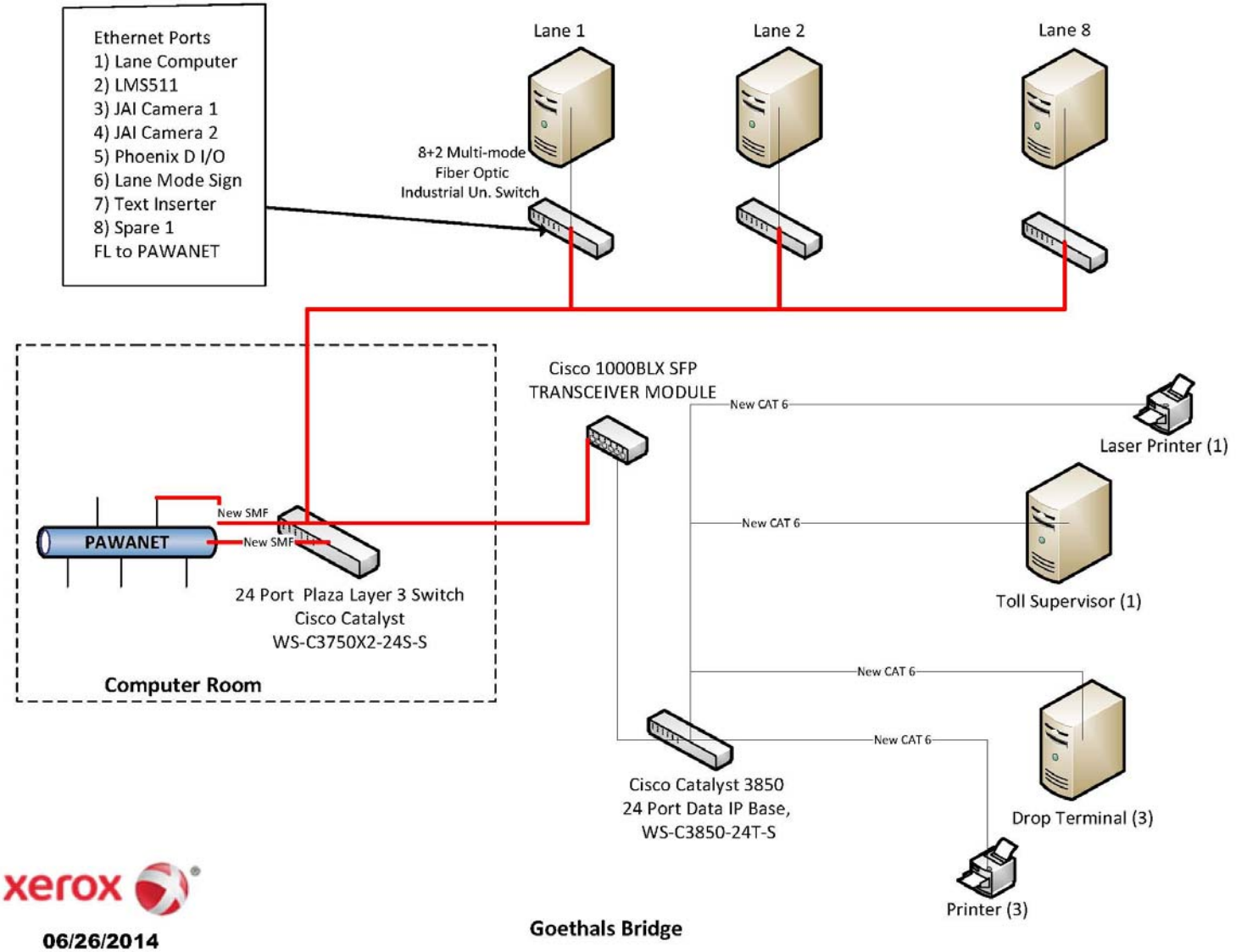
-THIS PAGE INTENTIONALLY LEFT BLANK-


Ethernet Ports
1) Lane Computer
2) LMS511
3) JAI Camera 1
4) JAI Camera 2
5) Phoenix D I/O
6) Lane Mode Sign
7) Text Inserter
8) Spare
FL to PAWANET
Lane 1
Lane 2
Lane 9
8+2 Multi-mode
Fiber Optic
Industrial Un. Switch
24 Port Plaza Layer 3 Switch
Cisco Catalyst
WS-C3750X-24S-S
New SMF
PAWANET
New SMF
Maintenance Building
New CAT 6
New CAT 6
Toll Supervisor (1)
Laser Printer (1)
Cisco 1000BLX SFP
TRANSCEIVER MODULE
New CAT 6
Cisco Catalyst 3850
24 Port Data IP Base,
WS-C3850-24T-S
Drop Terminal (3)
Printer (3)
Holland Tunnel
xerox
06/26/2014

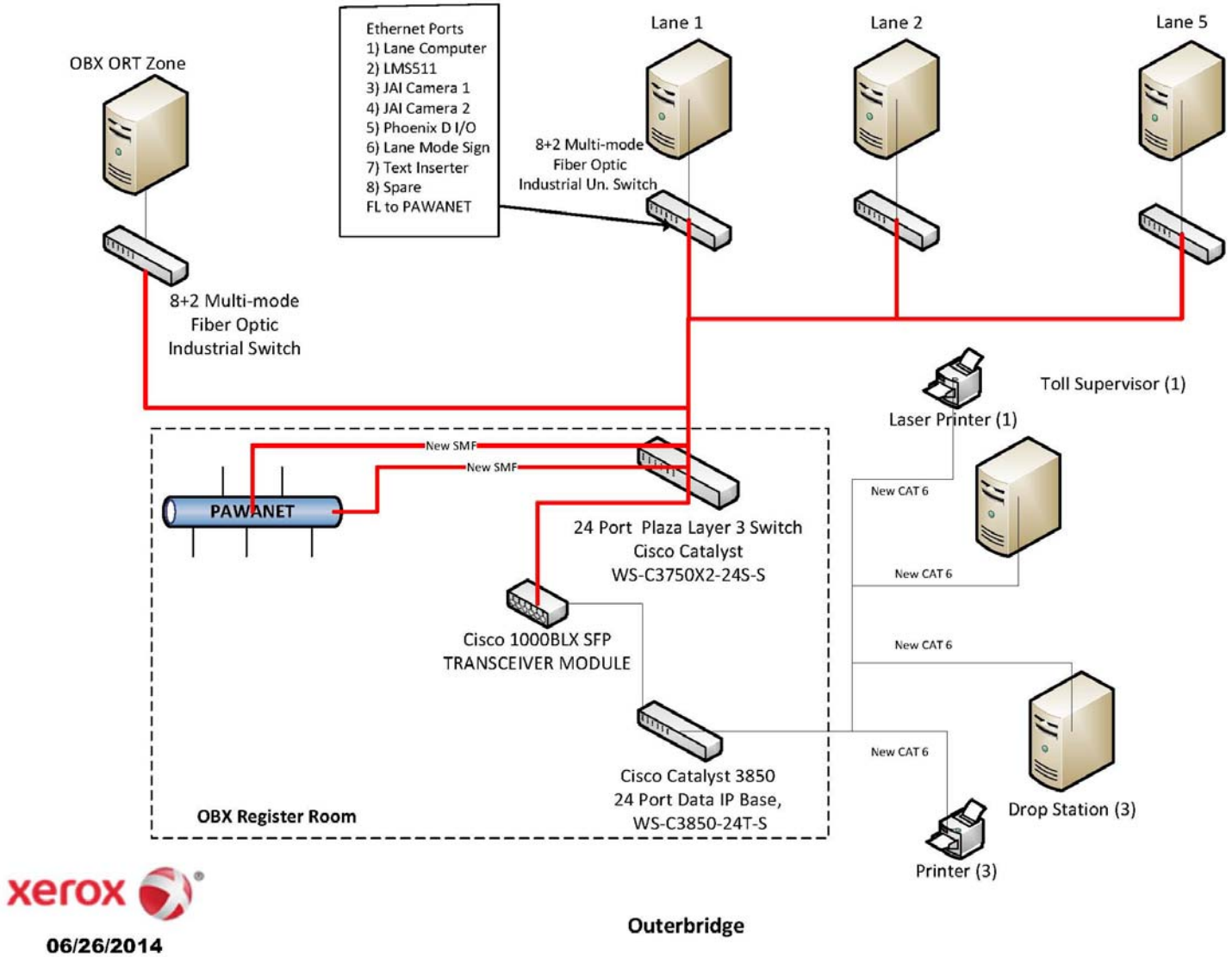
-THIS PAGE INTENTIONALLY LEFT BLANK-


Lane 1
Lane 2
Lane 14
Ethernet Ports
1) Lane Computer
2) LMS511
3) JAI Camera 1
4) JAI Camera 2
5) Phoenix D I/O
6) Lane Mode Sign
7) Text Inserter
8) Spare
FL to PAWANET
8+2 Multi-mode
Fiber Optic
Industrial Un. Switch
New SMF
PAWANET
New SMF
24 Port Plaza Layer 3 Switch
Cisco Catalyst
WS-C3750X2-24S-S
Computer Room
Laser Printer (1)
Toll Supervisor (1)
New CAT 6
Cisco 1000BLX SFP
TRANSCEIVER MODULE
New CAT 6
Cisco Catalyst 3850
24 Port Data IP Base,
WS-C3850-24T-S
Drop Station (6)
Printer (6)
Lincoln Tunnel
xerox
06/26/2014

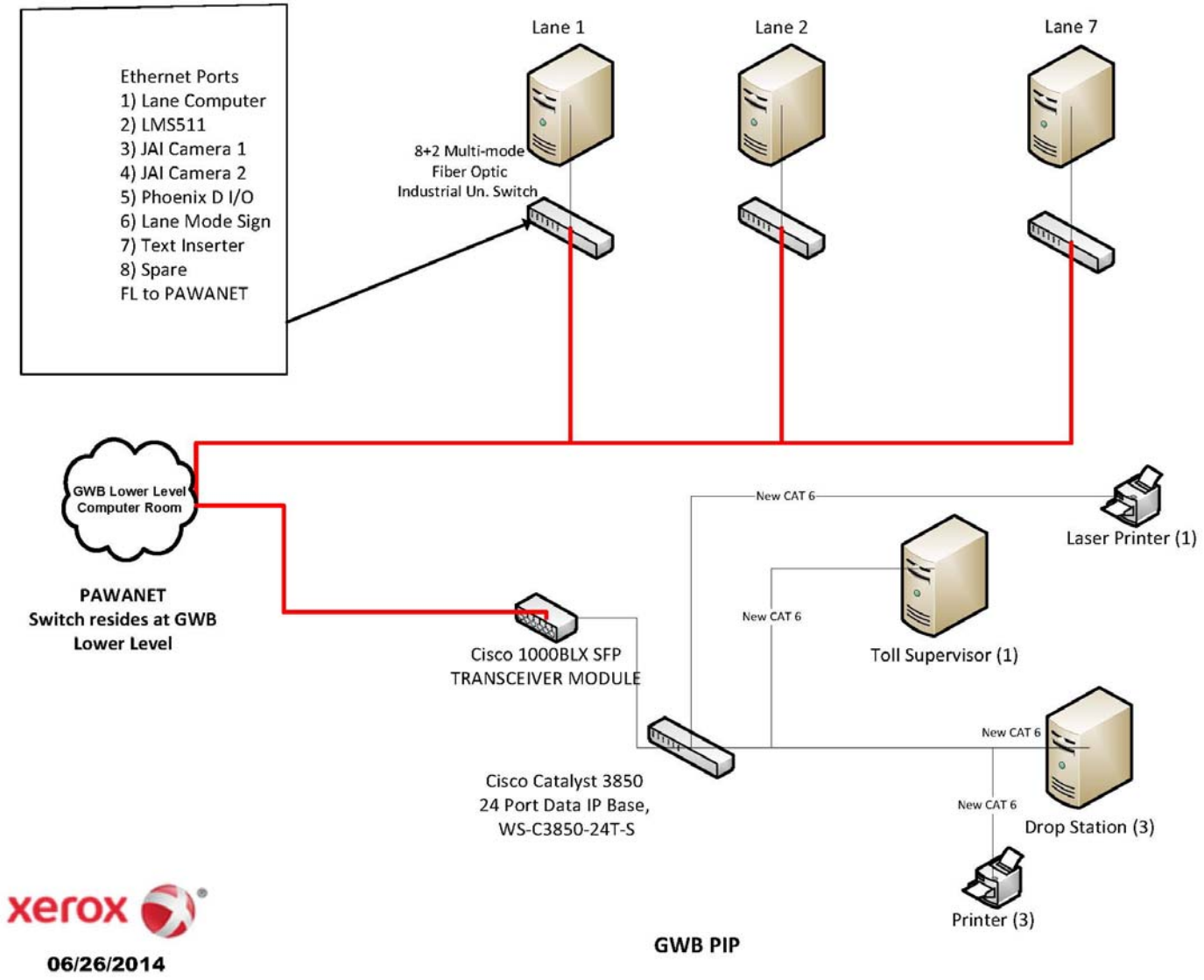
-THIS PAGE INTENTIONALLY LEFT BLANK-


Ethernet Ports
1) Lane Computer
2) LMS511
3) JAI Camera 1
4) JAI Camera 2
5) Phoenix D I/O
6) Lane Mode Sign
7) Text Inserter
8) Spare 1
FL to PAWANET
Lane 1
Lane 2
Lane 8
8+2 Multi-mode
Fiber Optic
Industrial Un. Switch
Cisco 1000BLX SFP
TRANSCEIVER MODULE
New CAT 6
Laser Printer (1)
New CAT 6
Toll Supervisor (1)
New SMF
New SMF
PAWANET
24 Port Plaza Layer 3 Switch
Cisco Catalyst
WS-C3750X2-24S-S
Computer Room
New CAT 6
New CAT 6
Cisco Catalyst 3850
24 Port Data IP Base,
WS-C3850-24T-S
Drop Terminal (3)
Printer (3)
xerox
06/26/2014
Goethals Bridge

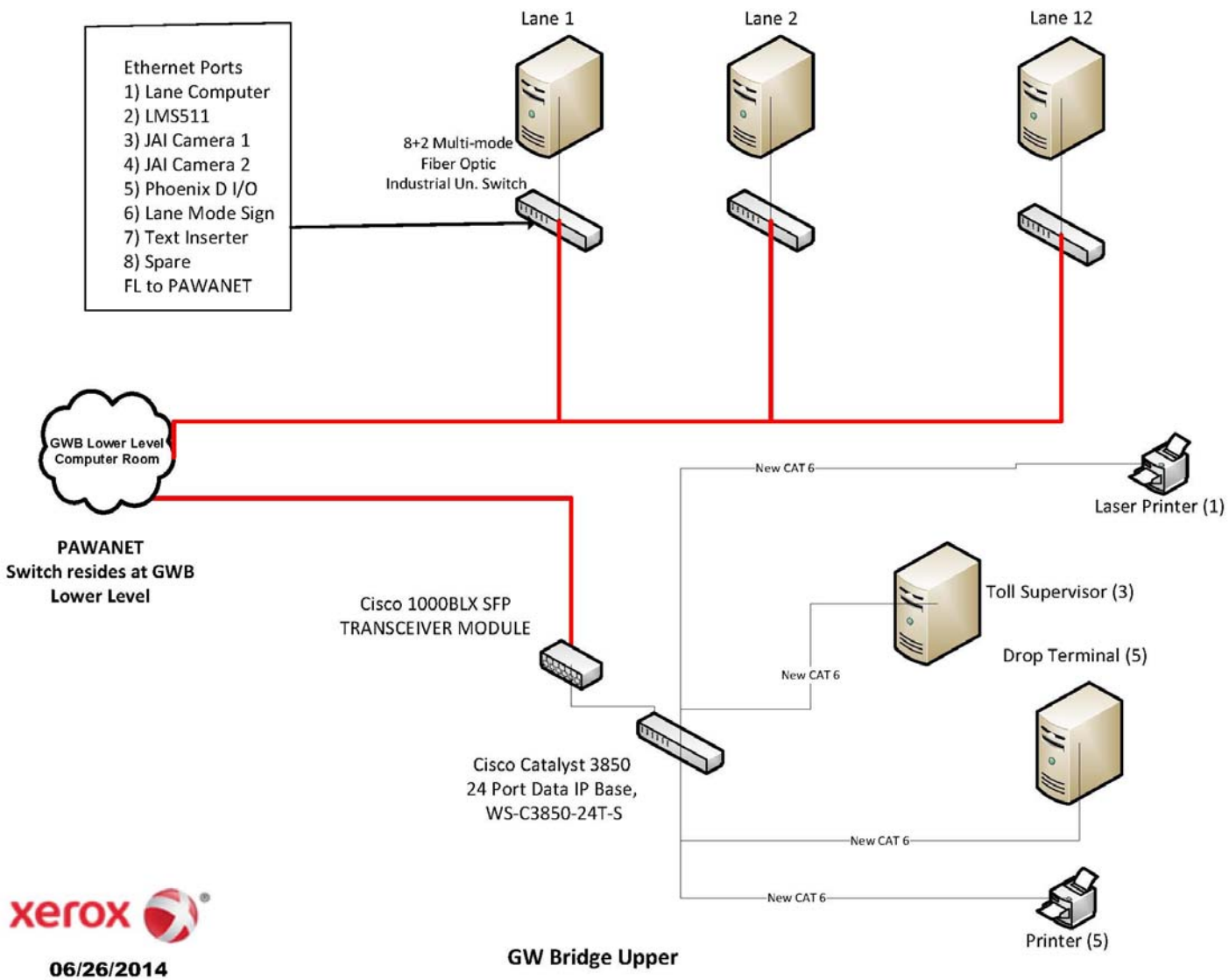
-THIS PAGE INTENTIONALLY LEFT BLANK-


Ethernet Ports
1) Lane Computer
2) LMS511
3) JAI Camera 1
4) JAI Camera 2
5) Phoenix D I/O
6) Lane Mode Sign
7) Text Inserter
8) Spare
FL to PAWANET
OBX ORT Zone
Lane 1
Lane 2
Lane 5
8+2 Multi-mode
Fiber Optic
Industrial Un. Switch
8+2 Multi-mode
Fiber Optic
Industrial Switch
Toll Supervisor (1)
Laser Printer (1)
New SMF
New SMF
PAWANET
24 Port Plaza Layer 3 Switch
Cisco Catalyst
WS-C3750X2-24S-S
New CAT 6
New CAT 6
Cisco 1000BLX SFP
TRANSCEIVER MODULE
New CAT 6
New CAT 6
Cisco Catalyst 3850
24 Port Data IP Base,
WS-C3850-24T-S
OBX Register Room
Drop Station (3)
Printer (3)
xerox
06/26/2014
Outerbridge

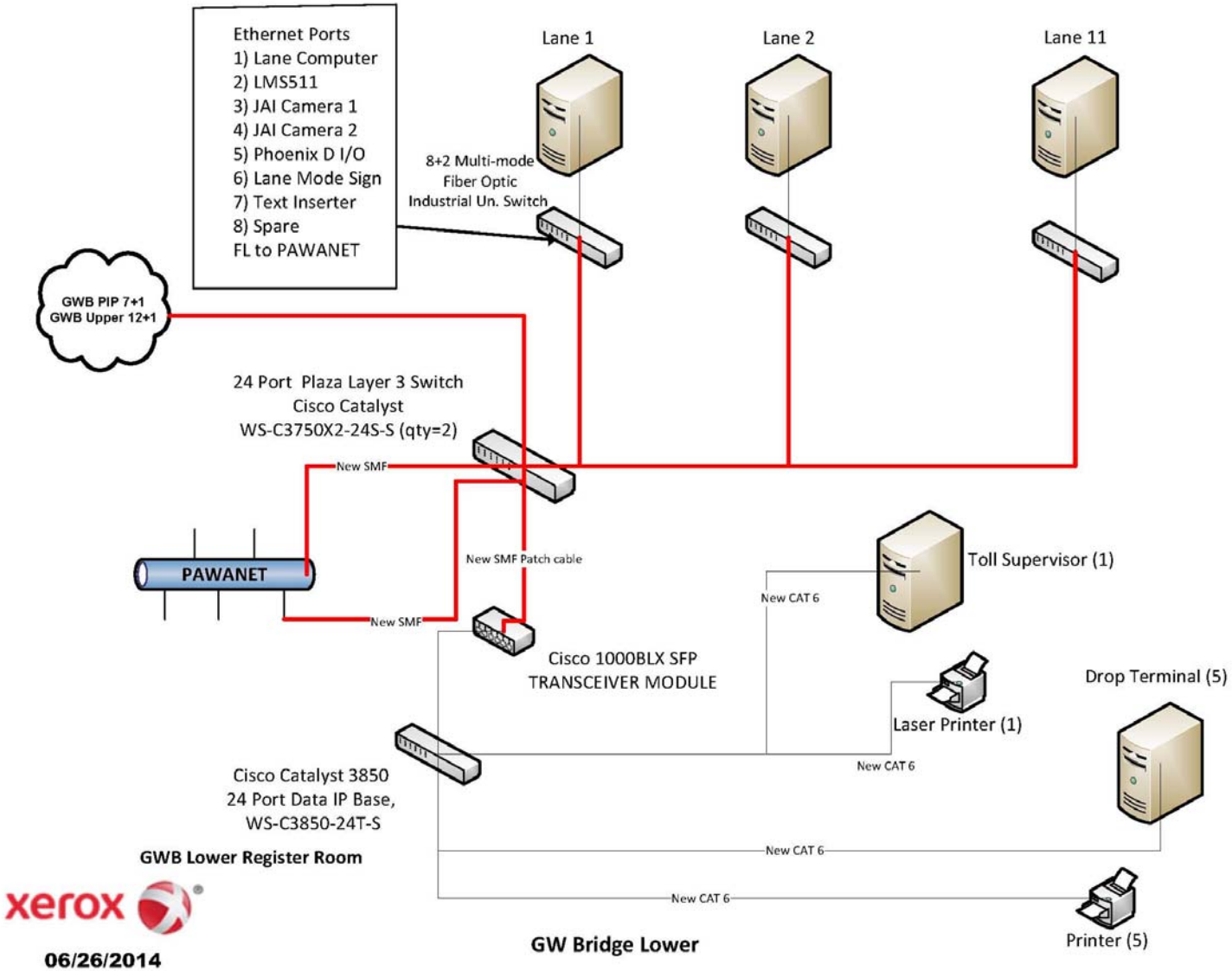
-THIS PAGE INTENTIONALLY LEFT BLANK-


Ethernet Ports
1) Lane Computer
2) LMS511
3) JAI Camera 1
4) JAI Camera 2
5) Phoenix D I/O
6) Lane Mode Sign
7) Text Inserter
8) Spare
FL to PAWANET
Lane 1
Lane 2
Lane 7
8+2 Multi-mode
Fiber Optic
Industrial Un. Switch
GWB Lower Level
Computer Room
PAWANET
Switch resides at GWB
Lower Level
New CAT 6
Laser Printer (1)
New CAT 6
Toll Supervisor (1)
Cisco 1000BLX SFP
TRANSCEIVER MODULE
New CAT 6
Cisco Catalyst 3850
24 Port Data IP Base,
WS-C3850-24T-S
New CAT 6
Drop Station (3)
Printer (3)
xerox
06/26/2014
GWB PIP

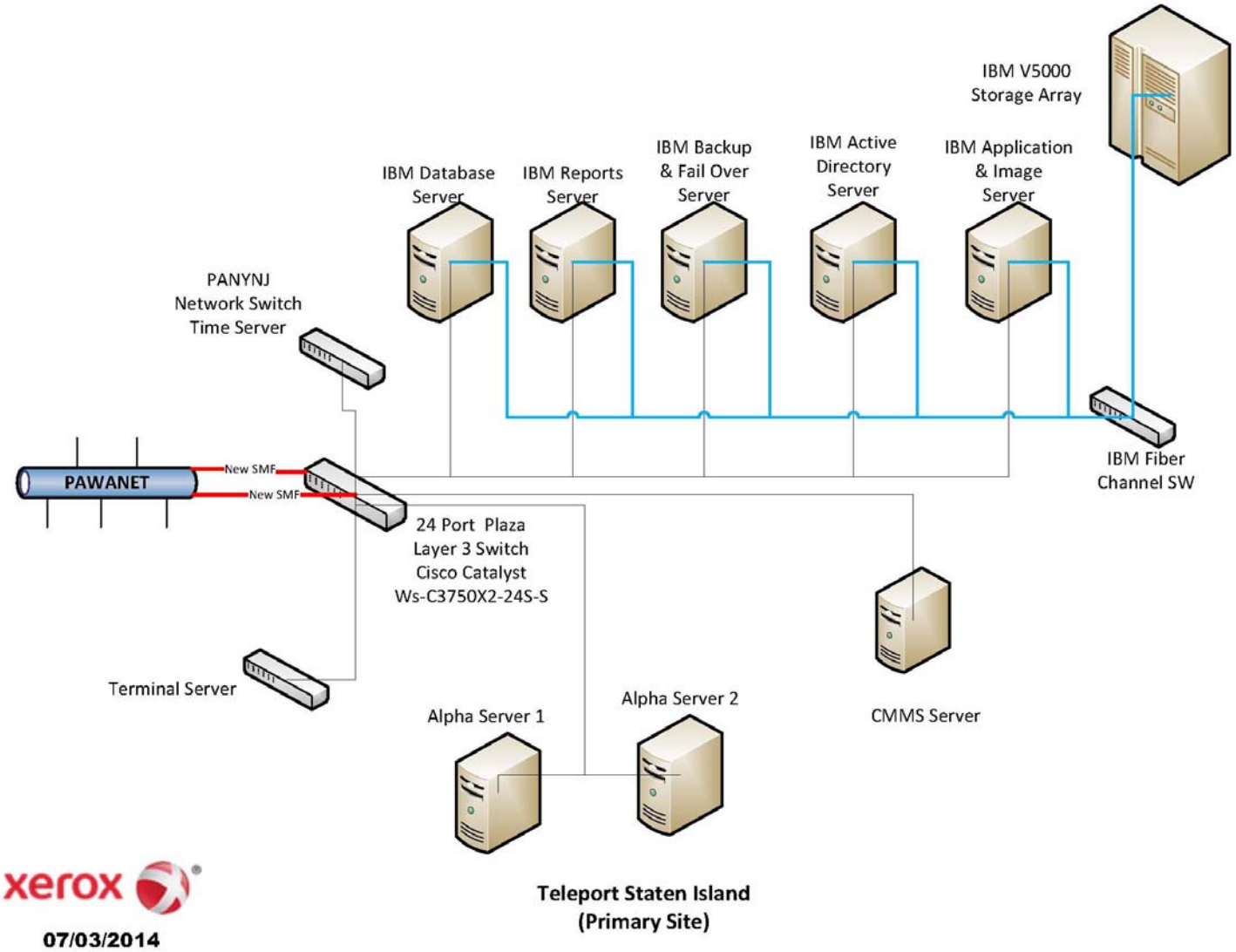
-THIS PAGE INTENTIONALLY LEFT BLANK-


Ethernet Ports
1) Lane Computer
2) LMS511
3) JAI Camera 1
4) JAI Camera 2
5) Phoenix D I/O
6) Lane Mode Sign
7) Text Inserter
8) Spare
FL to PAWANET
Lane 1
Lane 2
Lane 12
8+2 Multi-mode
Fiber Optic
Industrial Un. Switch
GWB Lower Level
Computer Room
PAWANET
Switch resides at GWB
Lower Level
Cisco 1000BLX SFP
TRANSCEIVER MODULE
Cisco Catalyst 3850
24 Port Data IP Base,
WS-C3850-24T-S
New CAT 6
Laser Printer (1)
Toll Supervisor (3)
Drop Terminal (5)
New CAT 6
New CAT 6
New CAT 6
Printer (5)
xerox
06/26/2014
GW Bridge Upper

-THIS PAGE INTENTIONALLY LEFT BLANK-


Ethernet Ports
1) Lane Computer
2) LMS511
3) JAI Camera 1
4) JAI Camera 2
5) Phoenix D I/O
6) Lane Mode Sign
7) Text Inserter
8) Spare
FL to PAWANET
Lane 1
Lane 2
Lane 11
8+2 Multi-mode
Fiber Optic
Industrial Un. Switch
GWB PIP 7+1
GWB Upper 12+1
24 Port Plaza Layer 3 Switch
Cisco Catalyst
WS-C3750X2-24S-S (qty=2)
New SMF
PAWANET
New SMF
New SMF Patch cable
Toll Supervisor (1)
New CAT 6
Cisco 1000BLX SFP
TRANSCEIVER MODULE
Drop Terminal (5)
Laser Printer (1)
New CAT 6
Cisco Catalyst 3850
24 Port Data IP Base,
WS-C3850-24T-S
GWB Lower Register Room
New CAT 6
New CAT 6
xerox
06/26/2014
GW Bridge Lower
Printer (5)

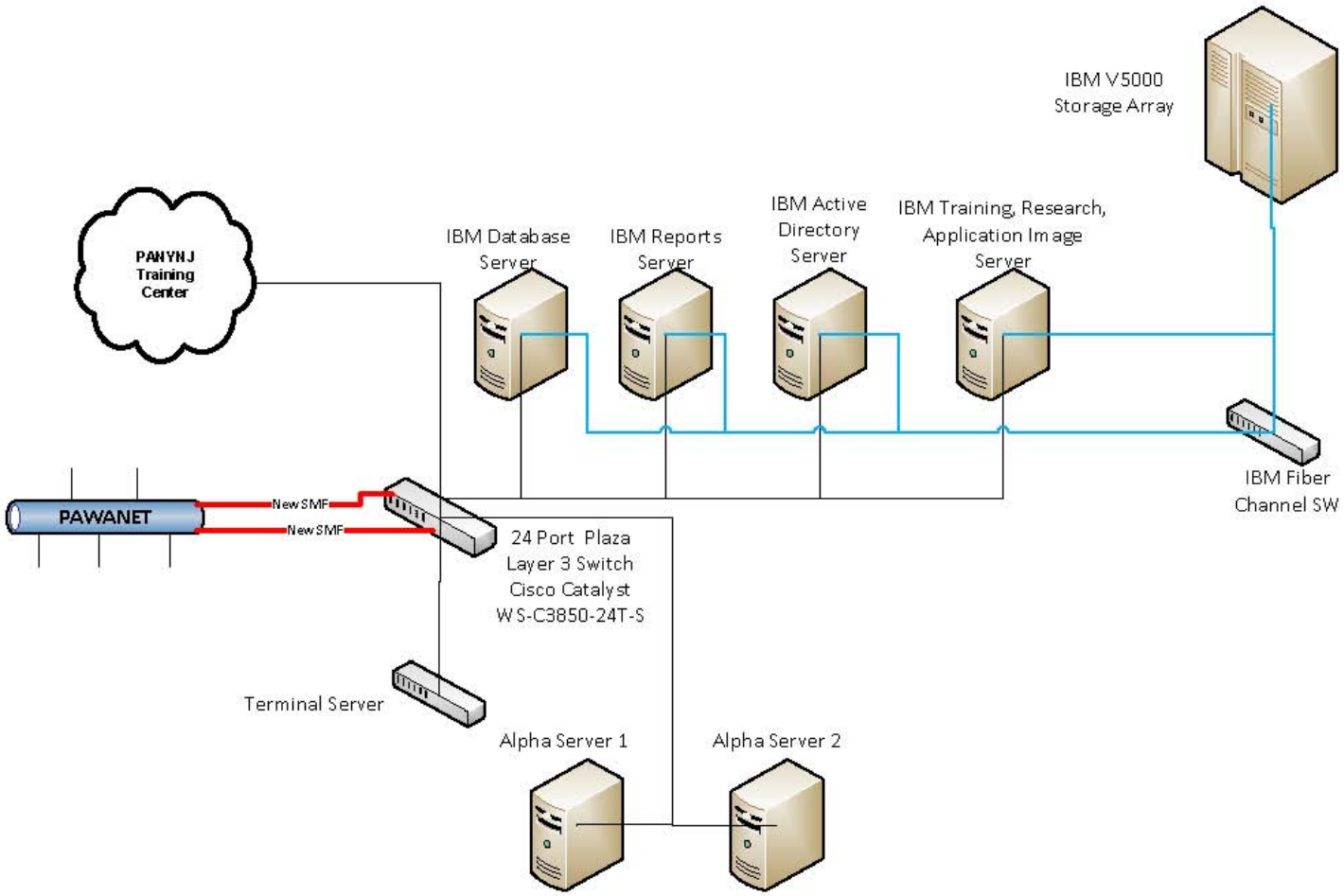
-THIS PAGE INTENTIONALLY LEFT BLANK-



xerox

07/03/2014

-THIS PAGE INTENTIONALLY LEFT BLANK-

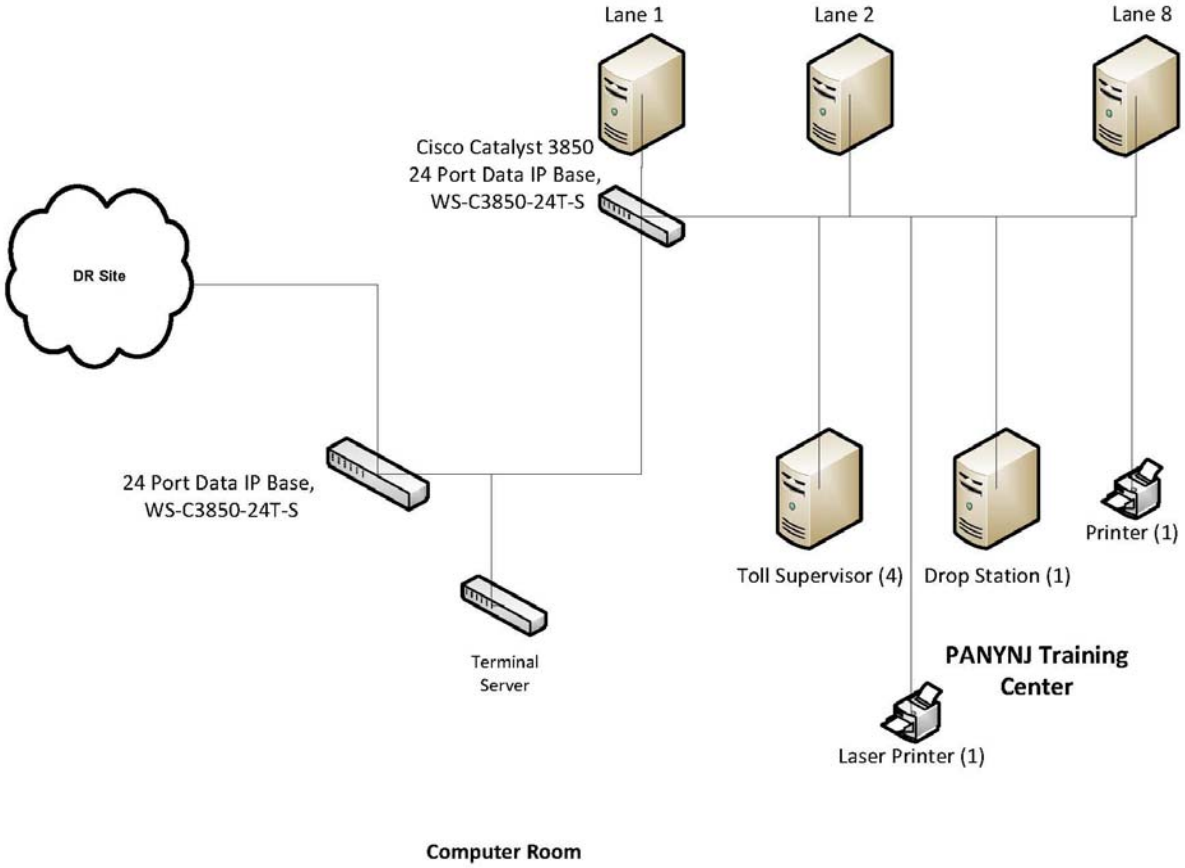


PANYNJ DR Site

xerox

07/03/2014

-THIS PAGE INTENTIONALLY LEFT BLANK-



xerox

07/03/2014

-THIS PAGE INTENTIONALLY LEFT BLANK-

15 Attachment 4 - Xerox Response to Authority Questions on ECH Upgrade and ECH to VECTOR Transaction Detail Mapping

-THIS PAGE INTENTIONALLY LEFT BLANK-

Port Authority of New York and New Jersey
Response to Questions
ECH Upgrade

Mark Cantelli, VP, CTO
Americas Commercial and State Government Transportation (ACSGT)
Xerox
12410 Milestone Center Drive, Suite 400
Germantown, MD 20874 USA
O: 301-820-4205
F: 301-820-4495
C: 240-305-2228
Mark.cantelli@xerox.com

Xerox

Transportation, Central and Local Government, TCLG

Revision History

Revisions of this document are listed in chronological order. There is no relationship between the document release number and the software release number.

Version Date	Changes Highlighted	Version #
February, 2014	N/A	1.0
February 07, 2014	Revisions due to conference call	2.0
February 07, 2014	Revisions due to directions provided by PANYNJ	3.0

Document Ownership

Owner	Mark Cantelli
Author	Manish Chourey

Important: This document has been through a formal review process. To the best of our knowledge it is accurate. Xerox reserves the right to make further modifications.

This material contains proprietary information of Xerox Transportation Systems and Services, TSS. Disclosure to others; use or copying without express written authorization of Xerox Transportation Systems and Services (TSS), is strictly prohibited.

Trademarks

All trademarks mentioned herein are the property of their respective holders. ©2013 Xerox Services, Transportation Systems and Services, TSS. XEROX® and the XEROX logo design are trademarks of the Xerox Corporation in the United States and/or other countries.

Version History

Version Number	Date	Description	Author
1.0	02/05/2014	Initial release	Manish Chourey
2.0	02/06/2014	Revised as a result of 2/5/2014 meeting	Mark Cantelli
3.0	02/13/2014	Revised based on new direction provided	Mark Cantelli
4.0	04/28/2014	Revised due to changes in scope	Mark Cantelli

Table of Contents

1 Introduction....2

2 Software Functions Available and Proposed for VECTOR 4G Toll Host....2

2.1 VECTOR 4G Toll Revenue Collection System (TRCS) Technical Details....2

2.2 Plaza Monitoring Window....4

2.3 Plaza Group Dashboard....5

2.4 Plaza Cash Management Overview....5

2.5 Collector Deposit....6

2.6 Audit....7

2.7 System Administration....8

2.8 VECTOR 4G File Downloads and External Interfaces....8

2.9 Canned Reports Available in VECTOR 4G TRCS....9

3 List of Existing and Non-Existing VECTOR 4G ITCS Power Builder Functions....10

4 List of Existing and Non-Existing VECTOR 4G ECH Functions....17

1 Introduction

This document is intended to provide additional information to support the firm-fixed price estimate provided by Xerox, and includes additional information in response to questions raised by the PANYNJ describing the effort required to integrate and implement changes to VECTOR 4G.

2 Software Functions Available and Proposed for VECTOR 4G Toll Host

For this infrastructure upgrade, we will deploy Oracle 11gR2 version and IBM Web-sphere application server on the database server to run the Linux Operating system. The Image server will receive images from the lanes and be the gateway to the storage. The database server with backup capability will be deployed on the primary and the secondary site, with the image server and storage on the primary server only. The reports will run on the Crystal Report Server 2008 or better, which is capable of scheduling reports with export capability into PDF, Rich text format, CSV data and Excel sheets.

2.1 VECTOR 4G Toll Revenue Collection System (TRCS) Technical Details

VECTOR 4G TRCS is a browser-based client running on Internet Explorer (IE 9.0), which makes the application accessible on any PC with PANYNJ network access. This tier is powered by the IBM Web-sphere and the database tier is powered by Oracle. The critical components of the system architecture follow.

User Interface

- Browser based application running on Internet Explorer 9.0
- Follows industry standard MVC pattern
- Allows Role Based Access
- UI architecture uses the following framework - Apache Struts, Java Servlets, Java Server Pages, Common Controls, AJAX

Data Persistence

- Oracle 11gR2 database for data store and forward
- Hibernate framework
- Java Transaction API allows database access through standards

Security

- Firewalls and SUDO access to power users
- Open LDAP / Active Directory– Manager Users, enables changes in security policies
- User Authentication via LDAP/AD and authorization via Oracle

- All screen access are controlled by rights and are associated to roles

Guaranteed Messaging

- Receive transactions in real time
    - Point-to-Point
- Send remote commands
    - Publish Subscribe (Topic)

Integrated Reports

- Uses Crystal Reports

Exhibit 1 shows the architecture of the replacement of ECH system to the latest version of VECTOR Tolls. Storage for the system is sized to store 7 years of all transactions online, 13 months of images online, and 3 months of training/test database. We anticipate the system is required to scale up on storage when AET lanes come on-line, we have purchased the storage array with growth potential of up to 400 TB. To perform system backups, we have provisioned a backup media server with LTO-5 drives capable of backing up database and image storage.

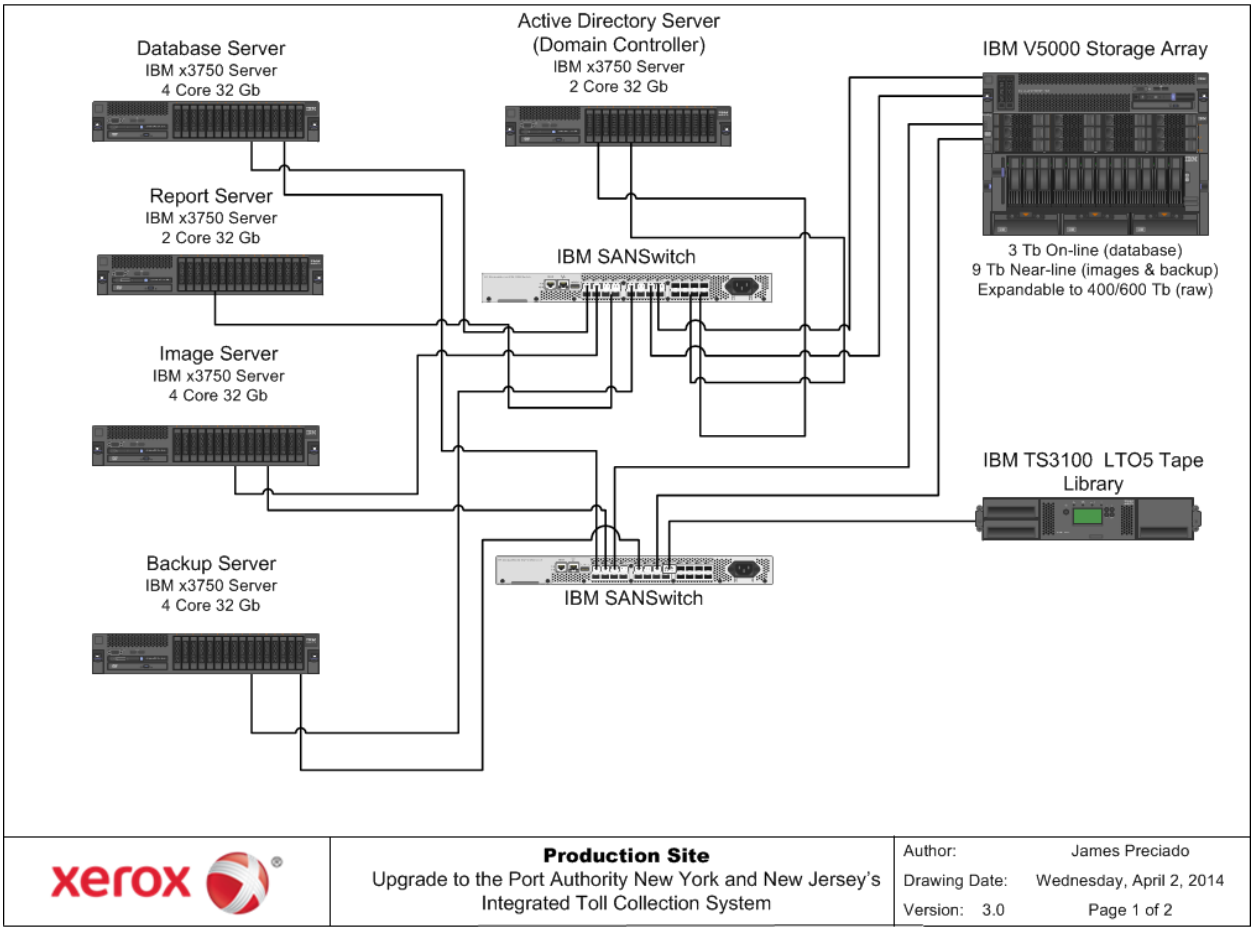


Exhibit 1. ECH Replacement Architecture

The ECH upgrade solution presented provides the scalability to 400TB with only the installation of hard drives.

At the disaster recovery site, we will provide a database server that restores the backups. Storage is sized to restore the database copies which includes, Hot Standby of the ECH database, restore copy of the ECH database, and Training database from the primary site at regular intervals.

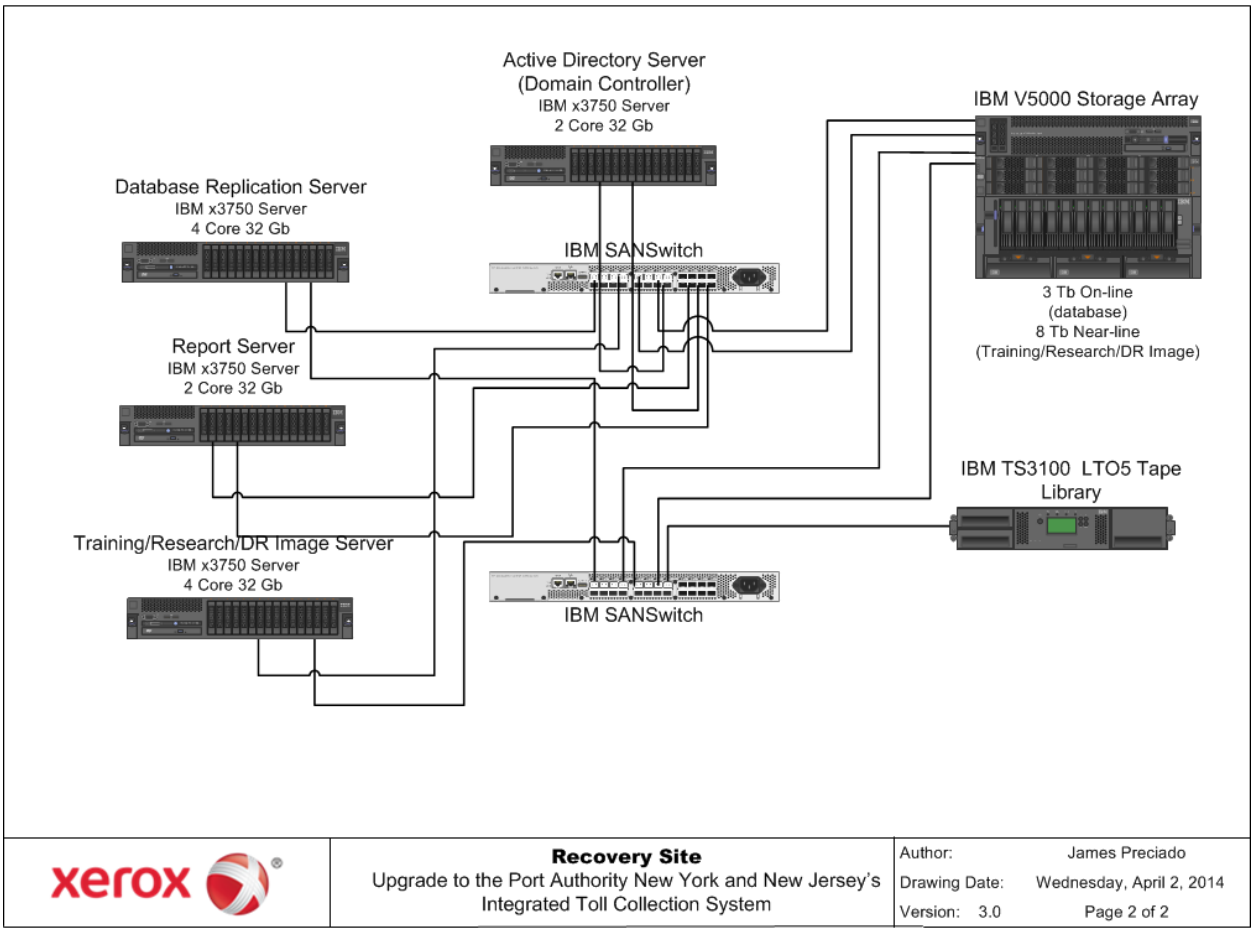


Exhibit 2. Disaster Recovery Site Databases

Upgraded disaster database server, switch, and library storage map.

2.2 Plaza Monitoring Window

The Plaza Monitoring Window is the centralized, self-refreshing screen that always displays the latest information. It simultaneously displays lane snapshot, latest transactions, latest alarms from all lanes in the plaza. The Plaza Monitoring window includes features to monitor detailed lane attributes like Current operational mode of the lane (Unstaffed, Manual mode), current state of the lane (Open, Closed, Standby), ID of the toll collector currently logged in at the lane and overall lane health and also displays running hourly, daily counts for various key indicators.

- Transaction History**:** Displays up to 300 most recent transactions per lane on the cache for quick access, with sorting feature, has plaza level monitoring and individual lane level monitoring.
- Message History**:** Displays up to 300 most recent lane messages and alarms for each lane or plaza with user sortable feature.
- Lane Command: Capability to perform remote lane operations like changing lane modes, closing automated lanes, and putting the lane in maintenance.
- Lane Equipment Status**:** Displays color coded health for every equipment installed within the lane along with integrated CMMS work order number for failed equipment's. The upgraded ECH will be integrated with the existing CMMS for alerts and error messages.
- Traffic Trend: Traffic trend for last 24 hours by payment types (like ETC, Cash, Violations) can be viewed by lane, plaza or group of plazas.
- Toll Collector Key Strokes: Displays the toll collector key strokes for a selected lane in real time without the knowledge and interruption of toll collector operation.

2.3 Plaza Group Dashboard

Group Dashboard is a single screen for a central location monitoring capabilities for all plazas. Displays color coded plaza health, and provides running hourly, daily counts combing all plazas and capability to view individual plazas in detail. Also displays individual lane health and latest transaction details. Screen has capability to view combined traffic trends to include all plazas or for single plaza.

2.4 Plaza Cash Management Overview

This section details the tasks and screens used in those tasks by various authorized supervisors (Toll Supervisors, Collectors, Auditors and Managers, and VECTOR 4G plaza operators) for daily cash management workflow activities. Based on Vector's role definition, unauthorized personnel will be denied access to this functionality.

Each plaza will have a predefined and preconfigured plaza change fund. Part of this change fund will be issued to collector as tour fund, send to bank as change order requests and periodically audited during the day. At the end of a supervisor shift, it is transferred to another supervisor to take over and manage the fund. All these activities are recorded in the system and can be reported on demand.

Plaza Funds Management Tasks

The following are Plaza Funds Management Tasks:

Issue Change Fund to Toll Supervisor: The outgoing supervisor will logon and transfers the change fund to a new Toll Supervisor in new shift.

Change Order Request Deposit: Toll Supervisor on Shift can then request a change order deposit to the vault or an external bank, the request amount will reduce from supervisor plaza fund.

Change Order from Bank: Toll Supervisor receives a change order from a Bank Courier or internal vault, accepts, and records it in the system by denomination.

Plaza Change Fund Audit: Toll supervisor who owns the plaza change fund will periodically record the outstanding tour fund, change order and the remaining plaza change fund to VECTOR 4G for auditing purposes.

Issue Tour Fund to Toll Collector: Toll Supervisor issues a tour fund to the Toll Collector. The amount that is loaned to the collector is reduced from the supervisor change fund and once the collector returns the tour fund back the amount is added to the supervisor change fund.

Return Toll Collector Tour Fund to Supervisor: Toll collector will return the tour fund to the supervisor and will be recorded in the system before a Money Room Clerk can count / scan the money bag and record it in the VECTOR 4G plaza.

Collector to Supervisor Currency Exchange: Toll collector can request from the supervisor to exchange the higher currency denomination for a lower one and it will be tracked in VECTOR 4G Plaza.

Transfer Funds: At the end of the shift the Toll Supervisor transfers responsibility for the funds to the next Toll Supervisor. This may include any outstanding change orders and tour funds.

2.5 Collector Deposit

VECTOR 4G offers features such as Money Bag inventory maintenance, Collector recording their self-count of money bag, supervisor and money room clerk associating money bags to collector tours and revenue dates. It is designed to support collector money bag counting in the facility and will also support the work flow to send the money bag to an external bank vendor for counting.

Collector Deposit: - Screen to record and review the collector count for current tour, shift and associate the money bags provided by the collector. Collector comments can be entered on the Screen from the Tour of Duty (TOD) sheet to the system so the auditor can review collector comments during auditing.

Random Bag: - Collector can report and record their count into VECTOR 4G or a supervisor can count the money before sending to third-party money vendor for counting, and this information can be used for auditing purposes. This functionality is provided by VECTOR 4G, but will be configured to deny access for all roles during the implementation.

Money Bag Maintenance: - Screen to manage the inventory of physical money bags if the facility uses money bag during their daily activity.

2.6 Audit

VECTOR 4G will provided robust auditing tools and collector performance measurement screens and reports. To audit any discrepancies, it stores the original data and the auditor can pull the pre-audit report anytime and compare it with the post audit report. As shown in Exhibit 3, VECTOR 4G provides detailed auditing features including, Class, Traffic, Deposit and Money Bag audits and movement.

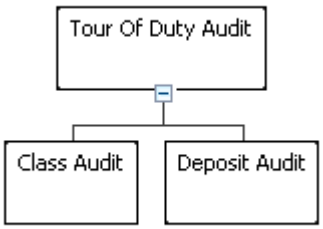


Exhibit 3. VECTOR 4G Auditing Paths

Class/ Traffic audits and Deposit/Money bag audits.

Class Audit

The Class Audit screen displays the details of expected revenue, variance, bank reported revenue, (also has capabilities for multiple nation's revenue reporting using variable exchange rates), system and AVC detected vehicles and axles, collector reported vehicles and axles, collector key stroke exceptions during the shift, lane alarms, transaction count in lane degraded mode and other states.

This summary detail provides the auditor with the data that is more than sufficient to choose to audit the toll collector tour of duty. Auditor would be able to add or remove traffic to any class and payment types for the collector tour segment.

Deposit and Money Bag Audits

The Deposit Audit feature provides the auditor the capability to perform deposit (money bag) adjustments. Auditor would be able to review any money bag type, review all money bags for a given Authority revenue day or bank deposit date. Move all or partial money from a money bag to another tour of duty or move it to audit bag associated to system level tour of duty.

Vector will support the current PA audit process as described in "PA Revenue Accounting Reconciliation and Toll Collector Audit Processes.doc"

Bank File processing:-

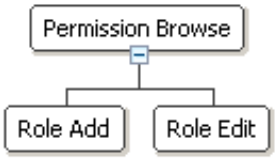
Vector will support the current PA bank file process as described in "PA Revenue Accounting Reconciliation and Toll Collector Audit Processes.doc"

2.7 System Administration

Employee Management: - Capability to add new employee, edit existing employees, change roles and role expiry dates.

Role Management: - Create new roles in the system and assign rights to those roles.

Every functionality / screen in VECTOR will have its own rights, an example of a right is ***ManageTollFare*** which provides an authorize user the ability to add a new toll schedule, and ***ViewTollFare*** provides ability to look at the toll fare for read only purposes. Likewise for some functionality there will be right to add a new data set or edit and existing data.



Role is a collection of rights, and VECTOR allows creating any number of roles (E.g. Supervisor Level 1, Supervisor Level 2) and assigning specific rights to each role.

VECTOR allows one employee to have multiple roles (example Employee 1 could be a Supervisor Level 1 on plaza1 and the same employee could be a Supervisor Level 2 on plaza 2).

Toll Fare Maintenance: - Create a new schedule and define new toll rates, create and manage a time of day variable pricing, holiday lists and special pricing.

Plaza Maintenance: - Screen to manage the plazas and their names and revenue times.

Lane Maintenance: - Screens to mark lanes as active and inactive, reboot the lane remotely using power managers.

Find Transaction: - Provides ability to search historical transactions, using various search criteria including, but not limited to, Plaza, Lane, Date range, Transaction types, Payment type, Class, Misclassifications, device number, fares etc. The screen also provides a link to the violation images for real time review.

Application Configuration:- Provides ability to configure application parameters like exception codes, plan types, toll revenue type, error codes and violation codes.

2.8 VECTOR 4G File Downloads and External Interfaces

VECTOR 4G is designed to support high volume tag file transfers to lane, frequent employee file downloads to lane, scheduled toll fare downloads or on demand, automatic lane configuration downloads during lane restarts, external bank file interfaces, transaction files to E-ZPass CSC. Change Order #103 will be implemented for all interfaces with CSC.

2.9 Canned Reports Available in VECTOR 4G TRCS

1. Collector Reports

   1.1. HOST0002A Segment of Duty.
   1.2. HOST0053U Collector TOD excluding E-Z Pass without Adjustments
   1.3. HOST0053A Collector TOD excluding E-Z Pass with Adjustments
   1.4. HOST0052 Employee TOD History
   1.5. HOST0004C Attendant Performance Standard Class Mismatch
   1.6. HOST0004D Attendant Performance Standard- Daily
   1.7. HOST0004M Attendant Performance Standard- Monthly
   1.8. HOST0067 Attendant Scheduling

2. Revenue Reports

   2.1. HOST0015 Deposits by Bank Deposit Date
   2.2. HOST0035- Plaza Deposit Record by Bank Revenue Date
   2.3. HOST0049 Plaza Deposit Record by TCS Revenue Date
   2.4. HOST0014 Deposits by Bank Revenue Date
   2.5. HOST0034 - Central Cash Accounting Plaza Return
   2.6. HOST0013 Revenue
   2.7. HOST0017 - No Funds
   2.8. HOST0070A TOD for E-ZPass with Adjustments
   2.9. HOST0070U TOD for E-ZPass without Adjustments
   2.10. HOST0069A ACM TOD with Adjustments
   2.11. HOST0069U ACM TOD without Adjustments

3. E-ZPass Reports
   3.1. HOST0061 E-ZPass Reconciliation Summary
   3.2. HOST0062 ORT Reconciliation Summary
   3.3. HOST0057 Home/Away E-ZPass Transaction
   3.4. HOST0022 E-ZPass File Transfer
   3.5. HOST0068 Transponder File Transmission

4. Audit Reports

   4.1. HOST0042- Final Audit
   4.2. HOST0047- Adjustment Summary
   4.3. HOST0001- Initial Audit
   4.4. HOST0030 Bank Adjustment
   4.5. HOST0020 Bag Discrepancy Audit
   4.6. HOST0048 ACM Bag Assignments Message Log
   4.7. HOST0031 Bank Deposit Piece Count
   4.8. HOST0019 Moneybag Manifest
   4.9. HOST0026 Employee List by Plaza
   4.10. HOST0064 Axle Dollar Variance

4.11. HOST0065 Retail Sales Detail
4.12. HOST0066 Retail Sales by Plaza

5. Traffic Reports

5.1. HOST0039 Daily Traffic Overview
5.2. HOST0060 Hourly Traffic by Lane
5.3. HOST0009 Traffic by Lane
5.4. HOST0058 Hourly Method of Payment

6. Traffic and Revenue

6.1. HOST0036 Traffic and Revenue Summary
6.2. HOST0010 Ranking of Traffic
6.3. HOST0032 Integrity - Lane vs. Host - Lane Only
6.4. HOST0033 Ranking Revenue

7. Daily Plaza Reports

7.1. HOST0005A Plaza Events
7.2. HOST0046 Transaction Detail

8. Excel Reports
8.1. HOST0031X Bank Deposit Piece Count
8.2. HOST0057x EZPass Home and Away
8.3. HOST0046x Transaction Detail
8.4. HOST0039x Daily Traffic Overview
8.5. HOST0036x Traffic and Revenue
8.6. HOST0058x Hourly Method of Payment
8.7. HOST0060x Hourly Traffic By Lane
8.8. HOST0032x Integrity

3 List of Existing and Non-Existing VECTOR 4G ITCS Power Builder Functions

Table 1 shows the existing and non-existing ITCS power builder reports and mapping to VECTOR 4G and indicates if the functionality is included or not in our based product. All functionality will be provided and has been included in our estimate.

Table 1. Existing and Estimated ITCS Functionality in VECTOR 4G

ITCS Reports Functionality	VECTOR 4G Available	Estimated (Yes/No)
Reports		
Facility Traffic	Report development and/or modification	Yes
Revenue	Report development and/or modification	Yes
Class	Report development and/or modification	Yes
Lane	Report development and/or modification	Yes
Lane Mode	Report development and/or modification	Yes
Transaction	Report development and/or modification	Yes
All Details	Report development and/or modification	Yes
Single Detail	Report development and/or modification	Yes
Lane Mismatch	Report development and/or modification	Yes
Detail with Summary	Report development and/or modification	Yes
Reconciliation Toll Collector	Report development and/or modification	Yes
Tour of Duty	Report development and/or modification	Yes
Cash Discrepancy	Report development and/or modification	Yes
Performance	Report development and/or modification	Yes
Mismatch with Images	Report development and/or modification	Yes
Tour Summary	Report development and/or modification	Yes

ITCS Reports Functionality	VECTOR 4G Available	Estimated (Yes/No)
Tour of Duty – Management	Report development and/or modification	Yes
Tour of Duty – Detail	Report development and/or modification	Yes
Tour of Duty – Detail – Collector	Report development and/or modification	Yes
Unregistered Transaction Analyst	Report development and/or modification	Yes
Transaction Type	Report development and/or modification	Yes
Unusual Activity	Report development and/or modification	Yes
Transaction Rates	Report development and/or modification	Yes
Violation Details	Report development and/or modification	Yes
TB&T Traffic	To Be Developed, Functionality does not exist in the base VECTOR application	Yes
Calendar Detail	Report development and/or modification	Yes
Record Traffic Detail	Report development and/or modification	Yes
Traffic Forecast	Report development and/or modification	Yes
Monthly Events Detail	Report development and/or modification	Yes
Incomplete Traffic Detail	Report development and/or modification	Yes
Weekly Traffic	Report development and/or modification	Yes
Monthly Traffic	Report development and/or modification	Yes
Miscellaneous	Report development and/or	Yes

ITCS Reports Functionality	VECTOR 4G Available	Estimated (Yes/No)
	modification	
Data Transfer	Report development and/or modification	Yes
Lane Messages	Report development and/or modification	Yes
Toll Lane Availability	Report development and/or modification	Yes
Lane Check	Report development and/or modification	Yes
Bad ID Authorization	Report development and/or modification	Yes
Tours for Toll Collectors	Report development and/or modification	Yes
Manual Logon Activity with Toll Collector Info	Report development and/or modification	Yes
Unusual Activity New	Report development and/or modification	Yes
Security Reports	Part of VECTOR 4G, requires modification	Yes
Employees	Report development and/or modification	Yes
Modules	Report development and/or modification	Yes
Groups	Report development and/or modification	Yes
Toll Schedules	Report development and/or modification	Yes
Validation	Part of VECTOR 4G, requires modification	Yes
Plazas	Report development and/or modification	Yes
Lanes	Report development and/or modification	Yes
Plan Types	Report development and/or	Yes

ITCS Reports Functionality	VECTOR 4G Available	Estimated (Yes/No)
	modification	
Exceptions	Report development and/or modification	Yes
Revenue Types	Report development and/or modification	Yes
Toll Classes	Report development and/or modification	Yes
Error Codes	Report development and/or modification	Yes
Message Thresholds	Report development and/or modification	Yes
Terminal Definitions	Report development and/or modification	Yes
Agencies	Report development and/or modification	Yes
IAG Class	Report development and/or modification	Yes
Violations Codes	Report development and/or modification	Yes
Engineering Reports	Report development and/or modification	Yes
Reconciled Rejected Violations Report	Report development and/or modification	Yes
Rejected Violation Review	Report development and/or modification	Yes
Uncollectable Violation Report with Review	Report development and/or modification	Yes
Rejected Violations by Status – Statistics	Report development and/or modification	Yes
Lane Hardware Errors	Report development and/or modification	Yes
Query By Example	Report development and/or modification	Yes
System Admin	Part of VECTOR 4G, requires	Yes

ITCS Reports Functionality	VECTOR 4G Available	Estimated (Yes/No)
	modification	
Security	Report development and/or modification	Yes
Employees	Report development and/or modification	Yes
Modules	Report development and/or modification	Yes
Groups	Report development and/or modification	Yes
Toll Schedules	Report development and/or modification	Yes
Validations	Report development and/or modification	Yes

Table 2 shows the existing and non-existing functionality and mapping to VECTOR 4G and indicates if the functionality is included or not in our based product. All functionality will be provided and has been included in our estimate.

.

Table 2. Existing and Estimated ITCS Functionality in VECTOR 4G

ITCS Functionality	VECTOR 4G Available	Estimated (Yes/No)
Image review	Image Pull-Up Available (no data entry)	Yes
Violations	Image Pull-Up Available	Yes
Mismatch – ETC	Image Pull-Up and Audit Adjustments Available	Yes
Mismatch – Collector	Image Pull-Up and Audit Adjustments Available	Yes
File	Part of VECTOR 4G, requires modification	Yes
Collector PIN Reset	UI and functionality development and/or modification	Yes
Reset ITCS Password Ctrl+R	UI and functionality	Yes

ITCS Functionality	VECTOR 4G Available	Estimated (Yes/No)
	development and/or modification	
Printer Setup	UI and functionality development and/or modification	Yes
Exit	UI and functionality development and/or modification	Yes
Plazas	Part of VECTOR 4G, requires modification	Yes
Lanes	Part of VECTOR 4G, requires modification	Yes
Plan Types	Unavailable	Yes
Exceptions	Unavailable	Yes
Revenue Types	Unavailable	Yes
Toll Classes	Part of VECTOR 4G, requires modification	Yes
Error Codes	Unavailable	Yes
Message Thresholds	Unavailable	Yes
Terminal Definitions	Unavailable	Not Required
Agencies	Unavailable	Yes
IAG Class	Unavailable	Yes
Violations Codes	Unavailable	Yes
TB&T	To Be Developed, Functionality does not exist in the base VECTOR 4G	Yes
Daily Traffic	Unavailable	Yes
Events	Unavailable	Yes
Max Volume	Unavailable	Yes
Traffic Forecast	Unavailable	Yes

4 List of Existing and Non-Existing VECTOR 4G ECH Functions

An example of missing functionality not currently provided in VECTOR 4G includes the abusing mismatch tags function, max volume tracking, and alert thresholds. Table 3 shows a more detailed list of available and unavailable functionality. All functionality will be provided as part of this proposal. All reports can be scheduled and distributed via a configurable email list. Email services and servers are provide by others.

Table 3. Existing and Non-Existing ECH Functionality in VECTOR 4G

Scheduler Job	Description	**VECTOR 4G Available (Yes/No)**	**Estimated (Yes/No)**
WTECH1 Server			
TRAN_LOGGER	Transaction Logger Process (from Lanes)	Available in VECTOR	Yes
TRAN_DMQS_PRINTSTAT	Send PRINTSTAT message to TRAN_LOGGER	Available in VECTOR	Yes
CSC_RECV_ETC	Receive ETC/VIOL recon transactions from CSC	Available in VECTOR	Yes
PA_CREATE_TAG_STATUS	Create & Zip TAG STATUS files (.HDR) & (.TDF) for lanes	Available in VECTOR	Yes
*MMS_SERVER	MMS Server process to prepare selective lane messages for MOMS pickup	Available in VECTOR	Yes
CHECK_TAG_FILE	Check for Tag File Download problems and produce Tag File Download Status Report	Available in VECTOR	Yes
LMON_MAIN	Lane Monitor process (messages)	Available in VECTOR	Yes
DAILY_CLEANUP	Daily Cleanup	Available in VECTOR	Yes
LANE_TRANSFER	Transmit via TCPIP & FTP ZIPed Tag/Emp/Toll to Lanes	Available in VECTOR	Yes

Scheduler Job	Description	VECTOR 4G Available (Yes/No)	Estimated (Yes/No)
CREATE_SEC_FILE	Create Security file..Update XFER_FILES & XFER_CONTROL for Download to Lanes	Available in VECTOR	Yes
PADE_15MIN	Port Authority Data Extract - 15 Minute Vehicle Traffic Summary Report	Available in VECTOR	Yes
DAILY_TRAFFIC	Update DAILY_TRAFFIC table	Available in VECTOR	Yes
PADE_HRLY	Port Authority Data Extract - Hourly Vehicle Traffic Summary Report	Available in VECTOR	Yes
*MLA_SERVER	Check multi logins of Collectors	Available in VECTOR	Yes
IMAGE_DKB0_DKB1	Image Backup DKB0 DKB1	Available in VECTOR	Yes
AIJBACKUP	Oracle AIJ Backup from DKD202:[DBMAINT.AIJ] to Tape	Available in VECTOR	Yes
CHECK_VIOL_REJ	Mike's Check Violation Rejects	Convert to scheduled report if possible.	Yes
CHECK_CROSS_LANE	Mike's Cross Lane Read Checker	Convert to scheduled report if possible.	Yes
CHECK_RECON	Mike's Check Open ETC/VIOL Transactions for 30 day Intervals	Convert to scheduled report if possible.	Yes
CHECK_SPEED	Mike's Check Speed	Convert to scheduled report if possible.	Yes
MMS_RESTART	MMS RESTART	Available in VECTOR	Yes

Scheduler Job	Description	**VECTOR 4G Available (Yes/No)**	**Estimated (Yes/No)**
DB_BACKUP	AIJ & RMU Backup & Send to Tape	Available in VECTOR	Yes
MMSMON	MMS Server Monitor	Available in VECTOR	Yes
EXP_TAGPGM	Mike's Express Lane Tag Program Check	Available in VECTOR	Yes
LOAD_MISMATCHERS	Loads frequent mismatchers	Convert to scheduled report if possible.	Yes
MISMATCHER_DETAILS	Reports on Mismatchers	Convert to scheduled report if possible.	Yes
*VECTOR_MC_SERVER	CMMS Server Interface Lane Priority Message Processing	Available in VECTOR	Yes
CHECK_AXLES	Generate axle check report for Maintenance	Convert to scheduled report if possible.	Yes
CHECK_FLUSH	Generate flush check report for Maintenance	Convert to scheduled report if possible.	Yes
CHECK_UNREG	Generate unregistered transaction report for Maintenance	Convert to scheduled report if possible.	Yes
CHECK_VIOL	Generate Breakdown by Revenue Type report for Maintenance	Convert to scheduled report if possible.	Yes
CHECK_DROPPED_AXLES	Generate potential dropped axles report for Maintenance	Convert to scheduled report if possible.	Yes
CHECK_VIOL_REJ_DETAIL	Generate violation reject detail report for Maintenance	. Convert to	Yes

Scheduler Job	Description	**VECTOR 4G Available (Yes/No)**	**Estimated (Yes/No)**
		scheduled report if possible.	
CHECK_AVI_PERF	Generate AVI Performance Report for Maintenance	Convert to scheduled report if possible.	Yes
POP_SERVER_RESTART	Restart POP Server Processing	Available in VECTOR	Yes
*DB_WATCH	Watch database for problems	Available in VECTOR	Yes
CHECK_AXLES_AM	Generate axle check AM report for Maintenance	Convert to scheduled report if possible.	Yes
MONTHLY_VIOL_REJ_DAMAGES	Monthly Violation Image Reject Damages Report	Convert to scheduled report if possible.	Yes
HOURLY_LANE_SUMMARY	Lane Alert Notification	Available in VECTOR	Yes
TRAN_BREAKDOWN_SUMM	This query provides a count for all possible permutations of transaction types	. Convert to new platform and scheduled job if possible.	Yes
TPECH1 Server			
CSC_SEND_ETC	Send ETC & Violation transactions to CSC	Available in VECTOR	Yes
VIOL_IMG_XFER	Violation Image Transfer	Available in VECTOR	Yes
DAILY_CLEANUP	Daily Cleanup	Available in VECTOR	Yes
VIOL_MISS_IMG	Violations/Mismatches Missing Images Report	Convert to scheduled report if possible.	Yes

Scheduler Job	Description	**VECTOR 4G Available (Yes/No)**	**Estimated (Yes/No)**
MISMATCH_UPDATE_ST	Sets the mismatch flag off in all ST files	Available in VECTOR	Yes
MISMATCH_DELETE_IMAGES	Deletes mismatch images from CSC pickup directory	Available in VECTOR	Yes
IMAGE/ARC205	Image Backup of Violations JPEG Image Arc's on DKB205	Available in VECTOR	Yes
IMAGE/CSC204	Image Backup of Violations JPEG Image Arc's on DKB204	Available in VECTOR	Yes
PROCESS/IMAGE/ACK	Process Image Ack Files	Available in VECTOR	Yes
ZIP/JPG/IMAGES	Create ZIP Image Files To Be Sent To CSC	Available in VECTOR	Yes
VIOL_IMAGE_DKB202_DKB203	Backup Lane Violation Images from DKB202 to DKB203:[DKB202]	Available in VECTOR	Yes
PROCESS_ABUSIVE_TAGS	Process PANYNJ Abusive Tags	Convert to scheduled report if possible.	Yes

ECH to Vector Transaction Detail Map

Item	ECH Table	ECH Column	Data Type	Domain	Matched?	Vector Table	Vector Column	Data Type	Note/Comment
1	ETC_TRAN_DETAIL	TRAN_DETAIL_SERIAL	BIGINT		Y	T_LANE_TX	LANE_TX_ID	NUMBER(19)	
2	ETC_TRAN_DETAIL	PLAZA_ID	CHAR(4)	T_D_PLAZA_ID	Y	T_MESSAGE_HEADER	PLAZA_ID	NUMBER(10)	
3	ETC_TRAN_DETAIL	LANE_ID	TINYINT	T_D_LANE_ID	Y	T_LANE_TX	LANE_ID	NUMBER(10)	
4	ETC_TRAN_DETAIL	TRX_DT	DATE VMS	T_D_DATE_TIME	Y	T_MESSAGE_HEADER	TX_DATE	TIMESTAMP(3)	
5	ETC_TRAN_DETAIL	LANE_SEQ_NUM	INTEGER		Y	T_LANE_TX	VEH_SEQ_NO	NUMBER(10)	
6	ETC_TRAN_DETAIL	LANE_MODE	CHAR(1)	T_D_LANE_MODE	Y	T_MESSAGE_HEADER	LANE_MODE	NUMBER(10)	
7	ETC_TRAN_DETAIL	LANE_TYPE	TINYINT		Y	T_MESSAGE_HEADER	LANE_TYPE	NUMBER(5)	
8	ETC_TRAN_DETAIL	TOLL_COLL_ID	INTEGER	T_D_SEGMENT_ID	Y	T_MESSAGE_HEADER	COLLECTOR_ID	NUMBER(11)	
9	ETC_TRAN_DETAIL	SEGMENT_ID	INTEGER	T_D_SEGMENT_ID	Y	T_LANE_TX	TOUR_SEGMENT_ID	NUMBER(10)	
10	ETC_TRAN_DETAIL	TAG_AGENCY_ID	TINYINT	T_D_TAG_ID	Y	T_LANE_TX	ACCOUNT_AGENCY_ID	NUMBER(10)	
11	ETC_TRAN_DETAIL	TAG_SERIAL	INTEGER	T_D_TAG_SERIAL	Y	T_LANE_TX	DEVICE_NO	VARCHAR2(12)	
12	ETC_TRAN_DETAIL	REVENUE_TYPE	CHAR(1)	T_D_REVENUE	Y	T_LANE_TX	TOLL_REVENUE_TYPE	NUMBER(10)	
13	ETC_TRAN_DETAIL	AMT_DUE	INTEGER(2)	T_D_TOLL_AMOUNTS	Y	T_LANE_TX	FULL_FARE_AMOUNT	NUMBER(12,2)	Unclear if this is the correct field
14	ETC_TRAN_DETAIL	PA_CLASS_CHARGED	TINYINT						
15	ETC_TRAN_DETAIL	TAG_CLASS	TINYINT		Y	T_LANE_TX	READ_AVI_CLASS	NUMBER(3)	
16	ETC_TRAN_DETAIL	AVC_CLASS	TINYINT	T_D_TOLL_CLASS	Y	T_LANE_TX	ACTUAL_CLASS	NUMBER(3)	
17	ETC_TRAN_DETAIL	PA_EXTRA_AXLES_CHRG	TINYINT						
18	ETC_TRAN_DETAIL	TAG_AXLES	TINYINT		Y	T_LANE_TX	READ_AVI_AXLES	NUMBER(3)	
19	ETC_TRAN_DETAIL	AVC_AXLES	TINYINT		Y	T_LANE_TX	ACTUAL_AXLES	NUMBER(3)	
20	ETC_TRAN_DETAIL	FWD_AXLES	TINYINT	T_D_FWD_AXLES	Y	T_LANE_TX	FORWARD_AXLES	NUMBER(3)	
21	ETC_TRAN_DETAIL	REV_AXLES	TINYINT	T_D_REV_AXLES	Y	T_LANE_TX	REVERSE_AXLES	NUMBER(3)	
22	ETC_TRAN_DETAIL	VEH_SPEED	TINYINT		Y	T_LANE_TX	VEHICLE_SPEED	NUMBER(5)	
23	ETC_TRAN_DETAIL	AVI_VALIDATION	CHAR(1)						
24	ETC_TRAN_DETAIL	READ_PERF	INTEGER		Y	T_LANE_TX	DEVICE_READ_COUNT	NUMBER(5)	
25	ETC_TRAN_DETAIL	IS_AVC_OVERHEIGHT	CHAR(1)	T_D_YN_FLAG					
26	ETC_TRAN_DETAIL	IS_VIOLATION	CHAR(1)	T_D_YN_FLAG					
27	ETC_TRAN_DETAIL	IS_CLASS_MISMATCH	CHAR(1)	T_D_YN_FLAG	Y	T_LANE_TX	IS_MISCLASS	VARCHAR2(1)	
28	ETC_TRAN_DETAIL	IS_LANE_CLASS_EXCEP	CHAR(1)	T_D_YN_FLAG					
29	ETC_TRAN_DETAIL	UPDATE_TIMESTAMP	DATE VMS	T_D_TIMESTAMP	Y	T_LANE_TX	UPDATE_TS	TIMESTAMP(3)	
30	ETC_TRAN_DETAIL	TX_AVI_VALIDATION	TINYINT						
31	ETC_TRAN_DETAIL	LANE_STATE	CHAR(1)	T_D_LANE_MODE	Y	T_MESSAGE_HEADER	LANE_STATE	NUMBER(3)	
32	ETC_TRAN_DETAIL	IS_LANE_DEGRADED	CHAR(1)	T_D_YN_FLAG					
33	ETC_TRAN_DETAIL	AVI_AVAIL	CHAR(1)	T_D_SPACE					
34	ETC_TRAN_DETAIL	IS_OP_AVAIL	CHAR(1)	T_D_YN_FLAG					
35	ETC_TRAN_DETAIL	IS_BOOTH_AVAIL	CHAR(1)	T_D_YN_FLAG					
36	ETC_TRAN_DETAIL	IS_ENTRY_AVAIL	CHAR(1)	T_D_YN_FLAG					
37	ETC_TRAN_DETAIL	IS_EXIT_AVAIL	CHAR(1)	T_D_YN_FLAG					
38	ETC_TRAN_DETAIL	IS_TREADLE_AVAIL	CHAR(1)	T_D_YN_FLAG					
39	ETC_TRAN_DETAIL	TRD_STRIPS_ACTIVE	TINYINT	T_D_TINYINT_ZERO					
40	ETC_TRAN_DETAIL	OP_SPEED	TINYINT	T_D_TINYINT_ZERO					
41	ETC_TRAN_DETAIL	LOOP_SPEED	TINYINT	T_D_TINYINT_ZERO					
42	ETC_TRAN_DETAIL	AVI_READ_TYPE	CHAR(1)	T_D_SPACE					
43	ETC_TRAN_DETAIL	AVI_WRITE_STATUS	CHAR(1)	T_D_SPACE	Y	T_LANE_TX	DEVICE_WRITE_STATUS	NUMBER(3)	
44	ETC_TRAN_DETAIL	TAG_IAG_CLASS	SMALLINT	T_D_SMALLINT_ZERO					
45	ETC_TRAN_DETAIL	COLL_CLASS	TINYINT	T_D_TINYINT_ZERO	Y	T_LANE_TX	COLLECTOR_CLASS	NUMBER(3)	Data dictionary says this is not applicable?
46	ETC_TRAN_DETAIL	COLL_AXLES	TINYINT	T_D_TINYINT_ZERO	Y	T_LANE_TX	COLLECTOR_AXLES	NUMBER(3)	
47	ETC_TRAN_DETAIL	UNKNOWN_AXLES	TINYINT	T_D_TINYINT_ZERO	Y	T_LANE_TX	UNKNOWN_AXLES	NUMBER(3)	
48	ETC_TRAN_DETAIL	IS_ETC_CARPOOL	CHAR(1)	T_D_YN_FLAG					
49	CSC_RECON	CSC_SEND_IDX	INTEGER	T_D_CSC_SEND_IDX					
50	CSC_RECON	CSC_RECV_IDX	INTEGER	T_D_CSC_RECV_IDX					

ECH to Vector Transaction Detail Map

Item	ECH Table	ECH Column	Data Type	Domain	Matched?	Vector Table	Vector Column	Data Type	Note/Comment
51	CSC_RECON	AMT_COLL	INTEGER(2)	T_D_TOLL_AMOUNTS	Y	T_LANE_TX	DISCOUNTED_AMOUNT	NUMBER(12 2)	
52	CSC_RECON	PLAN_TYPE	TINYINT	T_D_PLAN_TYPE	Y	T_LANE_TX	RECON_STATUS_IND	NUMBER(5)	
53	CSC_RECON	CSC_VIOL_STATUS	TINYINT		Y	T_LANE_TX	RECON_SUB_CODE_IND	NUMBER(5)	
54	CSC_RECON	IS_IMAGE_AVAIL	CHAR(1)	T_D_YN_FLAG	Y	T_LANE_TX	IMAGE_TAKEN	VARCHAR2(1)	Unclear if this is the correct field.
55	CSC_RECON	POSTED_DATE	DATE VMS	T_D_DATE	Y	T_LANE_TX	POSTED_DATE	TIMESTAMP(3)	
56	KEYSTROKES	KEYS	CHAR(80)	T_D_KEYS	Y	T_LANE_TX	KEYSTROKES	VARCHAR2(50)	
57	MANUAL_DETAIL	PLAN_TYPE	TINYINT	T_D_PLAN_TYPE					
58	MANUAL_DETAIL	AMT_COLL	INTEGER(2)	T_D_TOLL_AMOUNTS_ZERO	Y	T_LANE_TX	DISCOUNTED_AMOUNT	NUMBER(12,2)	
59	MANUAL_DETAIL	EXCEPTION_CODE	SMALLINT	T_D_EXCEPTION_CODE					
60	MANUAL_DETAIL	EXCEPTION_VALUE	INTEGER(2)	T_D_TOLL_AMOUNTS_ZERO					
61	MANUAL_DETAIL	SPECIAL_FLAG	CHAR(1)	T_D_SPACE					
62	MANUAL_DETAIL	REG_TYPE	CHAR(1)	T_D_SPACE					
63	MANUAL_DETAIL	IS_CLEAR_BUTTON	CHAR(1)	T_D_YN_FLAG					
64	MANUAL_DETAIL	IS_IMAGE_AVAIL	CHAR(1)	T_D_YN_FLAG	Y	T_LANE_TX	IMAGE_TAKEN	VARCHAR2(1)	Unclear if this is the correct field.
65	MANUAL_DETAIL	IS_RECEIPT_PRINTED	CHAR(1)	T_D_YN_FLAG					
66						T_LANE_TX	MESSAGE_ID (FK)	NUMBER(19)	Joins on T_MESSAGE_HEADER for logon message.
67						T_LANE_TX	PRECLASS_CLASS	NUMBER(3)	Preclass-AVC Class
68						T_LANE_TX	POSTCLASS_CLASS	NUMBER(3)	
69						T_LANE_TX	PRECLASS_AXLES	NUMBER(3)	Preclass-AVC Axles
70						T_LANE_TX	POSTCLASS_AXLES	NUMBER(3)	Postclass-AVC Axles
71						T_LANE_TX	EXIT_GATE_OPRN_REASON	VARCHAR2(20)	
72						T_LANE_TX	TURN_AROUND_RECEIPT	VARCHAR2(1)	Turn around receipt issued
73						T_LANE_TX	DEVICE_PROGRAM_STATUS	NUMBER(3)	.
74						T_LANE_TX	DEVICE_IAG_CLASS	NUMBER(5)	Tag IAG classification
75						T_LANE_TX	RECON_PLAN_ID	NUMBER(10)	Posted discounted plan
76						T_LANE_TX	AVC_TIME	TIMESTAMP(2)	
77						T_LANE_TX	TAG_READ_TIME	TIMESTAMP(2)	
78						T_LANE_TX	TAG_BLOCK_A	VARCHAR2(32)	
79						T_LANE_TX	TAG_BLOCK_C	VARCHAR2(32)	
80						T_LANE_TX	COMMAND_TYPE	NUMBER(5)	
81						T_LANE_TX	FARE_CALC_METHOD	VARCHAR2(1)	
82						T_LANE_TX	IMAGE_TKN_REASON	NUMBER(8)	
83						T_LANE_TX	TX_STRADDLING	NUMBER(3)	
84						T_LANE_TX	ENTRY_PLAZA_ID	NUMBER(10)	
85						T_LANE_TX	ENTRY_LANE_ID	NUMBER(10)	
86						T_LANE_TX	TRAVEL_DIRECTION	VARCHAR2(1)	
87						T_LANE_TX	ENTRY_TIME	TIMESTAMP(3)	
88						T_LANE_TX	DEVICE_VEH_WEIGHT_CLASS	NUMBER(3)	Vehicle weight class encoded on transponder (if any)
89						T_LANE_TX	DEVICE_REVENUE_TYPE	NUMBER(3)	Revenue type encoded on transponder (if any)
90						T_LANE_TX	DEVICE_MOUNT_LOCATION	NUMBER(3)	Tag mounting location encoded on transponder (if any)
91						T_MESSAGE_HEADER	SHIFT_ID	NUMBER(10)	Shift Number associated with Toll Collector's shift.
92						T_MESSAGE_HEADER	TOLL_TX_TYPE	NUMBER(3)	Record types that are supported by the Vector systems
93						T_MESSAGE_HEADER	LANE_HEALTH	VARCHAR2(28)	Agency-specific bitmap of lane devices status
94						T_MESSAGE_HEADER	AUDIT_ID	NUMBER(10)	Used for tracking audit actions associated with this message.
95						T_MESSAGE_HEADER	MESSAGE_SERIAL_NO	NUMBER(33)	
96						T_MESSAGE_HEADER	TOUR_ID	NUMBER(10)	
97						T_MESSAGE_HEADER	LANE_REV_NUM	NUMBER(10)	
98						T_MESSAGE_HEADER	FARE_TABLE_NUM	NUMBER(10)	
99						T_MESSAGE_HEADER	TOLL_TX_SUB_TYPE	NUMBER(3)	

16 Attachment 5 - Audit Department Controls Requirements Checklist

NOTE: Updated to reflect April 9, 2014 discussion with Authority Audit/ Procurement/ TB&T staff and Xerox

General

- Documented procedures, flowcharts and process maps for the application.
- Conduct regular audits, vulnerability testing, and security scanners.
- Evidence of conformity to ISO27001 requirements
- Physical access to the application hardware should be appropriately restricted.
- The application should have a warning banner, terms of use, and/or privacy statement that was approved by the Port Authority on the login screen.
- Remote access should be restricted and documented in accordance with PA policy.
- Background check should be performed on all personnel.

System/Security Administration

- Administrative personnel should receive adequate training.
- System and security administration procedures should be documented and distributed.
- Administrator(s) roles and responsibilities should be documented.
- Developers and/or programmers should not have access to the production server.
- Operating system administrators should not have access to the production database and application.
- SSAE 16 Service Organization Control (SOC) 2 (previously known as SAS 70 Level 2)

Hardening of operating system/database that supports the application:

- Disable and/or remove unnecessary ports/services.
- Remove all samples from the box.
- Default, public, and guest accounts should be secured/locked/removed.
- Change all passwords; delete all default content and login scripts.
- Limit administrative and user account privilege and access.
- Document system accounts like administrator, root, oracle, and sys.
- Document user/group access rights
  - Users/groups should be setup with least access required to perform job responsibilities.
- Follow PA password standards or better (90-day expiration, lockout after 3 incorrect password attempts, no concurrent logins, 6 alphanumeric characters)

NOTE: Toll Collector passwords are exempt from this requirement; however, Toll Supervisors must change their passwords every 90 days.

- Set “automatic session timeout” to 15 minutes of inactivity and require user to log back in with valid ID and password.

- Implement access control at the database level (i.e. user roles and permissions, passwords, secure links)
- Use secure encrypted remote access methods.
- If the application is a web application, log (and monitor) web traffic and trend the activity looking for abnormal activity.
- Ensure that appropriate security and vulnerability assessment tools are running.
- At login, last user login should not display.
- Inventory listing of hardware and software should be current and maintained.

License Management

- Ensure that application licensing requirements are documented, reviewed and maintained.
- Application licenses should be current/valid and individuals/groups with application access should have completed the necessary access request forms and adhere to licensing requirements.

Logical Access Controls

- Procedures to grant/modify/delete access should be documented.
  - Access request forms for adding/modifying/deleting users should be used.
  - Account expiration for contractors and consultants.
  - Accounts adequately identify the user – no generic accounts
- Ensure that security administrator procedures exist to:
  - Create/remove application access in a timely manner
  - Review user roles/permissions
- Validate that all users have accessed the application within the past 90 days.
  - Review dormant accounts
  - Inactive accounts should be removed.
- Each user has a unique user ID as described in the Port Authority Standard and Guidelines.
  - All user accounts profile should include Employee ID# and full user name.
- Roles should have a segregation of duties/roles.
  - Roles are setup with least access required to perform job responsibilities.
- Access Control List (ACL) should include:
  - Current list of ACL
  - Creation and updates to ACL
  - Testing and approvals of ACL
- The application should have the PA's warning banner on the login screen.
- The system should have an access role that would allow real only access to all application, database and operating system screens, functions, logs and reports.
- Remote access should be approved, secured, and documented in accordance with PA policy.
- Encryptions level at a minimum should be AES 256bit when encryption is used.

Password Controls

- Ensure that password controls for the application are consistent with PA requirements
  - Passwords must be at least 6 alphanumeric characters long
  - Passwords must be changed every 90 days (administrators every 30 days)

NOTE: Toll Collector passwords are exempt from this requirement; however, Toll Supervisors must change their passwords every 90 days.

  - Passwords must not be shared
  - Accounts should be locked after a three logon failures
  - Passwords should not be the same account name
  - No concurrent login capabilities
- Password file should be securely stored with limited access and encrypted.
- Application forces initial passwords to be changed and the initial passwords should not be easily guessable.
- Maintain a password dictionary and password history should be set to five (5).

Application Controls

Data Validation & Input Controls

- The application should have input controls to verify the validity of the data entered.

Data Retention and Management

- All data should be classified according to its sensitivity (confidential, etc) and protected accordingly.
- Data archive strategy should be documented and in place.
  - Should specify how long active data is kept.

Data Integrity and Security

- Sensitive data, such as credit card #s and social security #s, should be encrypted.
- Data should be restricted and audit trails should be available to identify all user activity include view access to sensitive data.
- Data should be stored in the database encrypted and blocked from user views in the application unless it is authorized.

Application Interfaces

- Interface file should be secured and archived.
- Reconciliation of data should be done on a batch record and totals. Detail data reconciliations should be completed on periodic basis.

Processing Controls

- Application databases/interfaces should have the necessary controls to prevent processing of inaccurate, duplicate, or unauthorized transactions and producing inaccurate outputs.
- Controls to ensure that all data is processed and accounted for should be in place.
- Rejected items should be logged, tracked and resolved in a timely manner.

Change Management

- Processes and tools should be used to report, track, approve, fix, and monitor changes on the application.

- The application and all changes to the application should be tested before being put into production.
    - Documentation of approval for change and evidence of testing should be in place.
    - Specific timetable/schedule should be documented
    - Emergency procedures should be documented and distributed.

Application Logging, Audit Trails and Record Retention

- Audit trails for operating, application, and database systems should exist and reviewed.
- Users and roles should be tracked and reviewed
    - Maintain documentation
- All failed logon attempts should be logged.
- All sensitive transactions and changes should be logged and an audit trail created.
- Audit trails should contain who made the change, when it was made, and what was changed.
- Only the security administrator should have access to change or delete these logs or audit trails.
- Audit trails should be reviewed by the business owner(s) and security administrator.

Management Reporting

- Management reporting should be produced through the application.
- Transaction logs should be maintained and reviewed periodically.
- Access reports by user and privilege should be produced and reviewed periodically including access violation reports and exception transaction reporting.

Contingency Planning, Disaster Recovery and Backup Management

- A business contingency plan and a disaster recovery plan for the application should be documented and stored off-site, including escalation plan and current call tree.
- Plans should be tested and the outcomes of the tests (success/failure) should be documented.
- Regular backups of the application and the application data should be stored off-site.
- Application executables should be stored off-site or in escrow.
- Application configurations should be documented and backed-up.
- Full system backup should be encrypted.
- Backup procedures should be documented.
- Tape maintenance should include:
    - Periodically testing integrity of tape
    - Procedures for tape destruction due to faulty or scratched hardware.

Performance Monitoring

- Incident monitoring procedures should be documented and incidents logs should be reviewed to ensure that appropriate action is taken.
- Performance statistics should be examined and reviewed periodically by system administrators/business owner(s).
    - If vendor(s) support the application, a service level agreement for uptime, performance monitoring, updates, etc., should be confirmed.

- Baseline tools or security products should be used and checked on a quarterly basis.

Patch Management

- Patch management procedures and documentation
  - Procedures should include testing, approvals, and distribution.
  - Documentation should include emergency procedures.
- Apply all new patches and fixes to operating system and application software for security.

Physical Protection

- Physical access to the application hardware should be appropriately restricted.
  - Physical access secured by single authentication mechanism i.e. swipe card.
  - Physical security adequate for equipment (locked cabinets). [Generally, Authority responsibility for location security; Contractor responsibility under Maintenance Contract for AVI, LEC and other cabinets containing ITCS equipment].
- Appropriate fire suppression systems should be in place. [Authority responsibility]
- Environmental condition adequately controlled (no water, dirt, and clutter) and monitored. [Authority responsibility]
  - Temperature and humidity monitoring should be implemented.
- Security cameras installed in sensitive areas. [Authority responsibility]
- Power surge protection and emergency power backup are in place.

Anti-virus Management

- Virus patch management procedures should be documented, including emergency update procedures.
- Virus software should be implemented and up-to-date.
- An engine and definition management should be in place.
- A remote distribution server should be implemented
  - Documentation on remote distribution should be current and maintained.
- Intrusion detection system should be in place, including incident response procedures.
- Firewalls should be implemented
  - Firewall rules documentation should be up-to-date.

Wireless Device

- Devices should be using WPA/WPA2 and AES encryption or better.
- Devices should disallow broadcasting of the SSID.
- All default parameters should be changed.
- Devices should have MAC address filtering enable or some type of authentication mechanism in place.

Web Application Vulnerabilities and Controls

- Best Practice and Standards:

  - The Open Web Application Security Project (OWASP) - www.owasp.org
  - www.webappsec.org (a consortium of web application security professionals)
  - Center for Internet Security (CIS) – www.cisecurity.org
- Perform data validation & integrity checks for field values and ensure the HTML special characters are stripped for all HTML request.
- Do not allow site pages to be cached by user browsers.
- All sensitive, personal or confidential data (including SSN, passwords, session IDs for sensitive applications, confidential or sensitive business transactions, etc.) should be transmitted between browser and server within an SSL-encrypted session (or other encrypted transmission) and are encrypted in the database at rest.
- All sensitive and personal data should be masked and encrypted were possible.
- Legal Issues:
  - The site should have a privacy statement and term of usage.
  - American Disability Act – Section 508 should be considered during the development process due to the requirement that federal agencies' electronic and information technology is accessible to people with disabilities.
- Web Authentication: To prevent passwords from being passed in the clear, have authentication occur within an SSL encrypted tunnel. Use SSL (certificate) to protect the password.
- Password Reset:
  - For internal applications, reset passwords via the helpdesk or security administrator of the site
  - For external applications, send temporary password to known e-mail address, that must be changed upon login and/or
  - Have customer service reset after the user has been validated.
  - If possible, use two-factor authentication like Secure ID fobs.

Credit Card Processing Checklist

- PCI Standards should be enabled and be PCI compliant. Ensure all vendors and consultants are required to be PCI compliant to PCI DSS v2.
- A segregated network and/or an approved Point of Sale terminal should be in place for the system or terminal used to process credit card transactions.
- The credit card processor standard and requirements should be enabled, i.e. maintain transaction data for two years.
- Maintain the security of the customer information, including not storing credit numbers, the cardholder CVC/CVV numbers or any of the data from the magnetic strip on the credit card.
- Maintain the transaction data for contesting chargebacks, ensure that the processor fees are appropriate and do reconciliations of the transactions processed and the money deposited in the Port Authority bank accounts.
- The appropriate Port Authority functional areas should be made aware credit card processing activity and should be involved applying for the Merchant ID for MasterCard/Visa, Discover and American Express.
- Create a privacy policy and procedure for staff and consultants.

- Perform quarterly vulnerability scans of the network that contains the credit card processing, annual PCI reviews according to the PCI DSS, and annual system penetration testing.

-THIS PAGE INTENTIONALLY LEFT BLANK-

17 Attachment 6 - Applicable Authority Technical Specifications

02073	Cutting, Patching and Removal
02506	Concrete Pavement Patching
02850	Plywood Sign Panels and Wood Sign Posts
02851	Aluminum Sign Panels
03602	Grouting (Non-Metallic)
05080	Stainless Steel Finish
05506	Miscellaneous Steel
07270	Firestopping
15410	Plumbing Piping and Appurtenances
15430	Plumbing Specialties
16000	Electrical General Requirements
16110	Raceways
16114	Cable Trays
16115	Underground Conduit Systems
16120	Wires, Cables, Splices, Terminations (600 Volts or Less)
16126	Fiber Optic Cabling
16127	Control/Signal Transmission Media
16133	Control Panels, Enclosures/Cabinets, and Terminal Boxes
16135	Boxes and Fittings
16140	Wiring Devices
16190	Supporting Devices
16450	Grounding
16452	Bonding
16470	Panel Boards
16475	Overcurrent Protective Devices (600 Volts or Less)
16680	Inductive Detector Cable and Detector Sensor Unit

The Contractor shall use standard Authority Technical Specifications in addition to those listed above, as needed.

-THIS PAGE INTENTIONALLY LEFT BLANK-

DIVISION 2

SECTION 02073

CUTTING, PATCHING AND REMOVAL

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for cutting, patching and removal of existing construction.

1.02 QUALITY ASSURANCE

A. Cutting, patching and removal shall be performed by workers skilled in the specific trades involved.

B. Site Conditions

1. Except for portions shown to be relocated or retained by the Authority, remove and transport off Authority property all portions of the existing construction shown on the Contract Drawings to be removed in accordance with Division 1 clause entitled "Recycling of Construction Debris Material".
2. All construction debris shall become the Contractor's property.
3. Prior to start of Work, make an inspection accompanied by the Engineer to determine physical condition of adjacent construction that is to remain.

1.03 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

All materials required for patching shall be new. Patching materials shall match in every respect adjacent portions of the existing construction unless otherwise shown on the Contract Drawings.

PART 3. EXECUTION

3.01 PROTECTION

A. Protect existing adjacent surfaces to remain and finished surfaces at all times and repair or replace, if damaged, at no cost to the Authority and to the satisfaction of the Engineer.

B. Protect all existing and new construction including utilities, finishes and equipment from water, damage, weakening or other disturbance.

3.02 CUTTING, PATCHING AND REMOVAL

A. Perform all cutting, patching and removal as shown on the Contract Drawings. Work shall be performed in accordance with the approved methods using approved materials.

B. Do not cut or remove more than is necessary to accommodate the new construction or alteration.

C. Maintain the integrity of all construction at all times.

D. Do not allow removed materials and debris to accumulate at the construction site; remove them at the end of each work period or daily. All areas adjacent to, and leading to and from the site shall be kept free of removed materials and debris.

E. Do not burn, bury, or dispose of in storm drains, wetlands or waterways on Authority property debris of any type.

F. Dispose of debris resulting from removal operations in accordance with all local laws and regulations that would apply if the Authority were a private corporation.

END OF SECTION

SECTION 02073

CUTTING, PATCHING AND REMOVAL

APPENDIX "A"

SUBMITTALS

A. Product Data

Submit to the Chief of Materials Engineering, Materials Engineering Unit, Port Authority Technical Center, 241 Erie Street, Jersey City, New Jersey, 07310-1397, for approval, all product data sheets for the materials to be used for patching.

B. Construction/Installation Procedures

Submit to the Engineer plans, methods, equipment and procedures as applicable for cutting, patching and removal.

END OF APPENDIX "A"

SECTION 02073

CUTTING, PATCHING AND REMOVAL

INSTRUCTIONS TO SPECIFIER

A. Contract Drawings

Ensure that the Contract Drawings show the following items specified in the text:

(1.01)	Any specific and/or unusual cutting, patching (and removal) requirements.
(1.02 B.1)	Show limits of removal and materials and equipment to be relocated or retained by the Authority, if any.
(2.01)	Details of existing (construction) materials to be matched for patching.

END OF INSTRUCTIONS

DIVISION 2

SECTION 02506

CONCRETE PAVEMENT PATCHING

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for partial-depth and full depth pavement patching for Portland cement concrete pavement and curb and sidewalk repairs using cementitious patch material.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M 182	Burlap Cloth Made From Jute or Kenaf
AASHTO M 254	Corrosion Resistant Coated Dowel Bars

American Concrete Institute (ACI)

ACI 318	Building Code Requirements for Reinforced Concrete

American Society for Testing and Materials (ASTM)

ASTM A 615	Deformed and Plain Billet - Steel Bars for Concrete Reinforcement
ASTM C 33	Concrete Aggregates
ASTM C 150	Portland Cement
ASTM C 260	Specifications for Air-Entraining Admixtures for Concrete
ASTM C 309	Liquid Membrane - Forming Compounds for Curing Concrete
ASTM C 494	Specifications for Chemical Admixture for Concrete
ASTM D 1751	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Do not place concrete when:

1. Ambient temperature is below 40 degrees F or is apt to fall below 40 degrees F during concrete set time.
2. Reinforcement, ground or forms which concrete will contact are not frost-free.
3. Placing temperature of concrete will exceed 85 degrees F.

4. Weather conditions would result in rapid drying or stiffening of concrete before it can be consolidated or excessive evaporation of mixing water.

1.04 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Cement

1. For 7-day cure, use ASTM C 150, Type I or II from a manufacturer approved by either New York State Department of Transportation or New Jersey Department of Transportation.
2. For 16-hour cure, use ASTM C 150, Type III from a manufacturer approved by either New York State Department of Transportation or New Jersey Department of Transportation.
3. For 6-hour cure, use "RAPID SET" as manufactured by CTS Cement Manufacturing Co.

B. Fine Aggregate

ASTM C 33.

C. Coarse Aggregate

ASTM C 33, Size Number 8, Class 4S (regardless of type) for partial depth patching,
ASTM C 33, Size Number 57, Class 4S (regardless of type) for full depth patching.

D. Water

Clean water suitable for drinking purposes, for both mixing and curing concrete.

E. Air Entraining Agent (AEA)

ASTM C 260

F. High Range Water Reducer (High Range WR)

ASTM C 494, Type F or G

G. Water Reducer Retarder

ASTM C 494, Type D

H. Preblended Concrete (for 6-hour cure)

1. EMACO 415 - manufactured by Master Builders
2. Five Star Highway Patch - manufactured by U. S. Grout Corporation
3. Five Star Structural Concrete - manufactured by U. S. Grout Corporation

4. Dayton HD - 50 - manufactured by Dayton Superior

5. Rapid Set Dot Repair Mortar - manufactured by CTS Cement Mfg. Co.

6. RAPID SET MORTAR MIX - manufactured by CTS Cement Mfg. Co.

I. Curing Materials

1. Liquid Curing Membrane

ASTM C 309, Class R Type 2

Curing membranes shall be wax-free. Membranes must be volatile organic compound (VOC) compliant for both the states of New York and New Jersey. Certification shall be supplied to the Engineer upon request. The membrane must restrict the loss of water to not more than 0.4 kilogram per square meter in 72 hours. Manufacturer's printed instructions for the coverage rate shall be supplied to the Engineer.

2. Burlap - AASHTO M 182, Class 4

J. Joints

1. Joint inserts and bituminous joint filler shall conform to ASTM D 1751 and shall be punched to admit dowels. Joint inserts for each joint shall be furnished in a single piece for the full depth and width required for the joint.

2. Tie bars (ASTM A 615, Grade 40) for longitudinal joints shall conform to the Section entitled, "CONCRETE REINFORCEMENT".

3. Dowels for transverse joints shall be straight, smooth, solid round bars, free from burring or other deformation that would interfere with free movement in the concrete. They shall be resistant to abrasion resulting from pavement expansion and contraction and shall be one of the following:

a. Carbon steel (ASTM A 615, Grade 60) conforming to AASHTO M 254.

b. Organic coated steel dowel bars (ASTM A 615, Grade 60) conforming to AASHTO M 254.

K. Sand - Cement Bonding Compound

A uniform mixture of cement, fine aggregate and water in the same proportions as the concrete to be placed.

2.02 LOW SHRINKAGE ACCELERATOR

Low shrinkage accelerator shall conform to ASTM C 494, Type C, non-chloride. In addition, when mixed in the proportions hereinafter specified, concrete containing such accelerator shall develop a compressive strength of 2000 psi $\pm$400 psi within 16 hours of placement, based on an ambient temperature of 70 degrees F or above and an internal concrete temperature of 70 degrees F or higher. Adjustments shall be made for on-site conditions such as longer curing hours or other conditions listed in 1.03 of this Section as applicable. This material shall be compatible with, and a product of, the air entraining agent manufacturer. Concrete chloride content shall conform to the requirements of ACI 318 table 454.

2.03 PROPORTIONING INGREDIENTS

A. Where 6-hour* cure time is available prior to overlay operations or opening to traffic, mix concrete in the proportions specified in the following table:

Cement (Rapid Set)	94 pounds
Fine Aggregate	210 pounds
Coarse Aggregate	215 pounds
Water	5.2 gallons
High Range WR	23 ounces
AEA	as required to obtain 5% to 6% Retained Air
Retarder	as required

In Lieu of the above, contractor may use one of the preblended concrete mixes specified 2.01 H, extended with coarse aggregate as per manufacturer's recommendation.

*Longer cure time may be required if temperature falls below 50 degrees F. Do not open to traffic or overlay operations until F'c = 2000 psi.

B. Where 16-hour** cure time is available prior to overlay operations or opening to traffic, mix concrete in proportions specified in the following table:

Cement: Type III	94 pounds
Fine Aggregate	180 pounds
Coarse Aggregate	213 pounds
Water	4.1 gallons
High Range WR	17 ounces
Accelerator, non-chloride	43 ounces
AEA	as required to obtain 5% to 6% Retained Air

**Longer cure time may be required if temperature falls below 65 degrees F. Do not open to traffic or overlay until F'c = 2000 psi.

C. Where 7-day cure time is available prior to overlay operations or opening to traffic, mix concrete in the proportions specified in the following table:

Cement (Type I or II)	94 pounds
Fine Aggregate	176 pounds
Coarse Aggregate	284 pounds
Water	5.25 gallons
High Range WR	None
Accelerator, non-chloride	None
AEA	as required to obtain 5% to 6%Retained Air

D. Adjustment of Proportions

1. Design Mixture

a. The above mixes for standard weight concrete were designed using fine aggregates with a specific gravity of 2.65 in a saturated surface-dry condition and coarse aggregate with a specific gravity of 2.83.

b. If the materials proposed for use differ from the above, adjustments to the listed proportions should be made to insure proper yield.

c. The ratio of the fine to the coarse aggregate will be subject to determination by the Engineer, but will be within 10 percent of the values given in the foregoing table.

PART 3. EXECUTION

3.01 PREPARATION

A. Partial-Depth Repairs

1. Saw cut the perimeter of the area to be removed then remove deteriorated and delaminated concrete to a sound surface where directed by the Engineer or where shown on the Contract Drawings and in accordance with details shown on the Contract Drawings.

2. Remove deteriorated and delaminated concrete to a sound surface by means of pneumatic or mechanical chipping tools in accordance with the following:

   a. Removal of concrete shall progress from the inside of the repair area toward the edges, and the chisel point shall be directed toward the inside of the patch.

   b. Pneumatic hammers heavier than nominal 30-pound class shall not be used.

   c. Pneumatic hammers or mechanical chipping tools shall be operated at an angle not to exceed 45 degrees relative to the surface of the area being repaired.

   d. The Contractor shall remove deteriorated concrete to a sound surface for a depth not less than 1/4 inch nor more than 3/4 inch beyond the deteriorated layer of concrete.

3. The Contractor shall not use power tools to remove concrete adhered to exposed reinforcing steel. Removal of concrete, rust and/or corrosion adhered to exposed rebars shall be performed by abrasive blasting.

4. Abrasive blast clean the exposed faces of the concrete and all exposed reinforcing steel removing all loose particles, rust, oil, dust, traces of asphalt concrete and any other contaminants.

5. Follow abrasive blast cleaning with an oil-free air-blast.

6. The Contractor shall apply bonding agents as follows:

   a. For patch materials other than preblended concrete coat cleaned surfaces with sand cement compound scrubbed into the surface with a mason's brush, immediately prior to depositing concrete.

   b. For preblended concrete apply prime coat in accordance with the patch material manufacturer's written instructions.

7. Abrasive blasting shall be performed in accordance with the Section entitled "ABRASIVE BLASTING OF PAVEMENTS".

8. Install compressible joint inserts in existing joints bounding the patch and in accordance with the details shown on the Contract Drawings.

B. Full-depth Repairs

1. Remove deteriorated concrete where directed by the Engineer or where shown on the Contract Drawings.

2. Saw cut full-depth the perimeter of the area to be removed, including any joints located along the perimeter.

3. Unless otherwise specified on the Contract Drawings, remove deteriorated concrete by either the liftout or breakout method explained below:

   a. Liftout Removal - Drill holes through the slab, insert lift pins, connect pins to lifting equipment using chains or cables, liftout slabs using lifting equipment and load onto trucks for disposal off-site.

   b. Breakout Removal - Using jackhammers breakup concrete from center of the area to be removed to six inches from the saw cuts. Within six inches from the saw cuts use of a jackhammer will not be permitted and a chipping hammer shall be used to complete the removals. Load broken concrete onto trucks for disposal off-site.

4. Prepare base by repairing any soft spots or areas disturbed by the removals in accordance with the details on the Contract Drawings.

5. Compact base with mechanical tampers.

6. Dowel Installation

   a. Dowel bar size and spacing shall be in accordance with the details shown on the Contract Drawings.

   b. Drill dowel holes with gang drills. Single hand-held drills will not be permitted.

   c. Clean dowel holes with an oil-free air-blast.

   d. Place grout at the back of the dowel hole. Insert dowel, twisting the dowel one full turn during insertion and install the grout retension disk in accordance with the details on the Contract Drawings.

   e. Dowel bars and assemblies shall be checked for position and alignment. The maximum permissible tolerance on dowel bar alignment in each plane, horizontal and vertical, shall not exceed 1/4 inch per foot of dowel bar. Dowel position shall meet the following:

      (1) Horizontally, within plus or minus 1/2 inch of specified spacing.

      (2) Vertically, within plus or minus 1/2 inch at mid-depth of slab.

      (3) Midpoint of the dowel relative to the center of the joint, within one inch.

7. Install compressible joint inserts in existing joints bounding the patch and in accordance with the details shown on the Contract Drawings.

3.02 MIXING CONCRETE

A. Mix concrete in an approved type power operated batch mixer, provided with a counting device and a timing device of the escapement type, arranged to lock the discharge lever until the batch has been thoroughly mixed for the required time after the materials are placed in the mixer.

B. Mix ingredients dry, and after water has been added, until there is a uniform consistency of materials.

C. Do not permit raw materials to enter the drum of the mixer until all materials of the preceding batch have been discharged. Clean the mixer thoroughly at regular intervals, and when directed by the Engineer.

D. The mixer shall rotate at a peripheral speed of approximately 200 feet per minute and each batch shall be mixed not less than 1 1/2 minutes for a mixer with a capacity of 1 cubic yard or less, and not less than 2 minutes for larger capacity mixers.

E. Concrete from Mobile mixers or Ready-mixed trucks may be used at the option of the Contractor, provided; however, that the type and method of operation shall be approved in advance by the Engineer. Mobile mixers shall be calibrated in the presence of the Engineer.

3.03 DEPOSITING CONCRETE

A. Deposit concrete only in the presence of the Engineer and by methods approved by the Engineer.

B. Thoroughly consolidate concrete using spud vibrators so that the concrete is worked into all corners and around all embedded material and will not result in excessive voids or honeycomb on the surface.

3.04 FINISHING

A. Screed concrete from the center of the patch toward the edges.

B. The concrete patch surface, if to be overlaid with asphalt concrete shall receive a "float finish". The concrete patch surface, if not to be overlayed with asphalt concrete, shall receive a "broom finish". The designated finish shall be applied to horizontal surfaces immediately after screeding and before initial setting has begun.

C. Sidewalks shall receive a "float finish". Float finish shall be applied to horizontal surfaces immediately after screeding and before initial setting has begun. Tool edges and joints for width of 2 inches and round corners to a radius of 1/4 inch with an approved edging tool. Install expansion joints at not more than 20-foot intervals in sidewalk with matching joints in curbs. Use 1/4-inch bituminous joint filler. Score sidewalk in squares as approved by the Engineer.

D. Curb repairs shall receive a "trowel" finish.

3.05 CURING AND PROTECTION

A. All pavement patches shall be cured using either an approved wet curing procedure, or a water-based liquid curing membrane that is wax-free. Liquid curing membrane shall not be used on areas requiring a sealer as specified in 3.05 B below unless certification of compatibility from the manufacturer of the curing membrane is submitted to the Engineer for approval. If a wet curing procedure is selected and approved, such procedure shall be maintained for the duration of the curing.

B. For sidewalk and curb repairs, seal surfaces of new concrete with a concrete sealer in accordance with the Section entitled "SILANE SEALER".

C. Provide suitable means for maintaining a temperature in the concrete of at least 50 degrees F for not less than 3 days for concrete not subject to any loading and for 6 days for concrete that will be subject to partial loads. Do not add salts, chemicals or admixtures of any kind to the concrete, except as provided herein.

D. Protect concrete surfaces by means approved by the Engineer, to prevent damage or marring.

END OF SECTION

SECTION 02506

CONCRETE PAVEMENT PATCHING

APPENDIX "A"

SUBMITTALS

A. Within 15 days after award of the Contract submit to the Engineer for approval samples of all the concrete ingredients intended for use during the course of the Contract. Submit in sufficient quantity to obtain 5 cu. ft. of concrete. Submit all required materials to the Port Authority of New York and New Jersey, Materials Engineering Division Laboratory, 241 Erie Street, Jersey City, NJ 07310-1397.

B. Resubmit samples for approval any time that a change in materials is intended.

C. A sample of the dowel bars, for approval.

D. A sample of the joint insert, for approval.

E. If required, submit to the Engineer for approval a letter from the manufacturer of the liquid curing membrane certifying their product is compatible with concrete sealer to be used.

END OF APPENDIX "A"

DIVISION 2

SECTION 02850

PLYWOOD SIGN PANELS AND WOOD SIGN POSTS

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for the following:

1. Plywood sign panels for use in temporary pedestrian, bicycle, and vehicular guide, warning and regulatory roadway signs. Sign type usage is shown on the Contract Drawings.

2. Wood sign posts and footings for sign panel side-of-road installations.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

<u>American Association of State Highway and Transportation Officials (AASHTO)</u>	
LTS-5-I2	Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals.
MASH	Manual for Assessing Safety Hardware.
AASHTO M 133	Specification for Preservatives and Pressure Treatment Processes for Timber.
AASHTO M 168	Specification for Wood Products.
<u>American National Standards Institute (ANSI) / American Society of Mechanical Engineers (ASME)</u>	
ANSI/ASME B18.2.1	Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
ANSI/ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
ANSI/ASME B1.13	Metric Screw Threads: M Profile.
<u>American Society for Testing and Materials (ASTM International)</u>	
ASTM A 153	Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
ASTM A 325	Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
ASTM A 490	Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
ASTM B 209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
ASTM B 211	Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.

ASTM B 221	Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
ASTM D 245	Practice for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber.
ASTM D 2555	Practice for Establishing Clear Wood Strength Values.
ASTM D 4956	Specification for Retroreflective Sheeting for Traffic Control.
	American Traffic Safety Services Association (ATSSA)
Guidelines	Quality Guidelines for Temporary Traffic Control Devices and Features.
	American Wood Protection Association (AWPA)
AWPA U1	Use Category System: User Specification for Treated Wood.
	Federal Highway Administration (FHWA)
MUTCD	Manual on Uniform Traffic Control Devices for Streets and Highways.
SHS	Standard Highway Signs Including Pavement Markings and Standard Alphabets.
	US Department of Commerce (DOC)
	National Institute of Standards and Technology (NIST)
Voluntary Product Standard PS 1	Structural Plywood.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Design of signs and sign structure shall provide sufficient strength to withstand the wind loading generated by a basic wind speed of 120 miles per hour as per AASHTO LTS-5-I2.

B. Sign supports and framing shall be designed to meet the required wind loading. Posts shall be designed for direct embedment in the soil by excavation and backfill, or by driving with hand or mechanical equipment.

1.04 QUALITY ASSURANCE

A. Each plywood sheet shall be grade marked and certified in accordance with NIST PS 1.

B. Temporary signs will be evaluated by the Engineer for acceptability in accordance with ATSSA's Quality Guidelines for Temporary Traffic Control Devices and Features.

C. Temporary sign supports shall conform to the requirements of the FHWA's MUTCD and AASHTO's MASH.

1.05 DELIVERY, STORAGE, AND HANDLING

A. All sign components and materials shall be transported and handled in a manner that shall cause no permanent deformation, injury or damage. Store sign components and materials above ground.

B. When not in service, temporary signs and portable temporary sign supports shall be stored in such a manner and location that they do not interfere with or present a hazard to vehicular, bicycle or pedestrian traffic. No signs or supports shall be stored on the traveled way or sidewalk during non-working hours. Portable temporary sign supports stored on the roadside within the roadside recovery area, or any area that may be traversable by an errant vehicle, shall be laid flat such that no part of the support is more than 4 inches above the ground. No sign supports shall be leaned against or overhang the traffic side of traffic barriers. The faces of stored signs shall not be visible to traffic in any direction, regardless of the orientation of the sign.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Plywood Sign Panels

1. Plywood sign panels shall be flat and shall not be bowed or warped and shall conform to NIST PS 1.

2. Plywood panels for temporary signs shall be exterior-type plywood with a medium density overlay, 5-ply and A-C grade or better.

3. Thickness of plywood sign panels and plywood battens shall be not less than 1/2 inch. Backs and edges of temporary plywood sign panels shall be painted white.

B. Retroreflective Sheeting

1. Retroreflective sheeting shall be colored, flexible, weather resistant and shall have a smooth outer surface. If the retroreflective sheeting contains spherical lens elements, the lens elements shall be embedded within a transparent plastic, to produce a smooth, flat outer surface. All sheeting shall be of uniform appearance, free from ragged edges, cracks, scales, blisters or other defects.

2. Prepare the surface of the sign panels for the application of the retroreflective sheeting in strict accordance with the recommendations of the manufacturer of the retroreflective sheeting.

3. Retroreflective sheeting shall be one of the following ASTM D 4956 types, as shown on the Contract Drawings:

a. ASTM Type I: A medium-intensity reflective sheeting also known as engineer grade. Use for pedestrian signs, except where high reflectivity is required, as shown on the Contract Drawings.

b. ASTM Type III: A high-intensity reflective sheeting also known as high intensity. Use for pedestrian signs, temporary delineators and other work zone devices with the exception of vehicular and bicycle construction signs.

c. ASTM Type IX: A very-high-intensity retroreflective sheeting having highest retroreflective characteristics at short road distances. Use for bicycle and pedestrian signs, temporary vehicle construction signs, delineators, construction zone devices and vertical panels.

d. ASTM Type XI: A full cube prismatic retroreflective sheeting with highest level of retroreflective characteristics. Use for permanent vehicular, pedestrian and bicycle signs.

4. Comply with sign design standards in the FHWA's MUTCD, including standards for retroreflectivity, illumination and color.

C. Wood Sign Posts

1. Signs posts shall be constructed and installed in accordance with the FHWA's MUTCD and AASHTO's LTS-5-I2.

2. Wood sign posts shall be dry, No. 1 grade, S4S, Douglas Fir, Southern or Ponderosa Pine, Hemlock, Spruce or Western Larch conforming to the applicable requirements of AASHTO M 168. The posts shall be straight and true, free of splits, knots and warps or of steel or aluminum components.

3. All wooden posts shall be treated in accordance with the applicable requirements of AASHTO M 133 and AWPA U1.

4. Posts shall be surfaced four sides, have a uniform cross-section, and shall be sized not less than 4 inches by 4 inches. The post shall be graded for the following stress grades in accordance with the grading rules developed from ASTM D 245 for the selected stress grades. Using the clear wood properties of ASTM D 2555, the bending stress of the post shall be not less than 1200 psi.

5. All 4 by 6 inch posts shall have two 1-1/2 inch diameter breakaway holes drilled through the center of the post parallel to the sign face 4 inches and 18 inches above grade and filled with flexible sealant. All 6 by 8 inch posts shall have two 3-inch diameter breakaway holes drilled through the center of the post parallel to the sign face 4 inches and 18 inches above grade and filled with flexible sealant.

D. Stiffeners, Brackets and Miscellaneous Hardware

1. Horizontal and vertical sign panel stiffeners (Z bars) and panel brackets shall be fabricated of aluminum Alloy 6061-T6 conforming to ASTM B 221.

2. Other miscellaneous aluminum hardware including bolts, nuts, washers, screws, rivets, pull-type lockbolts and serrated or knob stem blind rivets shall be fabricated to meet the requirements of ASTM B 209 and ASTM B 211 for Alloy 2024-T4 with No. 205 Alumilite Finish. Ensure that bolt heads and nuts are American National Standard, Regular Series, hexagonal, semi-finished, conforming to ANSI/ASME B18.2.1 and B18.2.2, and that threads are American National Standard, Coarse Series, Class 2 Fit, conforming to ANSI/ASME B1.13. Finish bolts with an anodic coating thickness of not less than 0.0002 inches and chromate seal. Use washers conforming to ASTM B 209, Alloy 2024-T3.

3. High strength steel bolts, nuts and washers used in steel-to-steel connections shall conform to ASTM A 325 or ASTM A 490. High-strength bolts, nuts and washers shall be galvanized in accordance with ASTM A 153. Steel bolts, nuts and washers used in contact with aluminum shall be coated with cadmium or a cadmium/tin combination. All cadmium and cadmium/tin coatings shall be given a chromate treatment in or with an aqueous solution of salts, acids or both to produce a protective chromate coating.

E. Footings

1. Soil bearing plates shall be attached at the bottom of the post as required in 1.03, or as otherwise shown on the Contract Drawings.

2. Breakaway posts, if required, shall be as shown on the Contract Drawings. Breakaway posts and footings shall be designed in accordance with the requirements of 1.03, as described in 2.01 C.4, or as otherwise shown on the Contract Drawings.

3. Concrete footings, if required by 1.03, shall conform to 2.01 F.

4. Portable sign supports shall be as specified in "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.

F. Concrete

1. All concrete footings for sign construction, as required by 1.03, shall conform to the requirements of Division 3 Section on concrete.

2.02 CONSTRUCTION FEATURES

A. Sign face text, symbol and border layouts shall be as shown on the Contract Drawings and shall conform to the requirements of the FHWA's MUTCD.

B. Sign characters shall be as shown on the Contract Drawings, or if not shown, shall be in accordance with the FHWA's SHS, and shall include letters, numerals, symbols and borders.

C. Sign corner and border radii shall be as shown in the FHWA's SHS. If not shown in the SHS, sign corner and border radii shall be approximately one-eighth of the height of the sign but shall not exceed 12 inches. Sign borders shall be as shown in the FHWA's SHS. If not shown in the SHS, sign borders shall be of the same type character as the legend and shall be approximately the same width as the stroke width of the major lettering on the sign.

2.03 FABRICATION

A. Holes shall be drilled; cut edges shall be smooth and true, and free from burrs or ragged breaks. All fabrication except for cutting the lower ends of embedded posts shall be done in the shop. The plywood panels shall be clean, dry, and free from oils, dust, grit or any other contaminants that would adversely affect the adhesion of the retroreflective sheeting.

B. In preparing sign panels for retroreflective sheeting, the entire Grade A surface to be covered shall be wiped down with a tack cloth to remove all saw dust and sanding residue.

C. All panel and batten surfaces to be glued shall be slightly roughened and then glued with waterproof adhesive prior to assembly.

D. After panel preparation, the edges and back or rear surface of all sign panels and battens shall be painted with two coats of approved white exterior paint.

PART 3. EXECUTION

3.01 INSTALLATION

A. Erect and remove signs as shown on the Contract Drawings, or as ordered by the Engineer, and in such a manner that the traveling public is informed and protected at all times.

B. Side-of-road ground mounted signs shall normally be erected so that the sign face is truly vertical to the profile line, and so the intersection angle measured between the sign face and the centerline of the travel lane which the sign serves is 93 degrees. Where lanes divide or curve, sign faces shall be oriented to be most effective both day and night, and to avoid the possibility of specular reflection.

C. Wood sign posts for side-of-road mounting shall be embedded in the soil to the depth in accordance with the design requirements in 1.03. The hole for the embedment shall be excavated using a manual post-hole digger or appropriately sized power driven auger. After the hole has been excavated, align the post to the sign face direction, hold vertical in the hole, and tamp suitable excavated material in the annular space. Holes resulting from sign post removals shall be filled with suitable material to restore the areas to their original states as directed by the Engineer.

D. Securely fasten all signs to their supports with bolts, nuts and washers of aluminum (2024-T4 alloy) or hot-dip galvanized steel in accordance with 2.01 D and in accordance with the design requirements in 1.03.

E. Use plywood battens and aluminum panel stiffeners as required by 1.03 and in conformance with the applicable requirements of 2.01.

F. Horizontal and vertical sign clearances shall be as shown on the Contract Drawings.

G. Other non-wood post mounting of plywood signs, such as overhead sign installations, shall be as shown on the Contract Drawings and as specified in 1.03 and 1.04.

H. Concrete footings, if required by 1.03, shall be placed in accordance with the requirements of Division 3 Section on concrete, and shall not extend more than 4 inches above grade.

3.02 FIELD QUALITY CONTROL

A. Field Inspections

1. Immediately prior to erection, all material will be inspected by the Engineer for damage that is attributable to improper transportation, handling or storage procedures.

2. The Engineer will conduct an inspection of each completely erected sign in the daylight and at night for proper location, line and grade of signs, vertical post alignment, condition, appearance, reflectorization and visibility.

3. As the Work progresses, the location, position and condition of all signs shall be monitored by Contractor in accordance with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.

END OF SECTION

SECTION 02850

PLYWOOD SIGN PANELS AND WOOD SIGN POSTS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

A. Shop Drawings

Detailed sign face layout for all sign panels showing letter height, width, colors, spacing between letters, words, symbols and lines, border width, symbols details and overall dimensions of the sign panels.

1. Shop drawings of sign panel and posts showing the sizes of the members and their connection details. Also show the total length of the posts for each sign and show an elevation view of each of the signs as erected with vertical clearance below the lowest sign panel to adjacent roadway, and other relevant dimensions.

B. Catalog Cuts

Catalog cuts of all the materials used for sign faces.

C. Calculations

Prior to fabrication, submit computations for the design of the sign panels and supports, as required in 1.03, signed by a Professional Engineer licensed to practice in the State where the Work is performed.

END OF APPENDIX "A"

SECTION 02850

PLYWOOD SIGN PANELS AND WOOD SIGN POSTS

INSTRUCTIONS TO SPECIFIER

A. Contract Drawings

Ensure that the Contract Drawings show the following items specified in the text:

(1.01 A.1)	Sign type usage of plywood sign panels.
(2.01 A.3)	Type of retroreflective sheeting.
(2.01 E.1)	Attachment of soil bearing plates to post.
(2.01 E.2)	Breakaway posts and footings details.
(2.02 A)	Sign face text, symbol and border layout details.
(2.02 B)	Sign characters including letters, numerals, symbols and borders used.
(3.01 A)	Details for erection and removal of signs.
(3.01 F)	Horizontal and vertical sign clearances.
(3.01 G)	Mounting of any plywood signs on non-wood posts.

B. Other Items

Ensure that the following clauses and Specification Sections are included in the Contract Booklet as required:

(2.01 E.4; 3.02 A.3)	Division 1 - General Provisions – "Maintenance of Traffic and Work Area Protection".
(2.01 F.1; 3.01 H)	Division 3 Section on Concrete.

END OF INSTRUCTIONS

DIVISION 2

SECTION 02851

ALUMINUM SIGN PANELS AND SUPPORTS

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for the following:

1. Aluminum sign panels for use in permanent and temporary pedestrian, bicycle, and vehicular, guide, warning and regulatory roadway signs.
2. Posts and footings for aluminum sign panel installations.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Association of State Highway and Transportation Officials (AASHTO)	
LTS-5-I2	Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals.
MASH	Manual for Assessing Safety Hardware.
American National Standards Institute (ANSI) / American Society of Mechanical Engineers (ASME)	
ANSI/ASME B18.2.1	Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
ANSI/ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
ANSI/ASME B1.13	Metric Screw Threads: M Profile.
American Society for Testing and Materials (ASTM International)	
ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
ASTM A 193	Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
ASTM A 194	Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
ASTM A 325	Specification for Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
ASTM A 490	Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
ASTM B 209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

ASTM B 211	Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire.
ASTM B 221	Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
ASTM D 4956	Specification for Retroreflective Sheeting for Traffic Control.
	American Welding Society, Inc. (AWS)
AWS D1.2	Structural Welding Code – Aluminum.
	Federal Highway Administration (FHWA)
MUTCD	Manual on Uniform Traffic Control Devices.
SHS	Standard Highway Signs.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Design of signs, supports and framing shall provide sufficient strength to withstand the wind loading generated by a basic wind speed of 120 miles per hour as per AASHTO LTS-5-I2.

B. The construction of all signs shall be in conformance with the FHWA's MUTCD and AASHTO's MASH.

1.04 QUALITY ASSURANCE

A. All welders shall be qualified in accordance with the qualification procedures of AWS D1.2.

1.05 DELIVERY, STORAGE, AND HANDLING

All sign components and materials shall be transported and handled in a manner that shall cause no permanent deformation, injury or damage. Store sign components and materials above ground.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Aluminum Sign Panels

1. Aluminum sheets and plates shall conform to ASTM B 209, Alloy 6061-T6.

2. Fabricate panels from standard sheet widths. The thickness for panel sizes of 30 inches by 30 inches or smaller shall be 0.080 inch and the thickness of larger panels shall be 0.125 inch, unless otherwise shown on the Contract Drawings.

3. Panel blanks shall be free from laminations, blisters, open seams, pits, holes or defects that may affect their strength, appearance or use. The thickness shall be uniform and the blanks shall be commercially flat.

B. Retroreflective Sheeting

1. Retroreflective sheeting shall be colored, flexible, weather resistant and shall have a smooth outer surface. If the retroreflective sheeting contains spherical lens elements, the lens elements shall be embedded within a transparent plastic, to produce a smooth, flat outer surface. All sheeting shall be of uniform appearance, free from ragged edges, cracks, scales, blisters or other defects.

2. Prepare the surface of the sign panels for the application of the retroreflective sheeting in strict accordance with the recommendations of the manufacturer of the retroreflective sheeting.

3. Retroreflective sheeting shall be one of the following ASTM D 4956 types, as shown on the Contract Drawings:

   a. ASTM Type I: A medium-intensity reflective sheeting also known as engineer grade. Use for pedestrian signs, except where high reflectivity is required, as shown on the Contract Drawings.

   b. ASTM Type III: A high-intensity reflective sheeting also known as high intensity. Use for pedestrian signs, temporary delineators and other work zone devices with the exception of vehicular and bicycle construction signs.

   c. ASTM Type IX: A very-high-intensity retroreflective sheeting having highest retroreflective characteristics at short road distances. Use for bicycle and pedestrian signs, temporary vehicle construction signs, delineators, construction zone devices and vertical panels.

   d. ASTM Type XI: A full cube prismatic retroreflective sheeting with highest level of retroreflective characteristics. Use for permanent vehicular, pedestrian and bicycle signs.

4. Comply with sign design standards in FHWA's MUTCD, including design standards for retroreflectivity, illumination and color.

C. Sign Supports

1. Sign posts, framing, supports, foundations and mountings shall be so constructed as to hold signs in a proper and permanent position, and to resist swaying in the wind or displacement by vandalism.

2. Sign posts, framing, supports and foundations shall be constructed and installed in accordance with the FHWA's MUTCD and AASHTO's LTS-5-I2.

3. All sign posts, framing and supports shall be metal. The use of wood and other non-metallic materials will not be permitted for the fabrication of any sign posts, framing and supports.

D. Stiffeners, Brackets and Miscellaneous Hardware

1. Horizontal and vertical sign panel stiffeners (Z bars) and panel brackets shall be fabricated of aluminum Alloy 6061-T6 conforming to ASTM B 221.

2. Other miscellaneous aluminum hardware including bolts, nuts, washers, screws, rivets, pull-type lockbolts and serrated or knob stem blind rivets shall be fabricated to meet the requirements of ASTM B 209 and ASTM B 211 for Alloy 2024-T4 with No. 205 Alumilite Finish. Ensure that bolt heads and nuts are American National Standard, Regular Series, hexagonal, semi-finished, conforming to ANSI/ASME B18.2.1 and ANSI/ASME B18.2.2, and that threads are American National Standard, Coarse Series, Class 2 Fit, conforming to ANSI/ASME B1.13. Finish bolts with an anodic coating thickness of not less than 0.0002 inches and chromate seal. Use washers conforming to ASTM B 209, Alloy 2024-T3.

3. High strength steel bolts, nuts and washers used in steel-to-steel connections shall conform to ASTM A 325 or ASTM A 490. High-strength bolts, nuts and washers shall be galvanized in accordance with ASTM A 153. Steel bolts, nuts and washers used in contact with aluminum shall be coated with cadmium or a cadmium/tin combination. All cadmium and cadmium/tin coatings shall be given a chromate treatment in or with an aqueous solution of salts, acids or both to produce a protective chromate coating.

4. Stainless steel nuts shall conform to ASTM A 194, Grade 8F, except that the nuts shall be lock nuts with semifinished hex nuts equivalent to American Standard Heavy Series. Stainless steel bolts, washers and screws shall conform to ASTM A 193, austenitic steel.

E. Footings and Foundations

1. Footings and foundations shall be designed in accordance with the requirements of 1.03, or as otherwise shown on the Contract Drawings.

2. Breakaway posts, if required, shall be as shown on the Contract Drawings. Breakaway posts and footings shall be designed in accordance with the requirements of 1.03, or as otherwise shown on the Contract Drawings.

3. Concrete footings, if required by 1.03, shall conform to 2.01 F.

F. Concrete

1. All concrete footings and foundations for sign construction, as required by 1.03, shall conform to the requirements of Division 3 Section on concrete.

2.02 CONSTRUCTION FEATURES

A. Sign face text, symbol, and border layouts shall be as shown on the Contract Drawings and shall conform to the requirements of the FHWA's MUTCD.

B. Sign characters shall be as shown on the Contract Drawings, or if not shown, shall be in accordance with the FHWA's SHS, and shall include letters, numerals, symbols and borders.

C. Sign corner and border radii shall be approximately one-eighth of the height of the sign but shall not exceed 12 inches; or radii shall be as shown in the FHWA's SHS. Sign borders shall be of the same type character as the legend and shall be approximately the same width as the stroke width of the major lettering on the sign, or as shown in the FHWA's SHS.

D. The Contract number shall be painted on the bottom right of the back of sign panel. Text height shall be 2 inches and painted in white. For overhead sign structures, Contract number, sign panel number as well as sign structure number shall also be painted on the bottom right and back of sign panel.

2.03 FABRICATION

A. All shearing, cutting and punching shall be performed prior to preparing the blanks for application of retroreflective material. All edges and corners shall be filed or ground smooth, leaving the entire sign blank free from sharp edges and burrs.

B. The blanks shall be cleaned, degreased, and chromated or otherwise properly prepared in accordance with the sheeting manufacturer's recommendations. After treatment, clean cotton gloves shall be used in handling the sign blank until the retroreflective sheeting is applied. All fabrication except for cutting the lower ends of embedded posts shall be done in the shop. The aluminum panels shall be clean, dry and free from oils, dust, grit or any other contaminants that would adversely affect the adhesion of the retroreflective sheeting.

C. Welding of aluminum shall consist of inert gas shielded metal arc welding with consumable electrodes. All welding of aluminum shall be performed in the shop. No field welding of aluminum shall be permitted.

D. Necessary drilling of holes required for shop and field assembly after sheeting is applied shall be done such that the drill bit does not snag, rip or damage the sheeting outside of the drill hole. Holes shall be deburred prior to assembly.

E. Exposed bolt heads on the face of the assembly sign shall be touched up with enamel paint of the same color as the sheeting surrounding the bolts.

PART 3. EXECUTION

3.01 INSTALLATION

A. Erect, cover and remove signs as shown on the Contract Drawings.

B. Side-of-road ground mounted signs shall be erected so that the sign face is truly vertical to the profile line, and so the intersection angle measured between the sign face and the centerline of the travel lane which the sign serves is 93 degrees. Where lanes divide or curve, sign faces shall be oriented to be most effective both day and night, and to avoid the possibility of specular reflection.

C. Securely fasten all sign panels to their supports with bolts, nuts and washers of aluminum (2024-T4 alloy), hot-dip galvanized steel or stainless steel in accordance with 2.01 D, and in accordance with the design requirements in 1.03.

D. Horizontal and vertical sign clearances shall be as shown on the Contract Drawings.

E. Concrete footings, if required by 1.03, shall be placed in accordance with the requirements of Division 3 Section on concrete, and shall not extend more than 4 inches above grade.

3.02 FIELD QUALITY CONTROL

A. Field Inspections

1. Immediately prior to erection, all material will be inspected by the Engineer for damage that is attributable to improper transportation, handling or storage procedures.

2. The Engineer will conduct an inspection of each completely erected sign in the daylight and at night for proper location, line and grade of signs, vertical post alignment, condition, appearance, reflectorization and visibility.

3. As the Work progresses, the location, position and condition of all signs shall be monitored by the Contractor in accordance with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.

END OF SECTION

SECTION 02851

ALUMINUM SIGN PANELS AND SUPPORTS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

A. Shop Drawings

1. Detailed sign face layout for all sign panels showing letter height, width, colors, spacing between letters, words, symbols and lines, border width, symbols details and overall dimensions of the sign panels.
2. Shop drawings of sign panels showing the sizes of the members and their connection details including joining and anchorage, stiffening and bracing.

B. Catalog Cuts

Catalog cuts of all the materials used for sign faces.

C. Calculations

Prior to fabrication, submit computations for the design of the sign panels and supports, including all footings and foundations, as required in 1.03, signed by a Professional Engineer licensed to practice in the State where the Work is performed.

END OF APPENDIX "A"

SECTION 02851

ALUMINUM SIGN PANELS AND SUPPORTS

INSTRUCTIONS TO SPECIFIER

A. Contract Drawings

Ensure that the Contract Drawings show the following items specified in the text:

(2.01 A.2)	Specifications for the fabrication of sign panels.
(2.01 A.3)	Type of retroreflective sheeting.
(2.01 E.1)	Footings and foundation design details.
(2.01 E.2)	Breakaway posts and footings details.
(2.02 A)	Sign face text, symbol and border layout details.
(2.02 B)	Sign characters including letters, numerals, symbols and borders used.
(3.01 A)	Details for erection, covering and removal of signs.
(3.01 D)	Horizontal and vertical sign clearances.

B. Other Items

Ensure that the following clauses and Specification Sections are included in the Contract Booklet as required:

(2.01 F.1; 3.01 E)	Division 3 Section on Concrete.
(3.02 A.3)	Division 1 - General Provisions – "Maintenance of Traffic and Work Area Protection".

C. Designer Note

1. If required in Contract Drawings, prior to painting, clean all galvanized surfaces of all dirt, grease, and other foreign materials. All exposed galvanized steel and aluminum, including sign panel and structure elements, post, back of signs, z-bars and fasteners, shall be painted with Paint System N-2S (semi-gloss) as per Specification Section 09910. The top finish paint coat shall be dark gray to match Benjamin Moore color 1631.

END OF INSTRUCTIONS

DIVISION 3

SECTION 03602

GROUTING (NON-METALLIC)

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for non-metallic, non-shrink, cement-based grouting.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM C 109	Test Method for Compressive Strength of Hydraulic Cement Mortars
ASTM C 191	Test Method for Time of Setting of Hydraulic Cement by Vicat Needle
ASTM C 827	Test Method for Early Volume Change of Cementitious Mixtures

1.03 JOB CONDITIONS

Do not mix or place grout when the ambient temperature is below 40 degrees F or conditions indicate that the ambient temperature will fall below 40 degrees F within 72 hours, unless the areas to be grouted are enclosed and heated in an approved manner or otherwise approved by the Engineer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver grout in the manufacturer's sealed original bags or containers bearing the manufacturer's name and product identification, in a manner to prevent damage by breakage, water or moisture.

B. Store all material on platforms and cover as necessary to protect it from water and moisture.

C. Deliver, protect and handle all tools and equipment in a manner to prevent damage that may make them defective for the purpose for which they are intended.

1.05 SUBMITTALS

See Appendix "A" for Submittal Requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Grout shall be one of the following:

1. "Masterflow 713" - manufactured by Master Builders
2. "Five Star Grout" - manufactured By U.S. Grout Corporation
3. "Euco N-S Grout" - manufactured by Euclid Chemical Co.

B. Grout shall be premeasured and prepacked by the manufacturer, requiring only addition of potable water for mixing.

PART 3. EXECUTION

3.01 PREPARATION

Areas to be grouted as shown on the Contract Drawings shall be cleaned of all foreign materials, to the satisfaction of the Engineer.

3.02 MIXING AND PLACING

A. Use only the crew trained by the manufacturer's representative.

B. Mix and place the grout in accordance with manufacturer's methods approved by the Engineer.

C. Placement shall be continuous to avoid cold joints and voids. Grout shall be rodded or spaded to prevent the formation of air pockets.

3.03 FIELD TESTS

A. The Engineer may take and test samples of the grout being placed in accordance with ASTM C 109, C 191 and C 827.

B. In the event that tests of the grout placed reveal any failure to meet requirements of this Section, the Engineer will require removal and replacement of all portions of grout from the batch from which the sample was taken and the discontinuance of grouting until the Contractor has demonstrated to the satisfaction of the Engineer that the causes for failure have been corrected.

END OF SECTION

SECTION 03602

GROUTING (NON-METALLIC)

APPENDIX "A"

SUBMITTALS

A. Submit to the Manager, Materials Engineering Division, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397, a sample of the grout material for approval.

B. Submit manufacturer's instructions and methods for handling, storage, mixing and placing of the grout, for approval.

END OF APPENDIX "A"

DIVISION 5

SECTION 05080

STAINLESS STEEL FINISH

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies the application and repair of a non-directional stainless steel finish for Work specified in other Sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Uniformity of Finish: All stainless steel surfaces of each required type (sheet, plate and bars) shall appear to be identical. Closely follow the submittal requirements found in Appendix "A" of this Section, as supplemented by additional submittal and mock-up requirements found in other Stainless Steel Specification sections.

B. If the Engineer rejects stainless steel sample submissions for the reason that the non-directional finish was applied by a different entity than the one that produced the originally approved samples, have all rejected stainless steel refinished by the approved entity at no additional cost to the Authority.

C. Finisher Qualifications: The entity performing the stainless steel non-directional finish shall have completed within the last three years a minimum of two non-directional stainless steel applications of at least 1,500 square feet in area each.

D. Unless otherwise specified or otherwise shown on the Contract Drawings, all exposed stainless steel surfaces shall receive the same non-directional finish.

E. Furnish stainless steel products produced from the same mill for all stainless steel Work to receive a non-directional finish.

1.03 SUBMITTALS

A. See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 STAINLESS STEEL NON-DIRECTIONAL FINISH

A. The stainless steel to receive a non-directional finish shall receive an AISI No. 4 base finish applied prior to application of final non-directional finishing. Apply over the AISI No. 4 base finish a "satin" or "angel-hair" type finish made up of various sized and shaped grain lines, ranging from 1 to 10 millimeters and going in all directions and giving the appearance of very fine random scratches. This applied treatment shall be achieved through the use of a rotating disk hand-held power buffer and shall be applied using a circular motion. Do not use any ferrous metal tools (other than stainless steel) in working the finished surfaces of stainless steel.

B. The standard for non-directionality of stainless steel finishes applied under this Section shall be that the variation between adjacent areas of stainless steel must be imperceptible to the naked eye under normal daylight conditions. Submit range samples defining the maximum variation of finish that can be anticipated in the work. Pieces abutting or within 6 inches of each other, though not abutting, shall not vary by more than 1/2 the range and the variation shall be imperceptible to the naked eye under normal daylight conditions. Carefully inspect parts in the shop, grade for assembly compatibility and mark for installation location.

C. Finishes shall be shop-applied, unless prior permission to utilize other application methods is given in writing by the Engineer.

PART 3. EXECUTION

3.01 INSTALLATION

A. Carefully install stainless steel Work so as to minimize the occurrence of scratching and other surface damage. Follow the requirements of the individual specification Sections for delivery, storage and handling procedures.

B. Repair of Damaged Surfaces

Should the surfaces become scratched or otherwise damaged upon or after installation, repair in the field to the satisfaction of the Engineer.

C. Refer to the individual Sections of these Specifications noted above in 1.01 A for additional installation requirements.

END OF SECTION

SECTION 05080

STAINLESS STEEL FINISH

APPENDIX "A"

SUBMITTALS

A. These submittal requirements are complementary to the submittal requirements found in other Stainless Steel Specifications Sections.

B. Samples for Initial Selection: For required non-directional finish, submit fourteen (14) 24 inch x 24 inch sample panels of 18 gage sheet and 3/16 inch plate and fourteen (14) minimum 18-inch long samples of bars/structural shapes, if any. Samples shall show the full range of expected finish of these samples. The Engineer will select between six (6) and nine (9) samples for each type of material/finish as the acceptable range for Work of this Contract.

C. Samples for Verification: Samples shall be on lengths of bars not less than 12 inches and sheet/plate/panels not less than 24-inch square showing the full range expected in the finished construction. Should an individual Stainless Steel specification require more extensive samples, those requirements shall take precedence. These requirements are in addition to any mock-up requirements for individual Work items or the assemblies in which they occur.

D. Submit certificates, including types, quantities and batch numbers, for all stainless steel products receiving a non-directional finish.

END OF APPENDIX "A"

DIVISION 5

SECTION 05506

MISCELLANEOUS STEEL

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for metal fabrications, including but not limited to structural steel and iron shapes, plates, bars, tubes and pipe.

B. Items specified in this Section include but are not limited to the following, where shown on the Contract Drawings:

1. Loose steel lintels.
2. Shelf angles.
3. Ladders and safety cages.
4. Floor plates.
5. Nosings and treads.
6. Pipe bollards.
7. Miscellaneous steel framing and supports.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American National Standards Institute (ANSI)
ANSI A 14.3	Safety Requirements for Fixed Ladders.
	American Society of Mechanical Engineers (ASME)
ASME B 18.2.1	Square and Hex Bolts and Screws, Inch Series.
ASME B 18.6.1	Wood Screws (Inch Series).
ASME B 18.6.3	Machine Screws and Machine Screw Nuts.
ASME B 18.21.1	Lock Washers (Inch Series).
ASME B 18.22.1	Plain Washers.
	American Society for Testing and Materials (ASTM)
ASTM A 27	Specification for Steel Castings, Carbon, for General Application.
ASTM A 36	Specification for Carbon Structural Steel.
ASTM A 47	Specification for Ferritic Malleable Iron Castings.
ASTM A 48	Specification for Gray Iron Castings.
ASTM A 53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
ASTM A 123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

ASTM A 307	Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
ASTM A 500	Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
ASTM A 501	Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
ASTM A 563	Specification for Carbon and Alloy Steel Nuts.
ASTM A 780	Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
ASTM A 786	Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
ASTM A 1011	Specification for Sheet, Steel and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
ASTM B 633	Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
ASTM C 1028	Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
ASTM C 1107	Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
ASTM D 1187	Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
ASTM E 488	Test Method for Strength of Anchors in Concrete and Masonry Elements.
ASTM E 935	Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
ASTM F 568M	Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners.
ASTM F 593	Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
ASTM F 594	Specification for Stainless Steel Nuts.
	American Welding Society, Inc. (AWS)
AWS D1.1	Structural Welding Code – Steel.
AWS D1.3	Structural Welding Code – Sheet Steel.
	Code of Federal Regulations (CFR)
29 CFR Part 1910, Subpart D	Fixed Ladders.
	The Society for Protective Coatings (SSPC)
SSPC-Paint 20	Paint Specification No. 20 – Zinc Rich Primers (Type I, Inorganic, and Type II, Organic).
SSPC-PA 1	Shop, Field and Maintenance Painting of Steel.
SSPC-SP 3	Surface Preparation Specification No. 3 – Power Tool Cleaning.
SSPC-SP 6	Surface Preparation Specification No. 6 – Commercial Blast Cleaning.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Ladders

When installed, if any, shall comply with the following minimum requirements for structural performance, unless otherwise shown on the Contract Drawings:

1. Treads and Platforms

   Capable of withstanding a uniform load of 100 lbs. per sq. ft. and a concentrated load of 300 lbs., so located as to produce maximum stress conditions.

2. Handrails and Toprails

   Capable of withstanding the following loads applied as indicated below:

   a. Uniform load of 50 lbs. per linear ft. applied simultaneously in both vertical and horizontal directions.

   b. Concentrated load of 200 lbs. applied at any point in any direction when tested per ASTM E 935.

   c. Uniform and concentrated loads above need not be assumed to act concurrently.

3. Guards

   Intermediate rail balusters and panel fillers capable of withstanding a horizontal uniform load of 50 lbs. per sq. ft. of gross area of guard, including open areas of which they are part, of fabrication required or as shown on the Contract Drawings.

1.04 QUALITY ASSURANCE

A. When required by Appendix "A", submit design calculations for ladders, signed and sealed by a Professional Engineer licensed in the state in which Work is to be performed, indicating compliance with these Design and Performance Requirements.

B. Fabricator Qualifications

Firm experienced in producing metal fabrications similar to those indicated for Work of this Contract with a record of successful in-service performance and with sufficient production capacity to produce required units without delaying the Work.

C. Engineer Qualifications

A professional engineer who is legally qualified to practice in jurisdiction where construction site is located and who is experienced in providing engineering services required for applications shown on the Contract Drawings.

D. Welding Standards

Comply with applicable provisions of AWS D1.1 *Structural Welding Code – Steel* and AWS D1.3 *Structural Welding Code – Sheet Steel*.

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

E. Field Measurements

Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabricating. Show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Ferrous Metals

1. Metal Surfaces: For fabrication of Work exposed to view, use materials that are smooth and free of surface blemishes including pitting, roughness, seam marks, roller marks and rolled trade names.
2. Steel Plates, Shapes and Bars: ASTM A 36.
3. Rolled Steel Floor Plates: ASTM A 786.
4. Steel Bar Grating: ASTM A 1011 or ASTM A 36.
5. Steel Tubing: ASTM A 500, cold-formed; or ASTM A 501, hot-rolled; for exterior installations. Steel tubing shall be hot-dip galvanized coated per ASTM A 53.
6. Steel Pipe: ASTM A 53; type and grade (if applicable) as selected by fabricator and as required for design loading; Schedule 40 (standard weight), unless otherwise shown on the Contract Drawings; black finish, unless galvanized coating is shown on the Contract Drawings.
7. Brackets, Flanges and Fittings: Cast or formed metal of the same type material and finish as supported construction.
8. Gray Iron Castings: ASTM A 48, Class 30.
9. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47 Grade 32510, or cast steel, ASTM A 27. Furnish bolts, washers and shims as required, hot-dip galvanized per ASTM A 153.

B. Fasteners

1. General

   Zinc-Plated: ASTM B 633, Class Fe/Zn 25 (Service Condition 4–very severe) for exterior use and Class Fe/Zn 8 (Service Condition 2–moderate) where built into exterior walls. Select fasteners for type, grade and class required for application shown on the Contract Drawings.
2. Bolts and Nuts: Regular hexagon head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563, and where indicated, flat washers.
3. Machine Screws: ASME B18.6.3.
4. Lag Bolts: ASME B18.2.1.
5. Wood Screws: Flat head, carbon steel, ASME B18.6.1.
6. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.

7. Plain Washers: Round, carbon steel, ASME B18.22.1.

8. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

   a. Interior Locations: Carbon steel components zinc-plated complying with ASTM B 633, Class Fe/Zn 8.

   b. Exterior Locations: Alloy Group 1 stainless steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

C. Paint

1. Shop Primer for Ferrous Metal

   Zinc-rich primer, complying with SSPC-Paint 20, compatible with substrates and finish paint systems shown on the Contract Drawings. Comply with applicable requirements of Division 9 Section on Painting.

2. Galvanizing Repair Paint

   High zinc dust content paint for regalvanizing welds in galvanized steel with dry film containing minimum 94 percent zinc dust content, complying with SSPC-Paint 20.

3. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Grout

Pre-mixed, factory-packaged, nonshrink type, complying with ASTM C 1107, as manufactured by one of the following, or approved equal, for specified application:

1. Non-Metallic:

   "Five Star Grout", Five Star Products, Inc., Fairfield, CT
   "Masterflow 713 Plus", Master Builders, Inc. (Degussa), Cleveland, OH
   "NS Grout", Euclid Chemical Co., Cleveland, OH

2. Metallic:

   "Embeco 636 Plus", Master Builders, Inc. (Degussa), Cleveland, OH
   "Five Star Metallic Grout", Five Star Products, Inc., Fairfield, CT
   "NS Metallic Grout", Euclid Chemical Co., Cleveland, OH

3. Use metallic grout in concealed locations where not exposed to moisture. Use non-metallic nonstaining grout in exposed, wet and exterior locations, unless otherwise shown on the Contract Drawings.

2.02 FABRICATION

A. General

Fabricate items to sizes, shapes, profiles and dimensions required for application shown on the Contract Drawings or approved Shop Drawings, using proven details of fabrication and support. Use materials of type and thickness shown on the Contract Drawings or specified in this Section for various components of Work or, if not shown, as required to produce strength and durability in finished product for intended use.

1. Shop Assembly: Preassemble items in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly match mark units for reassembly and coordinated installation.
2. Form exposed Work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of 1/32 inch, unless otherwise shown. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
3. Weld corners and seams continuously, complying with AWS D1.1 and D1.3 recommendations as applicable. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.
4. Form exposed connections with hairline joints flush and smooth, using concealed fasteners wherever possible. Exposed fasteners, where used, shall be of type as shown on the Contract Drawings or, if not shown, Phillips flathead (countersunk) screws or bolts.
5. Fabricate joints that will be exposed to weather in a manner to exclude water, or with weep holes where water may accumulate.
6. Cut, drill and tap units to receive anchorage, hardware and similar items.
7. Furnish anchorage of type shown on the Contract Drawings, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use and for design loads. Furnish steel washers, except that where heads and nuts bear on wood structural connections, furnish malleable-iron washers.
8. Galvanizing

   Zinc coating by the hot-dip process for items shown on the Contract Drawings or specified in this Section to be galvanized. Coating thickness shall be as specified in the referenced standards.

   a. Rolled, pressed and forged iron and steel shapes, castings, plates, bars and strip 1/8 inch thick and heavier and assembled fabrications: ASTM A 123.
   b. Iron and steel hardware: ASTM A 153.

B. Steel Ladders

1. Fabricate ladders for locations shown on the Contract Drawings, with dimensions, spacings, details and anchorages as shown. Comply with requirements of ANSI A 14.3 or OSHA 29 CFR 1910, whichever is more stringent.
   a. Side rails shall be 1/2 inch by 2-1/2 inches continuous structural steel flat bar with eased edges, spaced 18 inches apart, unless otherwise shown.

b. Bar rungs shall be 3/4-inch diameter solid structural steel, spaced 12 inches on center.

2. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.

3. Top surface of each rung shall be non-slip; either coat the rung with aluminum oxide (corundum) granules set in epoxy resin adhesive or use a type of manufactured rung that is filled with aluminum oxide grout.

4. Support each ladder at top and bottom and at equally spaced intermediate points, so that no unsupported length of ladder shall exceed 5 feet. Use welded or bolted steel brackets, designed for adequate support and anchorage and to hold ladder clear of the wall surface with a minimum 7-inch clearance from wall to centerline of rungs.

5. Extend rails 42 inches above top rung and return rails to wall or structure, unless other secure handholds are furnished. If the adjacent structure does not extend above the top rung, gooseneck the extended rails back to the structure for secure ladder access.

6. Galvanize ladders, brackets and fasteners.

7. Ship's Ladders, if any

   Fabricate of open type construction with structural steel channel or steel plate stringers, pipe handrails and open steel grating treads, unless otherwise shown on the Contract Drawings. Furnish brackets and fittings necessary for installation.

C. Ladder Safety Cages

Fabricate from structural steel flat bars, assembled by welding. Comply with requirements of ANSI A 14.3 or OSHA 29 CFR 1910, whichever is more stringent.

1. Top and bottom primary hoops shall be 5/16 inch by 4-inch bar. For cages longer than 20 feet, space intermediate hoops not more than 4 feet on center from 5/16 inch by 2-inch bar between the primary hoops. Vertical flat bars 5/16 inch by 2 inches shall be secured to each hoop at maximum 9-1/2 inches on center, unless otherwise shown on the Contract Drawings. Secure assembled safety cage to ladder rails and adjacent construction shown.

2. Galvanize ladder safety cages and fasteners.

D. Loose Bearing and Leveling Plates

For steel items bearing on masonry or concrete construction, flat, free from warps or twists and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

E. Loose Steel Lintels

1. Fabricate from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

2. Weld adjoining members together to form a single unit where shown on the Contract Drawings.

3. Size loose steel lintels for equal bearing of 1 inch per foot of clear span, but not less than 8 inches bearing at each side of openings, unless otherwise shown on the Contract Drawings.

4. Galvanize loose steel lintels located in exterior walls.

F. Shelf and Relieving Angles

1. Fabricate from steel angles of sizes indicated and for attachment to concrete framing. Fabricate with slotted holes to receive 3/4 inch bolts, spaced not more than 6 inches from ends and not more than 24 inches on center, unless otherwise shown on the Contract Drawings.
2. Miter and weld corners. Provide open joints at expansion and control joints. Joint width shall be 2 inches larger than expansion or control joint.
3. Galvanize shelf and relieving angles located in exterior walls.

G. Miscellaneous Framing and Supports

1. Furnish miscellaneous steel framing and supports not part of structural steel framework, as required by the Contract Drawings to complete the Work.
2. Fabricate miscellaneous units as shown on the Contract Drawings or, if not shown, of required dimensions to receive adjacent other Work to be retained by framing. Fabricate from structural steel shapes, plates and bars of welded construction using mitered joints for field connection, except as otherwise shown on the Contract Drawings.
3. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed. Space anchors 24 inches on center and furnish minimum anchor units of 1-1/4 inch by 1/4 inch by 8 inch steel straps, except as otherwise shown on the Contract Drawings.
4. Fabricate support for suspended toilet partitions as follows:
   a. Beams

      Continuous steel shapes of size required to limit deflection to L/360 between hangers, but use not less than C8 by 11.5 channels or another shape with equivalent structural properties.
   b. Hangers

      Steel rods, 1/2-inch minimum diameter, spaced not more than 36 inches on center. Thread rods to receive anchor and stop nuts. Fit hangers with wedge-shaped washers for full bearing on sloping flanges of support beam.
   c. Braces and Angles

      Steel angles of size required for rigid support of beam and for secure anchorage.
5. Galvanize miscellaneous framing and supports at exterior locations and where shown on the Contract Drawings.

H. Miscellaneous Steel Trim

1. Fabricate units from structural steel shapes, plates and bars, with continuously welded joints and smooth exposed edges, unless otherwise shown on the Contract Drawings. Miter corners and use concealed field splices wherever possible. Furnish cutouts, fittings and anchorages as required for coordination of assembly and installation with other Work.
2. Galvanize miscellaneous steel trim at exterior locations. Galvanize miscellaneous steel trim at interior locations where shown on the Contract Drawings.

I. Floor Plate

1. Fabricate raised-pattern floor plates from rolled-steel floor plate of thickness and in pattern shown on the Contract Drawings.
2. Abrasive-Surface: Manufacturer's standard abrasive granules rolled into surface of steel plate where shown on the Contract Drawings. Coefficient of friction (COF) shall be 0.6 or higher when tested according to ASTM C 1028.
3. Include steel angle stiffeners and fixed and removable sections with steel bar drop handles for lifting as indicated.

J. Extruded Nosings and Treads

1. Fabricate of material, color, sizes and configurations shown on the Contract Drawings. If not shown, fabricate cast-iron units with an integral abrasive finish. Lengths shall be as required to accurately fit each opening or conditions.
   a. Integral abrasive filler shall consist of aluminum oxide (corundum), silicon carbide or a combination of both, in an epoxy resin binder.
   b. Solid abrasive type units without ribs.
2. Available Manufacturers

   Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

   American Safety Tread Co., Inc., Helena, AL
   Balco Inc., Wichita, KS
   Safe-T-Metal Co., Inc., Mineola, NY
   Wooster Products Inc., Wooster, OH
3. Drill for mechanical anchors with countersunk holes located not more than 4 inches from ends and not more than 12 inches on center, evenly spaced between ends, unless otherwise shown on the Contract Drawings. Use closer spacing if recommended by the manufacturer.

K. Cast Nosings, Treads and Thresholds

1. Fabricate units of material, color, sizes and configurations shown on the Contract Drawings. If not shown, furnish cast-iron units with an integral abrasive finish. Lengths shall be as required to accurately fit each opening or conditions.
   a. Cast units with an integral abrasive grit consisting of aluminum oxide (corundum), silicon carbide or a combination of both.
   b. Plain surface texture, except where fluted or cross-hatched surfaces are shown on the Contract Drawings.
2. Available Manufacturers

   Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

   American Safety Tread Co., Inc., Helena, AL
   Balco Inc., Wichita, KS
   Safe-T-Metal Co., Inc., Mineola, NY
   Wooster Products Inc., Wooster, OH
3. Furnish anchors for embedding units in concrete, either integral or applied to units, as standard with the manufacturer.

4. Drill for mechanical anchors with countersunk holes located not more than 4 inches from ends and not more than 12 inches on center, evenly spaced between ends, unless otherwise shown on the Contract Drawings. Use closer spacing if recommended by the manufacturer.

L. Corner Guards

Fabricate from steel angles of sizes as shown on the Contract Drawings, but not less than 3 by 3 by 5/16 inch extending from floor to 42 inches above floor. Fabricate with 3/8 inch steel base plates for bolting to floor and with 1/4 by 2 inch steel strap braces at top. Furnish at least 2 vertical angles at each location along the length of the ladder where connections are made (except at internal corners), with strap extended between angles and from each angle to wall or column.

M. Wheel Guards

Fabricate from 3/4-inch thick, hollow-core, gray-iron castings of size and shape shown on the Contract Drawings. Fabricate with holes for countersunk anchor bolts and grouting.

N. Pipe Bollards

1. Fabricate from Schedule 40 black steel pipe, unless otherwise shown on the Contract Drawings. Prime and finish with two coats of paint as specified in Division 9 Section on Painting. Cap bollards with 1/4-inch minimum steel plate finished to match pipe, unless indicated to be concrete filled.
2. Fabricate sleeves for bollard anchorage from steel pipe, matching shape and configuration of bollard and with outside dimensions not less than 3/4 inch greater than outside dimensions of bollard. Weld 1/4-inch thick steel plate closures to bottoms of sleeves. Plate closures shall be 1 inch greater in length and width than outside dimensions of sleeves.
3. Reflective marking tape, if any, shall be in color shown and as specified in Division 2 Section on removable retro-reflective pavement marking tape.

2.03 SHOP PAINTING

A. Surface Preparation

Prepare ferrous metal surfaces to comply with requirements for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications as follows:

1. Exterior: SSPC-SP 6.
2. Interior: SSPC-SP 3.

B. Apply shop primer to surfaces of metal fabrications, except those that are galvanized or shown on the Contract Drawings to be embedded in concrete or masonry, in compliance with requirements of SSPC-PA 1 for shop painting.

PART 3. EXECUTION

3.01 PREPARATION

Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the construction site in time for installation.

3.02 INSTALLATION

A. Furnish and install anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction, including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

B. Cutting, Fitting and Placement

Perform cutting, drilling and fitting required for installation of metal fabrications. Set Work accurately in location, alignment and elevation plus level, true and free of rack, measured from established lines and levels. Furnish and install temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

C. Fit exposed connections accurately together to form tight hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint coat. Do not weld, cut or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

D. Field Welding

Comply with AWS D1.1 and D1.3 for procedures of manual shielded metal-arc welding, appearance and quality of welds made and methods used in correcting welding Work.

E. Setting Loose Plates

1. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of bearing plates or surfaces.
2. Set loose leveling and bearing plates on wedges or other adjustable devices. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.

F. Miscellaneous Framing and Supports

Install framing and supports in compliance with requirements of items being supported, including manufacturer's written instructions and requirements.

G. Supports for Toilet Partitions

Anchor supports securely to and rigidly brace from overhead building structure.

H. Nosings, Treads and Thresholds

1. Install with anchorage system indicated complying with manufacturer's recommendations.
2. Apply black bituminous coating to concealed bottoms, sides and edges of cast-iron units set into concrete.
3. Seal thresholds exposed to exterior with elastomeric sealant, complying with the applicable Division 7 Section on Sealants, for a watertight installation.

I. Wheel Guards

Anchor wheel guards to concrete or masonry construction complying with manufacturer's instructions. Fill cores solidly with concrete.

J. Bollards

1. Install bollards vertical to line and grade shown on the Contract Drawings.
2. Anchor bollards with 4 bolts through bottom plate with minimum 4 inch embedment into concrete, by core-drilling and grouting into concrete or by anchoring in place with concrete footings, as shown on the Contract Drawings.
3. Vibrate and tamp concrete to consolidate. Support and brace bollard until concrete has cured.
4. Seal joint between concrete footings and surrounding pavement and sidewalk in accordance with Division 2 Section on Pavement Joint Sealing.

3.03 ADJUSTING

A. Touch-Up Painting

1. Shop Painted Surfaces: Immediately after erection, clean field welds, bolted connections and abraded areas of shop paint. Paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop painted surfaces. Apply by brush or spray in a minimum dry film thickness of 2.0 mils.
2. Galvanized Surfaces: Immediately after erection, clean field welds, bolted connections and abraded areas. Apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 05506

MISCELLANEOUS STEEL

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

A. Product Data

Manufacturer's technical information, specifications, anchor details and installation instructions for miscellaneous steel products used, including grout and paint products.

B. Shop Drawings

For fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Furnish templates for anchor and bolt installation under other Sections if required.

C. Samples

Representative samples of materials, color, texture or design of finished products for nosings, treads and thresholds, if any.

D. Design Calculations

Submit design calculations signed and sealed by a professional engineer licensed in the state in which Work is to be performed, showing compliance with Design and Performance Requirements loading criteria.

E. Qualifications

1. Professional Engineer: Include experience qualifications.
2. Fabricator: Experience, in-service performance and capability qualifications.
3. Welder: Evidence of current AWS certification.

END OF APPENDIX "A"

DIVISION 7

SECTION 07270

FIRESTOPPING

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies firestopping for the following applications:

1. Penetrations through fire resistance rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
4. Sealant joints in fire-resistance-rated construction.
5. Voids at the intersection of partitions with structure above.

1.02 REFERENCES

The following is a listing of publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM E 84	Surface Burning Characteristics of Building Materials
ASTM E 119	Fire Tests of Building Construction and Materials
ASTM E 136	Behavior of Materials in a Vertical Tube Furnace
ASTM E 814	Fire Tests of Through - Penetration Fire Stops

Underwriters Laboratories (UL)

Fire Resistance Directory

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated in this Specifications Section, and the passage of smoke and other gases.

B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings shown on the Contract Drawings, as determined per ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814, where shown on the Contract Drawings and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where firestop systems protect penetrating items larger than a 4-inch-diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings shown on the Contract Drawings, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

E. For firestopping exposed to traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.

3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

F. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E 84.

G. Conditions Requiring Firestopping

1. General:

a. Provide firestopping for conditions specified whether or not firestopping is shown on the Contract Drawings, and, if shown, whether such material is designated as insulation, safing or otherwise.

b. Insulation types specified in other Sections of the Specifications shall not be installed in lieu of firestopping material specified herein.

2. Building Exterior Perimeters:

a. Where exterior facing construction is continuous past a structural floor, and a space (i.e. construction joint) would otherwise remain open between the inner face of the wall construction and the outer perimeter edge of the structural floor, provide firestopping to equal the fire resistance of the floor assembly. Mineral wool by itself is not an acceptable firestop. If mineral wool is part of firestop system, the mineral wool must be completely covered by appropriate thickness of UL or Warnock Hersey listed firestop sealant.

b. Firestopping shall be provided whether or not there are any clips, angles, plates, or other members bridging or interconnecting the facing and floor systems, and whether or not such items are continuous.

c. Where an exterior wall of composite type construction passes a perimeter structural members, such as a girder, beam, or strut and the finish on the interior wall face does not continue up too close with the underside of the structural floor above, thus interrupting the fire-resistive integrity of the wall system, and a space would otherwise remain open between the interior face of the wall and lower edge of the structural members, provide firestopping to continuously fill such open space.

3. Interior Walls and Partitions:

a. Construction joints between top of fire rated walls and underside of floors above, shall be firestopped.

b. Firestop system installed shall have been tested by either UL or Warnock Hersey, including exposure to hose stream test and including for use with steel fluted deck floor assemblies.

c. Firestop system used shall allow for deflection of floor above.

4. Penetrations:

a. Penetrations include conduit, cable, wire, pipe, duct, or other elements that pass through one or both outer surfaces of a fire rated floor, wall or partition.

b. Except for floors on grade, where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining structural floor or roof, provide firestopping to fill such spaces in accordance with ASTM E 814 (UL 1479).

c. These requirements for penetrations shall apply whether or not sleeves have been provided. Firestop the annular space between sleeve and surrounding surfaces.

5. Provide firestopping to fill miscellaneous voids and openings in fire rated construction in a manner essentially the same as specified herein.

1.04 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction, as though the Authority were a private corporation.

2. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:

a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.

b. Through-penetration firestop systems correspond to those shown on the Contract Drawings by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by Warnock Hersey, or by another qualified testing and inspecting agency.

3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from the face exposed to furnace fire. Provide systems complying with the following requirements:

a. Fire-Resistance Ratings of Joint Sealants: As shown on the Contract Drawings by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.

b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.

B. Information on Contract Drawings referring to specific design designations of through-penetration firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Engineer's prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction, as though the Authority were a private corporation.

C. Installer Qualifications: Engage an experienced Installer who has completed firestopping that is similar in material, design, and extent to that shown on the Contract Drawings for Work of this Contract and that has performed successfully.

D. Installer Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

E. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition shown on the Contract Drawings from a single manufacturer.

F. Field-Constructed Mockup: Prior to installing firestopping, erect mockups for each different through-penetration firestop system shown on the Contract Drawings to verify selections made and to demonstrate qualities of materials and execution. Build mockups to comply with the following requirements, using materials shown on the Contract Drawings for final installations.

1. Locate mockups on site in locations shown on the Contract Drawings or, if not shown on the Contract Drawings, as directed by Engineer.

2. Notify Engineer 1 week in advance of the dates and times when mockups will be erected.

3. Obtain Engineer's acceptance of mockups before start of final unit of Work.

4. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging completed unit of Work.

a. When directed, demolish and remove mockups from Project site.

b. Accepted mockups in an undisturbed condition at time of Substantial Completion may become part of completed unit of Work.

G. Provide firestopping products containing no asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

H. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

J. Engineer may employ and pay a qualified inspection agency to check installed firestopping systems for compliance with requirements.

K. Sequencing and Scheduling

1. Notify Engineer at least 1 week in advance of firestopping installations; confirm dates and times on days preceding each series of installations.

2. Do not cover up those firestopping installations that will become concealed behind other construction until Engineer and authorities having jurisdiction, if any, have examined each installation.

1.05 ENVIRONMENTAL CONDITIONS

A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.07 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

A. Endothermic, Latex Sealant:

1. LC-150 Firestop Sealant; Specified Technologies, Inc.; Somerville, NJ;
2. 3M Fire Dam 150; 3M Company, Construction Markets Division; St. Paul, MN;
3. Tremstop Acrylic Latex; Tremco, Inc.; Cleveland, OH.

B. Endothermic, Latex Compounds:

1. LC-150 Firestop Compound; Specified Technologies, Inc.;
2. 3M Fire Dam 150; 3M Company, Construction Markets Division.

C. Firestop Sleeve:

1. Biostop Pipe Collars; Bio Fireshield, Inc.;
2. Metacaulk Universal Collar 880; The RectorSealCorporation;
3. 3M Plastic Pipe Devices; 3M Company, Construction Markets Division;
4. Fyre Can; Tremco, Inc.; Cleveland, OH.

D. Intumescent Latex Sealant:

1. Biostop 700 Spray Applied Mastic, Bio Fireshield, Inc.;
2. LBC Latex Based Caulk; Nelson Firestop Products; Tulsa, OK;
3. Metacaulk 950; The RectorSeal Corporation;
4. Metacaulk 1000 Spray Applied Mastic; The RectorSeal Corporation;
5. SSS-100 Firestop Sealant; Specified Technologies, Inc.;
6. 3M CP 25 WB+; 3M Company, Construction Markets Division;
7. Tremstop WBM G; Tremco, Inc.; Cleveland, OH.

E. Intumescent Putty:

1. Biostop Fire Rated Putty Stix/Pads; Bio Fireshield, Inc.;
2. FSP Firestop Putty; Nelson Firestop Products;
3. Metacaulk Fire-Rated Putty Sticks/Pads; The RectorSeal Corporation;
4. SSP-100 Firestop Putty; Specified Technologies, Inc.;
5. 3M Moldable Putty+ (Stix/Pads); 3M Company, Construction Markets Division;
6. Tremco Flowable Putty; Tremco, Inc.; Cleveland, OH.

F. Intumescent Wrap Strips:

1. Biostop Pipe Collars; Bio Fireshield, Inc.;

2. WRS Wrap Strip; Nelson Firestop Products;
3. Metacaulk Wrap Strip; The RectorSeal Corporation;
4. SSW-12 Wrap Strips; Specified Technologies,Inc.;
5. 3M FS 195+ Wrap Strips; 3M Company, Construction Markets Division;
6. Tremco Wrap Strips; Tremco, Inc.; Cleveland,OH.

G. Job-Mixed Vinyl Compound:
1. USG Firecode Compound, United States Gypsum Co.; Chicago, IL.

H. Mortar:
1. K-2 Firestop Mortar, Bio Fireshield, Inc.;
2. Novasit K-10 Firestop Mortar, Bio Fireshield, Inc.;
3. CMP Firestop Compound; Nelson Firestop Products;
4. SSM-228 Firestop Mortar; Specified Technologies, Inc.;
5. 3M Fire Barrier Mortar; 3M Company, Construction MarketsDivision;
6. Tremstop Mortar System; Tremco, Inc.; Cleveland, OH.

I. Pillows/Bags:
1. Firestop Pillows, Bio Fireshield, Inc.;
2. PLW Firestop Pillows; Nelson Firestop Products;
3. SSB Series Firestop Pillows; Specified Technologies, Inc.;
4. Tremstop Pillow System; Tremco, Inc.; Cleveland, OH.

J. Silicone Sealants:
1. BioTherm 100/200; Bio Fireshield, Inc.;
2. CLK Firestop Caulk; Nelson Firestop Products;
3. SSB Series Firestop Pillows; SpecifiedTechnologies, Inc.;
4. Pensil 300 Firestop Sealant, GE Silicones; Waterford, NY;
5. Metacaulk 835, The RectorSeal Corporation;
6. Metacaulk 880, The RectorSeal Corporation;
7. 3M Fire Barrier 2000, 2000+ and 2003; 3M Company, Construction Markets Division;
8. Fyre Sil and Fyre Sil/SL; Tremco, Inc.; Cleveland, OH.

2.02 MATERIALS

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "Design and Performance Requirements" Article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:

1. Permanent forming/damming/backing materials including the following:

   a. Semirefractory fiber (mineral wool) insulation.

   b. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.

   c. Fire-rated formboard.

   d. Joint fillers for joint sealants.

2. Temporary forming materials.

3. Substrate primers.

4. Collars.

5. Steel sleeves.

C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

D. Fill Materials For Through-Penetration Firestop Systems

1. Endothermic, Latex Compound Sealant: Single-component,endothermic, latex formulation.

2. Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.

3. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.

4. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum foil on one side.

5. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.

6. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.

7. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

8. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant, nonsag grade. Unless otherwise shown on the Contract Drawings, firestop system shall use nonsag grade for both vertical and horizontal surfaces.

2.03 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application shown on the Contract Drawings.

PART 3. EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:

1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.03 INSTALLING THROUGH-PENETRATION FIRESTOPS

A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications shown on the Contract Drawings.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not shown on the Contract Drawings as permanent components of firestop systems.

C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications shown on the Contract Drawings.

B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.

C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration shown on the Contract Drawings or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.05 FIELD QUALITY CONTROL

A. Inspecting agency employed and paid by Engineer may examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.

B. Inspecting agency will report observations promptly and in writing to Contractor and Engineer.

C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.

D. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.06 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of issuance of Certificate of Final Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION

SECTION 07270

FIRESTOPPING

APPENDIX "A"

SUBMITTALS

A. Product data for each type of product specified.

1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

B. Shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition shown on the Contract Drawings.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop configuration for construction and penetrating items.

2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration approved by firestopping manufacturer's fire protection engineer with modifications marked.

C. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.

D. Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.

E. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Engineers and Owners, and other information specified.

END OF APPENDIX "A"

DIVISION 15

SECTION 15410

PLUMBING PIPING AND APPURTENANCES

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for domestic water service piping, storm and sanitary sewer piping, and appurtenances.

B. Domestic water service and storm and sanitary sewers installed under this Section end at the building line unless otherwise shown on the Contract Drawings. The continuation of the domestic water service and storm and sanitary sewers is specified under Division 2 of the Specifications. Types of material and installation of the piping under this Section shall be compatible with types of material and installation specified under Division 2.

C. Trenching and backfilling required in conjunction with underground piping furnished under this Section shall be as specified in applicable Sections of Division 2 and shall be included as Work under this Section.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

Design and performance of components and methods specified herein shall comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and the latest industry standards including, but not limited to the entities listed below.

New York City Building Code

New Jersey Uniform Construction Code

Municipal Water Company

American National Standards Institute (ANSI)

American Society for Testing and Materials (ASTM)

American Society of Mechanical Engineers (ASME)

Cast Iron Soil Pipe Institute (CISPI)

American Water Works Association (AWWA)

In addition, specific provisions cited herein shall govern for the associated specific application.

1.03 QUALITY ASSURANCE

A. Plumbing piping and appurtenances, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.

B. Entities performing the Work of this Section shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Clean all pipe sections of foreign matter and cover ends with temporary sheet metal closures or plastic end caps of sufficient tightness to prevent entry of foreign matter prior to shipping to the construction site.

B. Store pipe, fittings, valves and other components at the construction site on pallets or raised platforms with suitable coverings satisfactory to the Engineer to protect them against damage and weather.

C. Inspect all pipe, fittings, valves and other components for damage before moving them from storage to the point of installation at the construction site.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 PIPE, FITTINGS, AND FLANGES

A. Unless otherwise shown on the Contract Drawings, provide pipe (and tube), fittings and flanges in accordance with the "Pipe, Fittings, and Flanges Schedule" specified below, including gaskets, bolts, nuts, washers and other pressure containing parts necessary for the complete installation of piping systems.

B. Nipples shall be extra-heavy shoulder type. No close nipples shall be used. All nipples shall have designation mark of the manufacturer and shall conform to ASTM pipe specifications for system served.

C. Gaskets for flanges shall be 1/16-inch thick (after compression) rubber or neoprene, full-faced, and punched bolt holes.

D. Unions shall be malleable iron, threaded, conforming to ANSI B16.39.

Pipe, Fittings and Flanges Schedule

Systems	Pipe	Fitting and Flanges
Storm & Sanitary Drainage & Vent (underground)	Cast Iron, ASTM A 74, Service Weight Hub & Spigot Type	Cast Iron, ASTM A 74, Service Weight Hub & Spigot Type; caulked or compression type joints
Storm & Sanitary Drainage & Vent (above ground and underground)	Cast Iron, CISPI-301, ASTM A888, Service Weight Hubless Type	Cast Iron, CISPI-301, ASTM A 888, Service Weight, Hubless Type
Storm & Sanitary Pump Discharge	Galvanized Steel, ASTM A 53, Schedule 40	Galvanized Malleable Iron, ANSI B16.3, 150 lb. Class, Threaded
Sanitary Indirect Drainage	Galvanized Steel, ASTM A 53, Schedule 40	Galvanized Cast Iron (Drainage), ANSI B16.12, 125 lb. Class, Threaded
Domestic Water	Copper Tubing, ASTM B 88, Type L, Drawn, Nominal Wall	Cast Bronze, ANSI B16.18, Same Wall as Tube, Solder Joints
Domestic Water at Meter Assembly (3 inches and larger)	Galvanized Steel, ASTM A 53, Schedule 40	Galvanized Cast Iron, ANSI B16.1, 125 lb. Class, Flanged (Companion)

2.02 VALVES

A. General

1. Provide types of valves as and where shown on the Contract Drawings.
2. All gate and globe valves shall be the products of one manufacturer.
3. Valves shall be of one of the following manufacturers, or approved equal:
   a. Stockham Valves and Fittings.
   b. Crane Co.
   c. Walworth Co.
   d. NIBCO Inc.

B. Gate Valves

1. For piping 2 inches and smaller: Class 125, bronze body, screw-in bonnet, rising stem, solid wedge, approved equal of Stockham Fig. B-122 (threaded ends), or Fig. B-109 (soldered ends).
2. For piping 2-1/2 inches and 3 inches
   a. Class 125, iron body, bolted bonnet, rising stem, solid wedge, bronze mounted, flanged ends, similar to Stockham Fig. G-623, or approved equal.
   b. Class 150, bronze body, screw-in bonnet, rising stem, solid wedge, threaded ends, similar to Stockham Fig. B-122, or approved equal.

3. For piping 4 inches and larger: Class 125, iron body, bolted bonnet, solid wedge, bronze mounted, OS&Y, flanged ends, similar to Stockham Fig. G-623, or approved equal.

C. Globe Valves

Class 150, bronze body, screw-in bonnet, rising stem, integral seat, renewable disc, approved equal of Stockham Fig. B-22 (threaded ends), or Fig. B-24 (soldered ends).

D. Drain Valves

Class 125, gate valve, bronze body, screw-in bonnet, non-rising stem, solid wedge, threaded ends on inlet side of valve and hose end thread with cap and chain on the outlet side, similar to NIBCO Fig. T-113-HC, or approved equal.

E. Check Valves

1. For pipe 2 inches and smaller: Class 125, bronze body, horizontal swing, renewable disc, approved equal of Stockham Fig. B-321 (threaded ends), or Fig. B-319 (soldered ends).

2. For piping 2-1/2 inches and larger: Class 125, iron body, bronze mounted, bolted bonnet, horizontal swing, renewable seat, flanged ends, similar to Stockham Fig. G-931, or approved equal.

3. Ball Valves

For piping 1 inch and smaller: Class 150, bronze body, full port, bronze trim, approved equal of Stockham Fig. S-216 BRRT (threaded ends) or Fig. S-216 BRRS (soldered ends).

2.03 ACCESSORIES

A. Pipe and Valve Identification

1. Adhesive Bands

a. Provide approved adhesive bands in sets of two, one identifying the piping system type and the second, the direction of flow. Sets shall be provided in quantities sufficient to accommodate the requirements of 3.04 A of this Section.

b. For 3-inch or larger pipe, the adhesive band identifying the piping system shall display the name of the service in letters at least two inches high and the band indicating direction of flow shall display an arrow of similar size. For 2-1/2 inch or smaller pipe, the letters and the arrow shall be not less than one inch high. Bands shall be in colors and shall conform to ANSI A13.1.

c. Adhesive bands shall be W.H. Brady Co. "Quik-Label", or approved equal.

2. Valve Tags, Charts and Schedules

a. Provide each valve with a 2-inch diameter 18 gauge brass tag with brass chain. Service designation shall be 1/4-inch high and valve number shall be 1/2-inch high, on two lines with service designation on the upper line, and valve number on the lower line. The characters shall be indented and filled with durable black compound.

b. Provide diagrammatic valve charts and schedules, using a valve numbering system that differentiates between classes of service and indicates floor level of valve location.

c. Tags shall conform to the numbers, locations, and uses listed in the valve charts and schedules.

d. Valve charts and schedules shall be mounted under glass in wood frames or aluminum self-closing frames.

e. Tags and the frames for valve charts and schedules shall be manufactured by Seton Name Plate Corp., or approved equal.

B. Access Doors

Provide a complete list of all access doors required in finished walls, ceilings, partitions and any other areas for access to all valves concealed behind such finished construction. Access doors will be furnished and installed under other Sections.

2.04 PIPE HANGERS AND SUPPORTS

A. Design, fabricate and provide all pipe hangers and supports adequate to support and guide the piping, allow for forces imposed by expansion joints, satisfy structural requirements and maintain proper clearances with respect to adjacent piping, equipment and structures.

B. Hangers and supports shall include guides, anchors, stops, restraints, welded attachments, insulation shields, saddle strands, stays, braces, bolts, nuts, washers, expansion bolts, pipe clamps, beam clamps, and supplementary structural steel for pipe hangers and supports.

C. Keep the different types of hangers to a minimum. Provide clevis type hangers for sizes 3 inches and above.

D. Suspend hangers from beam clamps, brackets, fish plates, inserts or other approved means. Furnish and install any additional miscellaneous steel supports between building framing members as may be required. The installation of "C" clamps on beams must include retaining straps to prevent separation of beam and clamp.

E. Copper plate all hangers that will be in direct contact with brass or copper tubing.

F. Support vertical piping with steel riser clamps. Additional intermediate support brackets, secured to the structure, shall be installed on piping utilizing gasket or coupling joints in accordance with the manufacturer's recommendations.

G. Trapeze type hangers of steel construction, with hold-down U-bolts, may be used for two or more pipes which have a uniform slope throughout.

H. Base hanger loads on weight of pipe supported, weight of insulation covering and weight of fluid being transported.

I. When loads between supports can be expected to cause a sag in the pipe in excess of 1/4 inch, reduce spacing as necessary to stay within such a limit.

J. Provide and install on all supporting rods, a forged steel turnbuckle with top and bottom lockouts having a vertical adjustment of 6 inches, minimum.

K. All pipe hangers, rods, supports, insulation shields, clamps, and other associated components shall be galvanized.

L. Do not hang piping from other piping and ductwork, except for small water branches in pipe enclosures behind toilet rooms or as approved by the Engineer.

M. Vertical pipes shall be supported on every floor and at intervals between floors so that no more than 10 feet of pipe is unsupported.

N. Provide protection shields for all insulated piping at all points of support. Shields shall be 12 inches long, galvanized steel plate with a radius suitable for the required applications, including insulation.

O. Tabs in metal deck construction shall not be used to support pipe or equipment.

P. Provide pipe anchors where necessary to restrain forces due to thermal expansion and contraction of pipe.

Q. Anchors shall be adequately designed to rigidly oppose forces acting on them and shall be embedded in structural concrete or connected to the building structural steel framework.

R. Provide pipe guides where necessary to confine movement along the centerline of the pipe due to thermal expansion and contraction between anchors. Guides shall be adequately designed and placed, generally between 20 to 30 feet on centers and an equal distance from the expansion loop.

S. Expansion anchors, self-drilling expansion shields, power driven studs and similar devices shall not be used, unless specifically approved by the Engineer.

T. Unless otherwise specifically approved, hanger rod size and spacing shall be within the following limits:

1. Steel Pipe

Pipe Size	Maximum Hanger Spacing	Minimum Rod Size
1/2" to 1"	8 ft. o.c.	3/8"
1-1/4" to 2"	10 ft. o.c.	3/8"
2-1/2" to 3-1/2"	12 ft. o.c.	1/2"
4" and 5"	12 ft. o.c.	5/8"
6"	12 ft. o.c.	3/4"
8"	12 ft. o.c.	7/8"
10" and 12"	12 ft. o.c.	7/8"

2. Copper Tube

Pipe Size	Maximum Hanger Spacing	Minimum Rod Size
1/2" to 1-1/4"	6 ft. o.c.	3/8"
1-1/2" and 2"	8 ft. o.c.	3/8"
2-1/2" to 3-1/2"	10 ft. o.c.	5/8"

3. Cast Iron Soil Pipe (No-Hub)

   Supports for horizontal or vertical no-hub pipe shall be on each side of every stainless steel coupling except for spaces behind toilet rooms or where many fittings are installed at one location. At these points, support every 5'-0" o.c. and on as many fittings as necessary so that no more than one fitting shall be without a hanger in any 5'-0" space. Rod size shall be the same as for steel pipe above for corresponding pipe size.

4. Cast Iron Soil Pipe (Hub and Spigot)

   a. Support vertical piping at base and at each story height but in no case at intervals greater than 20 feet.

   b. Support horizontal piping at 5-foot intervals and behind every hub except for spaces behind toilet rooms or where many fittings are installed at one location. At these points, support every 5'-0" o.c. and on as many fittings as necessary so that no more than one fitting shall be without a hanger in any 5'-0" space. Rod size shall be the same as for steel pipe above for corresponding pipe size.

5. Base of Cast Iron Stacks

   Bases of cast iron stacks shall be supported on concrete, on brick laid in cement mortar, by metal bracket attached to the building construction, or by equivalent methods. All stacks shall be anchored so as to relieve the load from the base of the stack.

U. Hangers and supports shall be manufactured by Grinnell Corp., Carpenter & Patterson Inc., Michigan Hanger Co. Inc., or approved equal.

2.05 SLEEVES, SEALS, AND ESCUTCHEONS

A. Pipe Penetration through Walls, Partitions and Floors

1. Piping passing through masonry or concrete walls and framed partitions shall have a trim opening cut no greater than necessary for the installation of a sleeve secured therein. Sleeve shall be 1/2 inch in diameter larger than the diameter of the insulated pipe. Sleeve shall be flush with the finished wall or partition surface.

2. Sleeves through concrete floors for piping shall have the opening 1/2 inch in diameter larger than the diameter of the insulated pipe passing through. Floor sleeves shall project one inch above floor slab.

3. Pipe insulation shall be omitted at penetrations through fire-rated barriers. In all cases pack the annular space between the pipe (whether insulated or uninsulated) and sleeve with mineral wool. Additionally, at penetrations through fire-rated barriers seal the annular space to retain the fire integrity of the fire-rated barrier with nonhardening through-penetration firestops having F-ratings, compatible with the fire ratings of the barriers in which they are installed, per ASTM E 814. Firestop systems shall be UL-approved, and shall be as manufactured by 3M, Bio Fireshield, Inc., General Electric Company, Dow Corning Corporation, or approved equal.

4. Sleeves in walls and floors shall be galvanized steel pipe, Schedule 40 for sizes up to 10 inches and 3/8-inch wall thickness for 12 inches and larger. Sleeves in partitions shall be 20-gauge galvanized sheet metal.

5. Piping in exposed areas, passing through walls, floors or ceilings shall be fitted with chromium-plated cast brass escutcheons with fastening set screws.

6. Piping passing through floor waterproofing membrane shall be provided with a 4-pound lead flashing or a 16-ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches above the floor. The annular space between the flashing and the pipe shall be sealed watertight.

7. Piping passing through roof construction shall be provided with counterflashing, consisting of steel rainhood secured all around the pipe and overlapping the flashing.

B. Pipe Penetration through Exterior Foundation and Pit Walls

1. General

a. All penetrations for piping through perimeter foundation walls and subgrade pit walls shall be provided with the pipe sleeves and seals as shown on the Contract Drawings.

b. Sleeves shall be Schedule 40 for sizes up to 10 inches and 3/8-inch wall thickness for sizes 12 inches and larger. All pipe sleeves shall be galvanized steel, set into foundation walls with anchors and water stop plates.

2. Lead-Oakum Seals

Where "Lead-Oakum" seal is shown on the Contract Drawing, the annular space between the pipe and the sleeve shall be made watertight by caulking with oakum and poured lead, edged and trimmed.

3. Interlocking Modular Seals (Link-Seal)

a. Where "Link Seal" is shown on the Contract Drawings, seal shall be modular mechanical type, consisting of interlocking sealing element links shaped to continuously fill the annular space between the pipe and the sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the sealing elements to expand and provide a watertight seal between the pipe and the sleeved opening. The seal shall provide electrical insulation between the pipe and wall.

b. The inside diameter of each wall sleeve shall be sized as recommended by the manufacturer to fit the pipe, seal, and any coating or insulation to ensure a watertight joint.

c. Install sleeves and seals in accordance with the seal manufacturer's instructions to provide a watertight installation.

d. Seals for perimeter foundation wall penetrations shall be two individual sealing units in tandem unless otherwise shown on the Contract Drawings. Single sealing unit shall be used for pit wall penetration unless otherwise shown on the Contract Drawings.

e. Seals shall be Thunderline Corp. "Link-Seal", or approved equal.

PART 3. EXECUTION

3.01 INSTALLATION

A. General

1. Install piping and appurtenances in accordance with manufacturers' installation procedures, applicable codes and standards, and as specified.

2. Coordinate piping installation with other Work to avoid interference. Coordinate as necessary to ensure that all hangers, supports, sleeves and other built-in devices are incorporated in forms or in masonry to avoid necessity of cutting finished structure.

3. All measurements, both horizontal and vertical, shall be based on established benchmarks. All Work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the Work.

4. Perform necessary cutting and patching in accordance with requirements specified in Division 2 Section entitled "CUTTING, PATCHING AND REMOVAL". All openings in existing slabs required for pipe penetrations shall be core drilled.

5. Installation requirements for pipe hangers and supports and pipe penetration sleeves, seals, and escutcheons are specified in 2.04 and 2.05, respectively.

B. Piping

1. Install piping as shown on the Contract Drawings and straight and direct as possible, forming right angles or parallel lines with building walls, neatly spaced, with risers plumb and true.

2. Piping shall pitch back toward system drain valve and any installed low points or pockets shall have a hose end drain valve.

3. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing pipe, thoroughly clean the inside, free of cuttings and foreign matter. Cut all piping square and smooth and make up all joints to required limits.

4. Erect all piping to obtain sufficient flexibility to prevent excessive stresses in materials and excessive bending moments at joints or connections.

5. Make changes in pipe size by the use of reducing fittings. Do not use reducing bushings except by approval of the Engineer. Do not use close or shoulder nipples.

6. Arrange water piping so that system can be completely drained. Where lines are purposely pitched for drainage, a uniform grade shall be maintained. Lines shall be so supported as to prevent pocketing of water. No lines shall have pockets due to changes in elevation unless proper provisions for draining are made.

7. Installed piping shall not interfere with the operation or accessibility of doors and windows; shall not encroach on aisles, passageways and equipment; and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.

C. Pipe Joints

1. Threaded Joints

   Make up threaded joints tight using pipe joint Teflon compound or tape, applied on the male thread only.

2. Flanged Joints

   Make up flanged joints square and tight with gaskets. Dip bolts and nuts in mixture of graphite and oil immediately prior to installation.

3. Soldered Joints

   a. Cut ends of tubing square and remove all burrs. Clean inside and outside of tubing with steel wool.

   b. Make joints with non-corrosive paste flux and 95 per cent tin and 5 per cent antimony solder. Cored or lead-containing solder is not permitted.

   c. Remove excess solder while still in plastic state.

   d. Leave a fillet at the wall of the fitting.

   e. Prior to silver soldering, remove the internal parts of all valves or other devices to be installed directly in line.

4. Caulked Joints

   For cast iron pipe with hub, pack hub firmly with hemp or picked oakum and fill with molten lead, using a minimum of twelve ounces of lead for each inch of pipe size per joint and to a one-inch minimum depth. After the lead has cooled, the joints shall be thoroughly caulked, using approved caulking irons, faced smooth and made tight without the use of putty, paint or cement.

5. Compression Joints

   Make compression joint with ASTM C564 neoprene rubber gaskets and lubricant. Gaskets shall match class of pipe and fittings. Make joints in accordance with recommendations of CISPI.

6. Cast Iron No-Hub Joints

No-hub cast iron pipe joint shall be of a coupling type. Each joint shall consist of 2 spigot ends of pipe or fitting, and a sealing sleeve assembly, consisting of a stainless steel shield over a neoprene gasket, held together by stainless steel clamps. The gasket shall be slid over the ends of the two pipes to be joined, then the shield and clamps shall be placed over the gasket. The entire coupling shall be held firmly together by the clamps, by alternately turning the screws to 100-115 in.-lb. torque. Couplings shall be "Clamp-All" type manufactured by Clamp-All Corp., or Husky SD Series 4000 type manufactured by Anaheim Foundry Company, or approved equal.

3.02 FIELD TESTS

A. General

1. Perform tests as herein specified on the various piping systems or portions thereof prior to backfilling, painting, concealing or insulating.
2. Notify the Engineer and those authorities having jurisdiction, at least 48 hours in advance of making the required tests, so that arrangements may be made for their presence to witness the tests.
3. Provide and install all equipment and devices required in connection with tests. Provide all necessary materials, supplies, labor and power for the tests.
4. Should the tests reveal any leaks or deficiencies in piping installed under this Section, make the necessary repairs immediately, or, if required by the Engineer, replace defective work with new work without additional cost to the Authority. Repeat tests as directed until the entire installation is proven satisfactory. No temporary method of repairing leaks will be permitted.
5. Where piping installed under this Section is connected to any existing system, such installed piping shall be isolated from the existing system during the performance of the required field tests, unless otherwise directed by the Engineer.
6. The Engineer reserves the right to direct the Contractor not to isolate the newly-installed piping from the existing system during the performance of the required field tests. In such event, the Contractor shall correct any revealed leaks or other deficiencies within the first 20 feet of the existing system, measured in any direction from the point of connection with the newly installed piping, all as directed by the Engineer and at no additional cost to the Authority.
7. Dispose of water removed from pipelines in a manner that will not cause damage to any property.
8. Provide and install the required air vents in the piping system tested.
9. All equipment, including water coolers, and all controls and instruments shall be isolated from the piping system during test, as well as during cleaning, disinfecting and flushing procedures.

B. Hydrostatic Tests

1. Storm and Sanitary Drainage and Vent

a. Tightly close all openings in the entire system and fill it with water to the point of overflow above the roof. The water level shall be maintained for one hour.

b. When piping is tested in sections, test piping with a pressure equivalent to a 10-foot water head. The water level shall be maintained for one hour.

c. For piping added, relocated or replaced on existing systems, install a test tee at the lowest elevation of each added, relocated or replaced piece of pipe and fill it with water to overflow level of next highest fixture outlet or drain. The water level shall be maintained for one hour.

2. Domestic Water

a. Cap or plug all outlets, apply a hydrostatic pressure of 125 psi and sustain such pressure for one hour.

b. For piping added, relocated or replaced on existing systems, apply a hydrostatic pressure of 50 psi above the existing system pressure for one hour.

C. Cleaning and Disinfecting

The potable water system shall be disinfected prior to use by a method of disinfection in accordance with the applicable code.

3.03 PAINTING

Upon completion of the installation, remove all protecting materials, thoroughly remove all scale and grease and leave in a clean condition for painting. Piping to be painted shall be as shown on the Contract Drawings. Painting shall be in accordance with the requirements of Division 9 Section entitled "PAINTING".

3.04 PIPE AND VALVE IDENTIFICATION

A. Pipe Identification

Affix sets of pipe adhesive bands specified in 2.03 A.1 where they can be easily read, with their long dimension parallel to the axis of the pipe and no more than 40 feet apart on a piping system. At least one set of identifying bands shall be affixed in all occupied and unoccupied rooms as well as in all other spaces, such as hung ceilings or shafts, where piping may be viewed and the identity of the piping system cannot be readily ascertained. A set of such bands shall be affixed at each branch and riser takeoff; adjacent to each valve; at each pipe passage through floor and ceiling construction; at each capped line; and at each pipe passage to an underground area.

B. Valve Tags

Securely fasten valve tags specified in 2.03 A.2 with approved brass chain.

END OF SECTION

SECTION 15410

PLUMBING PIPING AND APPURTENANCES

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

A. Shop Drawings

1. Piping Shop Drawings

   Shop and coordination drawings shall be double line at a minimum of 3/8"=1'-0" scale.

   a. Piping layout and installation drawings including, at a minimum, the following:

      (1) Plans, elevation, sections and riser diagram.

      (2) Hanger, support locations and details. Indicate methods of attachment to building structure.

      (3) Pipe elevations and dimensions from main piping runs to a reference point.

      (4) Penetrations through fire rated and other partitions.

      (5) Location for piping accessories, including valves and access doors.

   b. Piping coordination drawings showing plan views and sections, drawn to scale, on which all items are shown and coordinated with all Work of other Sections.

B. Product Data / Catalog Cuts

1. Catalog cuts, including product performance data, for all items furnished under this Contract, including the following at a minimum:

   a. Pipe, pipe fittings and flanges including piping materials and schedule for each piping system.

   b. Valves, including valve charts and schedules.

   c. Hangers and supports, including schedule showing manufacturer's figure number, size, location and features of each required hanger and support.

   d. Sleeves and escutcheons.

   e. Pipe and valve tags identification bands.

2. List of access doors and schedules.

C. Construction and Installation Procedures

1. Field hydrostatic test procedure.

D. Operation and Maintenance Manuals

1. Operation and maintenance manuals providing comprehensive information for the specific approved equipment; including approved shop drawings and catalog cuts, sequence of operation, test results, troubleshooting, maintenance requirements, spare parts lists, electrical/control devices and electrical/control wiring diagram(s).

E. Site Inspection Reports

1. Field hydrostatic test results.

END OF APPENDIX "A"

SECTION 15410

PLUMBING PIPING AND APPURTENANCES

INSTRUCTIONS TO SPECIFIER

A. Contract Drawings

Ensure that the Contract Drawings show the following items specified in the text:

(2.01 A)	Piping requirements other than specified in the Schedule.
(2.02 A.1)	Types of valves (gate, globe, drain, check or ball).
(2.05 B.1.a)	Exterior foundation and pit wall penetration details.
(2.05 B.2)	"Lead-Oakum" seal.
(2.05 B.3.a)	"Link-Seal".
(2.05 B.3.d)	Tandem sealing and single sealing.
(3.03 B.1)	Piping layouts.
(3.03)	Piping to be painted under other Section(s) of the Specifications.

B. Other Items

1. Ensure that the Specifications include the following Section(s) referenced in this Section:

(3.01 A.4)	"CUTTING, PATCHING AND REMOVAL"
(3.03)	"PAINTING"

2. Modify Appendix "A" - Submittals as per project specific requirements.

END OF INSTRUCTIONS

DIVISION 15

SECTION 15430

PLUMBING SPECIALTIES

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for plumbing specialties.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

Design and performance of components and methods specified herein shall comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and the latest industry standards including, but not limited to the entities listed below:

American National Standards Institute (ANSI)
American Society of Mechanical Engineers (ASME)
American Society of Sanitary Engineering (ASSE)
American Society for Testing and Materials (ASTM)
Plumbing and Drainage Institute (PDI)

In addition, specific provisions cited herein shall govern for the associated specific application.

1.03 QUALITY ASSURANCE

A. Plumbing specialties of the types and sizes required shall have performed satisfactorily for purposes similar to those intended herein, for not less than three years.

B. Entities performing the work of this Section shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.04 DELIVERY, STORAGE, AND HANDLING

A. All specialties shall be factory-cleaned, wrapped and packaged in boxes prior to shipping to construction site.

B. Store specialties in clean, dry spaces and protect them from weather.

C. Prior to installation, inspect specialties for damage.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 DRAINS

A. General

1. Drains shall be of types and sizes shown on the Contract Drawings.
2. Special type drains other than those specified in 2.01 B and C below shall be provided as shown on the Contract Drawings.
3. Floor drains shall be provided with vandal proof grates in all areas except mechanical equipment rooms.
4. Drains shall be manufactured by Jay R. Smith Manufacturing Co., Josam Manufacturing Co., Zurn Industries Inc., Tyler Pipe Industries Inc./Wade Division, or approved equal.

B. Floor Drains

1. Toilet Rooms and Finished Areas

   Floor drains shall have cast iron body, with flashing collar, round top with nickel bronze adjustable strainer head; Jay R. Smith No. 2005-A or 2010-A, or approved equal.

2. Mechanical Equipment Rooms

   Floor drains shall have cast iron body, with flashing collar, round cast iron grate and slotted sediment bucket; Jay R. Smith No. 2230, or approved equal.

3. Drains receiving indirect waste shall be fitted with a cast iron funnel; Jay R. Smith No. 3581, or approved equal.

C. Roof Drains

1. Roof drains shall have cast iron body with adjustable extension sleeve, flashing collar and cast iron dome. Provide sump receiver and underdeck clamp for all roofs except poured-in place installations. Drain shall be Jay R. Smith No. 1015, or approved equal.
2. Install roof drains with 6-lb. lead flashing extending 12 inches beyond the outside diameter of the roof drain. Coordinate the installation with other affected Work.

2.02 VENT FLASHING COUPLINGS

A. Where shown on the Contract Drawings, provide cast iron, threaded (upper end) counterflashing sleeves; Jay R. Smith No. 1750, or approved equal.

B. Vents extending through roof shall be flashed watertight. Flashing shall be 6-lb. lead extending not less than 12 inches around the perimeter of the pipe, outside the barrel and terminate 12 inches above the roof with the vent flashing couplings specified above.

2.03 CLEANOUTS

A. Use "Y" (and "TY") fittings for cleanouts; full size "Y" for piping up to 4 inches and not less than 4-inch "Y" outlets for piping 5 inches and larger.

B. Provide cleanouts for storm and sanitary piping at bases of stacks, at changes in direction of horizontal piping, and at 50-foot intervals, minimum, on horizontal runs.

C. Floor cleanout deckplates shall be the following, or approved equal:

1. Unfinished areas: Jay R. Smith No. 4226.
2. Finished areas: Jay R. Smith No. 4026.
3. Tiled areas: Jay R. Smith No. 4146.
4. Carpeted areas: Jay R. Smith No. 4026-Y (with carpet marker).

D. Toilet room wall cleanouts shall be cast iron caulk ferrule and cast iron head seal plug with stainless steel cover and center screw; Jay R. Smith No. 4402, or approved equal.

E. Cleanouts at changes of direction of above-floor piping shall be cast iron caulk ferrule with straight threaded, tapered bronze plug; Jay R. Smith No. 4420, or approved equal.

F. All cleanout plugs shall be lubricated with graphite before installation.

G. Cleanouts shall be manufactured by Jay R. Smith Manufacturing Co., Josam Manufacturing Co., Zurn Industries Inc., Tyler Pipe Industries Inc./Wade Division, or approved equal.

2.04 FRESH AIR INLETS

A. Where shown on the Contract Drawings, provide fresh air inlets of perforated wall plate with pipe expander type securing device and spanner type tamperproof locking device; Jay R. Smith No. 9005, or approved equal.

B. Finish of plate shall be polished bronze, unless otherwise shown on the Contract Drawings.

2.05 DOMESTIC WATER METERS

Provide water meter(s) of the type and size(s) shown on the Contract Drawings. The meter shall be set horizontally, dial facing upward not more than three feet above floor, properly supported, and installed in accordance with the regulations of the local municipal water company.

2.06 STRAINERS

Where shown on the Contract Drawings, provide strainers of "Y" type with tapped blowdown connections, 150 psi w.w.p., bronze body, and bronze screens. Strainers shall be manufactured by Spirax Sarco Inc., Mueller Steam Specialty Co./MUESSCO, or approved equal.

2.07 GAUGES

A. Provide pressure gauges on water main, at pressure reducing valve assemblies and at other locations shown on the Contract Drawings.

B. Gauges shall be of bronze bourdon tube material, with 4-1/2-inch dial face and aluminum case and shall have a range of 160 psi with an accuracy of 0.5 percent of the scale range. Each gauge shall be provided with a snubber and cock. Pressure gauges shall be Weiss Instruments Inc. "Series UG-1", or approved equal.

2.08 THERMOMETERS

A. Provide thermometers on inlets and outlets of water heaters and circulating pumps, and where shown on the Contract Drawings.

B. Thermometers shall be of "red reading" Mercury, industrial glass type with V-shaped cast aluminum case, adjustable angle face, and stainless steel extension necks to suit insulation thickness, having a 9-inch long scale and a temperature range of 20 degrees F to 180 degrees F with an accuracy of one per cent of the scale range. Thermometers shall be provided with immersion bulb and separable socket. Thermometers shall be Weiss "Vari-Angle Industrial Thermometers", or approved equal.

2.09 AIR CHAMBERS

A. Provide full pipe size, 12-inch high air chambers at each plumbing fixture domestic water supply connection.

B. Provide full pipe size, 24-inch high air chambers at the top of each domestic water riser.

2.10 WATER HAMMER ARRESTORS

A. Provide water hammer arrestors adjacent to all equipment where quick-closing valves are provided and at other locations shown on the Contract Drawings.

B. Sizes and installation procedures of water hammer arrestors shall be in accordance with PDI Standards.

C. Water hammer arrestors shall be Jay R. Smith "Series 5000", or approved equal.

2.11 AIR RELIEF VALVES

A. Provide automatic air relief valves at high points in hot water piping and where shown on the Contract Drawings, with 3/4 inch threaded inlet; class 150 cast iron body and cap; valve, float, leverage and valve seat and compressed non-asbestos gasket. Pipe drain from relief valves shall spill over to adjacent floor drain, mop sink, or as shown on the Contract Drawings.

B. Relief valves shall be Taco Air Vent, Model 409, or approved equal.

2.12 NON-FREEZE WALL HYDRANTS

Where shown on the Contract Drawings, provide non-freeze wall hydrants, key operated with 3/4-inch, threaded inlets. Hydrant shall be all-bronze nickel-plated with hose connection, integral vacuum breaker, and stainless steel box with full 180 deg door opening, nickel-bronze face. Hydrants shall be Jay R. Smith No. 5509 QT, or approved equal.

2.13 HOSE BIBBS

Where shown on the Contract Drawings, provide Woodford Manufacturing Co. Model 24 C hose bibbs, or approved equal. Finish shall be rough brass in mechanical or non-finished spaces, and polished chrome-plated in all finished areas. Provide matching finish vacuum breakers at each hose bibb.

2.14 VACUUM BREAKERS

Vacuum breakers shall be bronze body, chrome-plated Watts Regulator Co. Model No. 288A-C, or approved equal. Check valve shall be provided at the outlet side of vacuum breaker.

2.15 BACKFLOW PREVENTERS

A. Where shown on the Contract Drawings, provide backflow preventers to prevent the backflow of contaminated water into the potable water supply. Each backflow preventer shall be a complete assembly, including tight-closing shutoff valves before and after the device, and shall be protected by a strainer. The design shall include test cocks and a pressure-differential relief valve located between two positive seating check valves. The device shall meet the requirements of ASSE Standards.

B. Backflow preventers shall be of a size shown on the Contract Drawings and shall be CMB Industries/FEBCO Division Model No. 825, Watts Regulator Co. Model No. 909, or approved equal.

2.16 DIELECTRIC FITTINGS

Connections between ferrous and non-ferrous pipe or equipment connections shall be made using isolating union or flange joints as manufactured by Watts Regulator Company, Series 3000, or approved equal.

PART 3. EXECUTION

3.01 INSTALLATION

Install plumbing specialties in accordance with the manufacturers' installation instructions.

3.02 PROTECTION

Upon completion of the installation, remove all protective materials and thoroughly clean all specialties to the satisfaction of the Engineer.

END OF SECTION

SECTION 15430

PLUMBING SPECIALTIES

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

A. Product Data / Catalog Cuts

1. Plumbing Specialties

a. Catalog cuts, including product performance data, dimensions, components, weights and assembly details, for each item furnished under this Contract, including the following at a minimum:

(1) Drain, floor and roof.

(2) Vent flashing coupling.

(3) Cleanouts.

(4) Fresh air inlets.

(5) Domestic water meters.

(6) Backflow prevention devices.

(7) Strainers.

(8) Gauges.

(9) Thermometers.

(10) Air chambers.

(11) Water hammers arrestors.

(12) Air relief valves.

(13) Non-freeze wall hydrants.

(14) Hose bibs.

(15) Vacuum breakers.

(16) Dielectric fittings.

B. Construction and Installation Procedures

1. Field test procedure.

C. Operation and Maintenance Manuals

1. Operation and maintenance manuals providing comprehensive information for the specific approved equipment; including approved shop drawings and catalog cuts, sequence of operation, test results, troubleshooting, maintenance requirements, spare parts lists, electrical/control devices and electrical/control wiring diagram(s).

D. Site Inspection Reports

1. Field test results.

END OF APPENDIX "A"

SECTION 15430

PLUMBING SPECIALTIES

INSTRUCTIONS TO SPECIFIER

A. Contract Drawings

Ensure that the Contract Drawings show the following items specified in the text:

(2.01 A.1)	Types and sizes of floor and roof drains.
(2.01 A.2)	Special types of floor and roof drains other than those specified.
(2.02 A)	Vent flashing couplings.
(2.04 A)	Fresh air inlets.
(2.04 B)	Fresh air inlet wall plate finish if other than polished bronze.
(2.05)	Domestic water meter type and size(s).
(2.06)	Strainers.
(2.07 A)	Pressure gauges if other than at the water main and pressure reducing valve assembly.
(2.08 A)	Thermometers if other than at inlets and outlets of water heaters and pumps.
(2.10A)	Water hammer arrestors if other than at equipment with quick-closing valves.
(2.11 A)	Relief valve locations if other than at high points in hot water piping and pipe drain spill-over locations if other than to floor drain or mop sink.
(2.12)	Non-freeze wall hydrants.
(2.13)	Hose bibs.
(2.15 A)	Locations of backflow preventers.
(2.15 B)	Sizes of backflow preventers.

B. Other Items

Modify Appendix "A" - Submittals as per project specific requirements.

END OF INSTRUCTIONS

DIVISION 16

SECTION 16000

ELECTRICAL GENERAL REQUIREMENTS

PART 1. GENERAL

1.01 SUMMARY

Unless otherwise shown on the Contract Drawings, or unless otherwise specified in other Sections of these Specifications, the general requirements specified in this Section are applicable to all electrical work of this Contract. Additional requirements applicable to individual Sections of these Specifications are specified in those Sections, or are shown on the Contract Drawings.

1.02 REFERENCES

The following is a listing of publications referenced in this Section:

	American National Standards Institute (ANSI)
ANSI C 2	National Electrical Safety Code.
	American Society of Testing and Materials (ASTM)
ASTM D 178	Standard Specification for Rubber Insulation Matting.
	National Fire Protection Association (NFPA)
NFPA 70	National Electrical Code.
	Occupational Safety and Health Administration (OSHA)

1.03 QUALITY ASSURANCE

A. Any entity performing Work shall have had experience on at least two projects involving quantities and complexities at least equal to those required under this Division or the applicable Section thereof.

B. All workmen performing under this Division shall be skilled workers of the trade involved. Where specialty work, such as splicing or welding are required, submit proof of training, experience and work history for each workman, for review by the Engineer. Only approved workmen shall perform specialty work.

C. All electrical work shall be performed under the supervision of an electrical contractor, licensed in the state (and the city as required) in which the work is to be performed. Submit a copy of the qualifying license for review by the Engineer.

D. All calculations required by this and other various Sections of these Specifications, or as shown on the Contract Drawings, shall be certified and sealed by a Professional Engineer licensed in the state in which the Work is to be performed, and shall be submitted to the Engineer for review.

E. Various Sections of these Specifications contain the requirement for the specific material or equipment to be furnished with an experience statement "satisfactorily used for purposes similar to those intended herein" or words of similar intent and a statement that specifies the required experience time. These statements shall mean that the manufacturer of the material or equipment being furnished for the Work specified in this Contract shall have manufactured similar material or equipment to that specified, for at least the time specified.

F. In various Sections of this Division there is a statement that refers to the length of required experience that must be satisfied.

G. Polyvinyl Chloride (PVC): PVC conduits, PVC-insulated power wiring, or items containing PVC, except PVC-insulated wiring for communications systems, remote control, signaling, and power limited circuits, shall not be installed in any indoor area. PVC-insulated wiring for communications systems, remote control, signaling, and power-limited circuits shall be furnished and installed in accordance with NFPA 70.

H. Asbestos

Asbestos or items containing asbestos shall not be furnished or installed.

I. Conformance Labels

All electrical materials and equipment for which there is a nationally recognized standard shall bear the conformance labeling of the third party inspection authority, such as Underwriters Laboratories Inc., Factory Mutual, ETL, or approved equal. Where the phrase "where there are established UL standards, shall bear the UL label", or words of similar intent appear in other Sections, the instructions for the conformance label above shall apply.

1.04 CODES AND STANDARDS

A. The electrical installation shall conform to all requirements of ANSI C2, NFPA 70, and the codes and standards specified in other Sections, all local codes and the requirements of OSHA, which would be applicable if the Authority were a private corporation.

B. Standards publications of technical organizations and regulatory agencies are referenced in other Sections, and unless stricter requirements are indicated, materials and equipment so specified shall be manufactured, tested and installed to conform, as a minimum, to the requirements of such reference standards and publications.

C. Installations for aeronautical markers, lighting, guidance signs, and other work as shown on the Contract Drawings, shall comply with the standards of the Federal Aviation Administration (FAA), where applicable.

D. In case of conflict between provisions of codes, laws and ordinances, the more stringent requirement shall apply.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturers' original unopened protective packaging.

B. Store materials in original packaging in a manner to prevent soiling, physical damage, wetting or corrosion prior to installation.

C. Handle in a manner to prevent damage to finished surfaces.

D. Where possible maintain protective coverings until installation is complete and remove such covers as part of final cleanup.

E. Touch up any damage to finishes to match adjacent surfaces to the satisfaction of the Engineer.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

1.07 SPECIAL TERMS

Throughout this and other Sections of this Division the term "Authority" is used. In PATH contracts, substitute the term "PATH" is deemed substituted for the term "Authority".

PART 2. PRODUCTS

2.01 MATERIAL AND EQUIPMENT TO BE FURNISHED

Equipment and materials furnished shall be new and unused, prior to this installation, first grade commercial quality and shall be essentially the standard cataloged products of a manufacturer regularly engaged in the manufacture of the products. Only those items specifically shown on the Contract Drawings as existing, relocated or Authority furnished shall be reused in this installation. Rebuilt or remanufactured equipment will not be permitted.

2.02 IDENTIFICATION

A. All parts of equipment, such as switchboards, panel boards, safety switches, motor starters, circuit breakers, time clocks, contactors and similar items shall be identified by name, function or control with laminated plastic nameplates consisting of two black sheets with one white sheet bonded to and between the two outer sheets and having letters machine engraved in the face sheet to the depth of the white plastic. Nameplates shall not be smaller than 1 inch by 3 inches with characters not less than one-quarter inch. Where letter sizes are not specified, use one-inch high letters for panel boards, switchboards and motor control centers and one quarter inch high elsewhere. Nomenclature shall be according to a schedule approved by the Engineer.

B. All device plates other than lighting switch plates, telephone and 120 volt, single phase, 15 or 20 ampere receptacles, shall have black or white (as directed) silk-screened lettering Helvetica Medium type face (or other type face as directed by the Engineer) designating:

1. System.
2. Voltage (where applicable).
3. Number of phases (where applicable).
4. Current rating (where applicable).
5. Frequency (where applicable).

C. Before placing orders for nameplates or silk-screened device plates, submit a typewritten list to the Engineer for review.

D. The outside of the covers of all junction or pull boxes located above hung ceilings and the inside of the covers of all junction or pull boxes exposed shall be labeled with an indelible marker indicating the operating voltage and the system contained therein.

E. All device plates of receptacles connected to a standby or emergency power distribution system shall be labeled with an orange plastic nameplate, engraved with the panel board and circuit number to which the receptacle is connected. Nameplate character engraved shall be not less than one-quarter inch in height.

F. Unless otherwise shown on the Contract Drawings, all panel boards, switchboards, switchgear, circuit breakers, switches and transformers connected to a standby or emergency power distribution system shall be finished Federal Safety Orange in color.

2.03 RUBBER MATTING

A. Provide continuous insulated rubber matting not less than 36 inches wide and not less than one quarter inch thick in one piece in front of:

1. Substation transformers.
2. Switchgear.
3. Switchboards.
4. Motor control centers.
5. Panel boards.
6. On each side and end of a standby or emergency generator set.
7. Other locations as shown on the Contract Drawings.

B. Matting shall conform to ASTM D 178, Type 2.

PART 3. EXECUTION

3.01 GENERAL

A. Work of this Division shall include all labor, material and apparatus necessary for the completion of all electrical work as shown on the Contract Drawings and as hereinafter specified, left ready for satisfactory operation.

B. Coordinate with Authority operations and construction by other trades.

1. Coordinate with the Work of all trades as necessary to facilitate timely completion, avoid unnecessary cutting and patching and to ensure proper installation and operation of all equipment.
2. Coordinate all components and aspects of the Work, in order to minimize power shutdowns to the power distribution systems. Should any part of the Work require an "off-hours" shutdown in excess of 8 hours, supply temporary services or feeders as required to maintain operation of the existing systems and equipment.

3. Furnish to appropriate trades, shop drawings, catalog cuts and instructions necessary for construction of concrete bases, concrete encasement, anchor bolts, and other construction required to accommodate installations under other Sections.

4. Obtain all wiring diagrams and other instructions required for proper electrical connection of equipment installed or furnished under other Divisions of these Specifications and coordinate the installation, wiring and connections for equipment furnished under this Division, or other various Divisions.

C. The arrangement of electrical equipment and conduit runs as shown on the Contract Drawings and described in the Specifications is schematic. Locate and install electrical work in coordination with other trades so that all electrical equipment and material is installed with working clearances in accordance with NFPA 70. Route conduit to avoid interference with existing installation and with work to be performed by other trades.

D. The location of equipment and motors shown on the Contract Drawings shall be subject to minor revisions due to field conditions or coordination with other trades without any increase in Contractor's compensation. Prior to roughing-in, verify the exact location of all electrical connections to equipment and motors from reviewed shop drawings and field verification.

E. Maintain records of all inspections, testing, overload and overcurrent settings throughout the construction and any corrective actions taken, and submit records to the Engineer for review.

F. All electrical work shall be subject to inspection by the Engineer. Correct any deficient work, as required for the approval of the Engineer.

G. Any equipment, materials, wiring or labor that are a necessary part of the electrical work and to its proper performance, although not specifically mentioned herein or shown on the Contract Drawings, shall be furnished and installed as if called for in detail, without additional cost to the Authority.

3.02 REMOVALS, RELOCATIONS, RECONNECTIONS, RESTORATIONS

A. Relocate existing equipment and materials as shown on the Contract Drawings.

B. Unless otherwise shown on the Contract Drawings, existing equipment and materials that are to be removed and not required to be relocated under this Contract, will become the property of the Contractor and shall be removed from the property of the Authority, and shall be properly disposed of. Disposal of equipment and materials shall comply with all local, state and Federal laws and regulations as if the Authority was a private corporation.

C. Unless specifically shown on the Contract Drawings, salvaged equipment and materials shall not be reused in the installation.

D. If existing electrical feeders, wiring, conduit, lighting fixtures or equipment interfere with the installation of new construction of any trade, the existing electrical feeder, wiring and conduit shall be rerouted or the equipment relocated in a manner approved by the Engineer to permit installation of the new construction. Where existing circuits or devices, or portions of the existing wiring system are to remain in service, but are interrupted by the construction, continue the existing wiring to maintain the remainder of the wiring system in operation.

E. Notify the Engineer immediately of any damage caused by the Contractor to existing wiring, services or feeders that are to remain in service. Repair the damage in a workmanlike manner to restore to service, at no cost to the Authority.

F. Before shutdown or discontinuation of service on any circuit, system or feeder, coordinate such activities with the Engineer in order to minimize shutdown periods. Provide a minimum of two weeks notice in writing to the Engineer before performing any shutdowns. The minimum period may be reduced with the express written permission of the Engineer.

3.03 LOCATION OF EQUIPMENT

A. Unless otherwise shown on the Contract Drawings, the location of outlets or devices, from finished floor to center of plate or device, shall be as follows:

1. Lighting switches: 48 inches.
2. Thermal switches: 48 inches.
3. Receptacles: 16 inches.
4. Telephone outlets: 16 inches.
5. Fire alarm stations: 48 inches.
6. Fire alarm horn/light signals: 7 feet 6 inches.
7. Clocks: 7 feet 8 inches.

B. Unless otherwise shown on the Contract Drawings, the location of equipment, from finished floor to top of enclosures shall not exceed 6 feet, 6 inches, and shall not protrude more than 4 inches if higher than 27 inches.

1. In exposed or public locations, panel boards and cabinets shall generally be flush mounted and all covers shall be identical in layout and size, and shall be installed to maintain a level and straight top and bottom alignment.
2. In concealed locations, or in closets or electrical or mechanical rooms, or non-public locations, panel boards and cabinets shall generally be surface mounted and shall be installed to maintain a level and straight top alignment.

3.04 DISSIMILAR METALS

A. Dissimilar metals shall mean those metals that are incompatible with one another in the presence of moisture, as determined from their relative positions in the Electrochemical Series, or from test data. Where dissimilar metals come in contact, paint the joint both inside and out with approved coating so as to exclude moisture from the joint, or provide a suitable insulating barrier separating the metals.

B. Transitions in raceways, from one metal to a dissimilar metal shall only be made at boxes or other enclosures, except where shown on the Contract Drawings.

3.05 NAMEPLATES

Secure nameplates on equipment or walls with stainless steel or brass screws.

3.06 RUBBER MATS

A. Install rubber mats in front of each panelboard, switchboard, motor control center, switchgear and substation transformers, and along each side and the end or each generator set, or as shown on the Contract Drawings.

B. Rubber mats, when installed, shall lay flat without curling.

3.07 CUTTING AND PATCHING

A. Perform all cutting and patching of existing construction required for installation of all materials and equipment as specified in this Division.

B. Perform all patching to match existing adjacent construction to the satisfaction of the Engineer and using the best possible workmanship of the various trades involved.

3.08 FINAL FIELD TESTS

A. The entire electrical installation shall be inspected prior to final acceptance testing, thoroughly cleaned, and damaged finishes touched up after final completion and prior to final acceptance testing being performed. Not less than 30 days prior to the testing, furnish a test plan, to the Engineer for review, outlining all aspects of the testing, including tests to be performed and the expected results.

B. Perform the following field test in the presence of the Engineer to demonstrate the reliability of the electrical installation. Give the Engineer a minimum of one-week advance notice of such tests.

1. Operate all electrical systems and equipment for a period of 24 hours, unless in the opinion of the Engineer, a different test period is required, to prove the operation and performance of a system and its equipment.

2. Should the foregoing test reveal any defects, promptly correct such defects and re-run the tests until the entire installation conforms to the requirements of these Specifications and the Contract Drawings.

C. Tests requiring certified reports and those requiring factory or field inspection shall be conducted and reported to the Engineer in conformance with standards herein specified.

D. In addition to the tests outlined above, after completion of the electrical system and prior to occupancy:

1. The following equipment and devices, as a minimum, shall be thermographically inspected utilizing a Hughes Aircraft Probeye infrared detector, or approved equal, with videotaping attachment.

a. High voltage cable splices and connections.

b. Switchboard.

c. Transformer.

d. Switchgear.

e. Panelboards.

f. Motor control centers.

g. Automatic transfer switch and emergency power system connections.

h. Chiller motor and starter connections.

i. All 600 volt (nominal) cable connections rated 100 amperes (#3 AWG) or greater.

j. Other equipment as shown on the Contract Drawings.

2. The inspection shall be made by an independent inspection company such as Infrared Services, Inc, Montville, N.J., General Electric Apparatus Service Division, or approved equal. The inspection shall be made with all equipment, motors, lighting fixtures, and miscellaneous loads operating and with all equipment covers removed. Inspection reports complete with color photographs of the infrared scan and control photographs indicating the ambient temperature and any hot spots of each item inspected shall be submitted to the Engineer for approval. Any equipment, connections or devices indicated to be operating improperly performing equipment shall be replaced or repaired by the Contractor at no cost to the Authority. The cost of the inspections and necessary repairs shall be included in the Contract.

E. Demonstrate to the Engineer equipment or systems installed or modified in this Contract.

1. After completion of all testing, and prior to placing equipment or systems in operation, demonstrate the features and operation of the equipment or systems to the Engineer, and all other staff or interested parties, as designed by the Engineer, so that operational and maintenance personnel are familiarized with the equipment and systems, as follows:

a. Switchboards and panelboards.

b. Transformer.

c. Switchgear.

d. Motor control centers.

e. Fire alarm and smoke detection systems.

f. Automatic transfer switches.

g. Standby/Emergency generator sets.

h. Other equipment as shown on the Contract Drawings.

2. Provide the necessary accessories, test equipment, and personnel, for each demonstration.

3. Complete all arrangements for the demonstrations through the Engineer.

4. Upon the completion of each demonstration or instructional session, obtain "sign-off" from the Engineer. The "sign-off" shall state that the demonstration or instructions for use were provided, that they were complete and were given to the designated personnel.

END OF SECTION

SECTION 16000

ELECTRICAL GENERAL REQUIREMENTS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

A. Shop Drawings

1. Substation and high-voltage transformers.
2. Switchgear.
3. Switchboards.
4. Motor control centers.
5. Emergency lighting battery systems.
6. Working drawings for the installation sequence of medium voltage cables, and other systems where shown on the Contract Drawings, including the reel designations for each leg of the installation. Drawings shall include the calculations for pulling tensions and sidewall pressure of all cable pulls, including identification of manhole locations with splices and manholes that will be "pulled-through" without splicing. Calculations shall be certified and sealed by a Professional Engineer licensed in the State in which the Work is to be performed.

B. Catalog Cuts

1. Conduit, and fittings.
2. Wire and cable.
3. Wiring devices.
4. Multi-outlet assemblies.
5. "Standard" outlet and junction boxes.
6. Medium voltage cable, splicing and termination kits.
7. Lightning arresters.
8. Capacitors.
9. Panel boards and cabinets.
10. General purpose transformers.
11. Circuit breakers.
12. Lighting fixtures.
13. Pulling devices and end seals.
14. Special pull and junction boxes.

15. Supporting devices.

C. Certifications

Training, experience and work history for certified splicers and welders.

D. Design Calculations

Calculations where required by the Specifications or the Contract Drawings.

E. Maintenance Manuals

Operation and maintenance manuals, where required by the Specifications or the Contract Drawings.

F. Schedules

Nameplate designations.

G. Record Documents

One set of Shop Drawings revised, completed and brought up to date showing the permanent construction as actually made, in accordance with "Shop Drawings, Catalog Cuts and Samples" of Division 1, and showing the exact location of all equipment and conduit runs, as actually installed.

H. Site Inspection Reports

A final copy of the records and certified test reports for all tests, to the Engineer for review, for not less than the following:

1. Primary cable and terminators insulation testing.
2. Insulation testing of 600V (nominal) cables rated 100 amperes (#3 AWG) and above.
3. Ground resistance test of each service ground.
4. Ground fault circuit breaker and receptacle testing.
5. Setting of all adjustable overcurrent devices.
6. Setting or size of all overload elements installed, indicating the following:
   a. Motor designation.
   b. Nameplate horsepower, full load current, voltage and phases.
   c. Operating current and voltage.
   d. Overload element size or setting.
7. Emergency power distribution equipment and system test results.

END OF APPENDIX "A"

DIVISION 16

SECTION 16110

RACEWAYS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for raceways.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American National Standards Institute (ANSI)
ANSI C 80.1	Rigid Steel Conduit - Zinc Coated
ANSI C 80.3	Electrical Metallic Tubing - Zinc Coated
ANSI C 80.5	Rigid Aluminum Conduit
ANSI C 80.6	Intermediate Metal Conduit - Zinc Coated
	National Electrical Manufacturers Association (NEMA)
ANSI/NEMA FB 1	Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
NEMA RN 1	Polyvinyl – Chloride (PVC) externally coated galvanized rigid steel conduit and intermediate metal conduit
NEMA TC-3	PVC Fittings for use with rigid PVC Conduit and Tubing
NEMA TC-6	PVC and ABS plastic utilities duct for underground installation
NEMA TC-8	Extra-strength PVC plastic utilities duct for underground installation
NEMA TC-14	Filament – Wound Reinforced Thermosetting Resin Conduit and Fittings
	National Fire Protection Association (NFPA)
NFPA 70	National Electric Code
	Underwriters Laboratories Inc. (UL)
ANSI/UL 1	Flexible Metal Conduit
ANSI/UL 5	Surface Metal Raceways and Fittings
ANSI/UL 6	Rigid Metal Conduit
ANSI/UL 209	Cellular Metal Floor Raceways and Fittings
ANSI/UL 360	Electrical Liquid-tight Flexible Steel Conduit

ANSI/UL 514B	Fittings for Conduit and Outlet Boxes
ANSI/UL 651	Schedule 40 and 80 Rigid PVC Conduit
ANSI/UL 651A	Type EB and A Rigid PVC Conduit and HDPE Conduit
ANSI/UL 797	Electrical Metallic Tubing
ANSI/UL 870	Wireways, Auxiliary Gutters, and Associated Fittings
ANSI/UL 884	Underfloor Raceways and Fittings
ANSI/UL 1242	Intermediate Metal Conduit
ANSI/UL 1479	Fire Tests of Through-Penetration Firestops

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original, unopened, protective packaging. Protective caps shall be removed only upon installation of conduit.

B. Store materials in a clean, dry space and protect them from weather.

C. Handle in a manner to prevent damage to finished surfaces.

1.04 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. General

1. Locations, types and sizes of raceways are shown on the Contract Drawings.
2. Minimum size of conduit shall be 3/4 inch.
3. Conduit shall be supplied in a minimum of 10-foot lengths and accordance with UL 6.

B. Rigid Metal Conduit

1. RGS - Rigid galvanized steel conduit (Heavy-wall) hot dipped galvanized inside and out, with hot dipped galvanized threads, conduit shall conform to UL 6 and ANSI C80.1.
2. RGS/PVC - PVC coated, rigid galvanized steel conduit (Heavy-wall) hot dipped galvanized inside and out with hot dipped galvanized threads. The interior of the conduit shall have a thermoplastic or thermosetting coating of a nominal thickness of .007 (7 mils) and shall conform to NEMA TC-14. All PVC coated conduit shall conform to NEMA RN-1.
3. IMC - Intermediate metal conduit, galvanized steel (medium-wall) conduit, threads shall be galvanized and shall conform to ANSI/UL 1242 and ANSI C80.6.
4. ALC - Aluminum conduit shall conform to UL 6 and ANSI C 80.5.

5. All preformed elbows shall be the same in construction to and of a type designed for use with the appropriate conduit and shall conform to UL 6.

6. All fittings shall be threaded and shall conform to NEMA FB-1.

7. If threads are cut after the zinc coating has been applied, the threads shall be treated with protective coating of zinc equivalent to hot-dipped process and conform to NEMA RN-1.

C. Electrical Metallic Tubing

1. EMT - Electrical metallic tubing (thin-wall) shall be galvanized steel and shall conform to ANSI/UL 797 and ANSI C 80.3.

2. All fittings shall be indenter or compression type made of malleable or pressed steel and shall conform to ANSI/NEMA FB 1.

D. Cellular Metal Floor Raceway

Cellular Metal Floor Raceway and Fittings shall conform to NFPA 70 and ANSI/UL 209.

E. Flexible Metal Conduit

1. FSC - Flexible steel (galvanized) conduit shall conform to ANSI/UL 1.

2. LSC - Liquid-tight flexible metal conduit shall conform to ANSI/UL 360.

3. Fittings shall be of a type designed for use with the respective conduit and shall conform to ANSI/UL 514B.

F. Surface Metal Raceways

1. Surface raceways shall conform to ANSI/UL 5.

2. Surface metal raceways shall come complete with all necessary accessories for installation.

G. Underfloor Raceways

1. Duct, fittings, and accessories shall be suitable for encasement in concrete and shall conform to NFPA 70 and ANSI/UL 884.

2. Underfloor raceways shall come complete with all necessary accessories for installation.

H. Rigid Nonmetallic Conduit

1. PVC Type 40 Standard Wall polyvinyl chloride (PVC) conduit shall conform to ANSI/UL 651 and NEMA TC-3.

2. PVC Type 80 Heavy wall polyvinyl chloride (PVC) conduit shall conform to ANSI/UL 651.

3. PVC Type "A" Light wall polyvinyl chloride (PVC) conduit shall conform to ANSI/UL 651A

4. PVC Type EB Light wall polyvinyl chloride (PVC) conduit shall conform to ANSI/UL 651A and NEMA TC-8.

5. PVC Type DB Light wall polyvinyl chloride (PVC) conduit shall conform to ANSI/UL 651A and NEMA TC-8.

6. HDPE Type 40 Standard wall High-Density Polyethylene (HDPE) Conduit shall conform to ANSI/UL 651A and NEMA TC-6.

7. FRE - Fiberglass Reinforced Epoxy (FRE) conduit shall conform to ANSI/NEMA TC-14.

I. Fire stops, Through Penetrations of Conduits

1. Where raceways penetrate wall or floor, fire stops with a fire rating equal or greater than the rating of the penetrated wall or floor shall be provided.

2. All fire stops shall conform to the UL 1479.

J. Wireways

1. Wireways shall be seamless galvanized steel construction, cover to be locked with captive screws and shall conform to ANSI/UL 870.

2. Wireways shall come complete with all necessary accessories for installation.

K. Fastening Devices

Provide inserts, clamps, bolts and washers, or any other type of fastening devices conforming to the requirements of the Section entitled "SUPPORTING DEVICES", required to secure conduits to walls or above hung ceilings. Unless otherwise shown on the Contract Drawings, all fasteners shall be hot dipped galvanized and of sizes and types recommended by the equipment manufacturer.

PART 3. EXECUTION

3.01 INSTALLATION

A. General

1. All conduit bends shall be accomplished with a trade approved bending tool and in accordance with the manufacturer's recommendations and NFPA 70.

2. Ream conduit ends free from burrs prior to installation, and draw joints up tight.

3. Make transitions in conduit from one metal to a dissimilar metal only at boxes or other enclosures, unless otherwise shown on the Contract Drawings.

4. Install concealed conduits or tubing in as direct a line as possible.

5. Install exposed raceways, located above hung or accessible ceilings, parallel with or at right angles to the lines of buildings and as close to the ceiling as possible, unless otherwise shown on the Contract Drawings.

6. Install expansion fittings in all conduits that cross expansion joints, where conduits attach to independent structures, or where exposed to large temperature changes.

7. Securely fasten threaded conduits entering enclosures, other than threaded cast boxes, by means of two lock-nuts, one on each side of the enclosure. Terminate the conduits in insulated bushings.

8. Cap all free ends of empty conduit to prevent water entrance.

9. Conduit through roofs and external walls of buildings, manholes and other structures shall be watertight. Contractor shall submit detailed shop drawings for the Engineer's approval.

10. Where portions of an interior raceway system are exposed to widely different temperatures, make provisions to prevent circulation of air from a warmer to a colder section through the raceways.

11. Apply zinc rich paint to all exposed threads after joints have been made up clean and tight.

12. Support all conduits as required in these Specifications under Section entitled "SUPPORTING DEVICES".

13. All conduit runs shall leave or enter structures perpendicularly.

14. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or mono-filament plastic line having not less than 200-lb tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.

B. Rigid Metal Conduit

1. RGS shall be used where Fire Alarm Systems are installed.

2. RGS/PVC shall not be used indoors.

3. IMC may not be used in wet locations, or high corrosive area, otherwise NFPA 70 Article 345 fully applies.

C. Electrical Metallic Tubing

EMT used for power feeder or branch circuits, shall not exceed 2-inch trade size. EMT used for control circuits and communications systems shall not exceed 4-inch trade size.

D. Cellular Metal Floor Raceway

Installation limits shall be defined by NFPA 70.

E. Flexible Metal Conduit

1. Install FSC for motor connections and for other equipment connections where subject to movement and vibration. Conduit shall be installed to permit maximum flexibility, without crushing or permanent deformation, and shall not exceed 18 inches in length, without approval of the Engineer.

2. Use LSC for the same installation conditions as FSC above, and where also subjected to one or more of the following conditions:

   a. Exterior locations;

   b. Condensating, moist, wet or humid conditions;

   c. Corrosive atmospheres;

   d. Water spray;

   e. Dripping oil, grease or water.

3. Install FSC and LSC with a separate, insulated copper, code-sized, equipment-grounding conductor, installed inside the flexible conduit.

F. Surface Metal Raceways

1. Only metallic surface metal raceways will be permitted, unless otherwise shown on the Contract Drawings. Installation shall be in accordance with manufacturer's written recommendations and instructions accompanying the raceways.

2. Provide surface raceway system with means for assuring a continuous ground path throughout.

3. Use fittings without sharp edges introduced into any part of the raceway system.

G. Underfloor Raceways

Install underfloor raceways in accordance with the Contract Drawings NFPA 70, ANSI/UL 884 and the recommendations and requirements of the manufacturer.

H. Polyvinyl Chloride (PVC) Conduit

1. PVC Conduit shall not be used indoors.

2. PVC Conduits Types 40 and 80 conform to NFPA 70 Article 347 except it shall not be used indoors.

3. PVC Conduits Types 40, A and EB shall be used for concrete encasement.

4. PVC Conduit Type DB shall be used for direct burial, sand encased.

I. High-Density Polyethylene (HDPE) Conduit

1. HDPE conduit shall not be used indoors.

2. HDPE Type 40 shall be used for direct burial or encased in concrete.

J. Fiberglass Reinforced Epoxy (FRE) Conduit

1. Shall be installed as described in NFPA 70.

2. All sweeps, bends, or changes in direction shall be done with fittings only.

3. Elbows and fittings shall be manufactured from the same resin/hardener/glass system as the conduit.

K. Dissimilar Metals

1. "Dissimilar metals" shall mean those metals which are incompatible with one another in the presence of moisture, as determined from their relative positions in the Electrochemical Series, or from test data.

2. Where dissimilar metals come in contact, paint the joint both inside and out with approved coating to exclude moisture from the joint, or provide a suitable insulating barrier separating the metals.

3.02 FIELD TESTS

A. Conduit Cleaning and Testing

1. After installation of conduits and accessories and completion of all concreting operations, if any, carefully clean and clear all conduit runs of all obstructions and foreign matter to the satisfaction of the Engineer.

2. Test conduits, in the presence of the Engineer, by pulling through each conduit a flexible cylindrical mandrel having an outside diameter not more than 1/4 inch smaller than the inside diameter of the conduit, but nominally 85 percent of the trade diameter, whichever is larger. Only nylon cable of adequate strength shall be used to pull the mandrel through the conduit system. The use of rope will not be permitted.

B. Connections to Existing Conduits

1. Where conduits installed under this Contract are connected to existing conduits, or conduits installed by others, test the entire run to the nearest box, manhole, handhole, or equipment enclosure as specified in 3.02 A.2 above.

2. Report immediately to the Engineer any defect or stoppage found in portions of the conduit system not installed under this Contract. Do not attempt to rectify any defect or stoppage found in conduit not installed under this Contract unless specifically instructed to do so by the Engineer. The Contractor's compensation for the rectifying of such defects or stoppages at the direction of the Engineer will be determined in accordance with the Clause of the Contract providing compensation for Extra Work.

3. The Engineer shall be the sole judge as to whether a defect or stoppage exists. Perform all tests required by the Engineer to enable him to make his decision.

END OF SECTION

SECTION 16110

RACEWAYS

APPENDIX A

SUBMITTAL REQUIREMENTS

A. Submit the following in accordance the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Shop Drawings

   Raceway systems - only when shop drawings are required by the Contract Drawings

2. Catalog Cuts

   a. Conduit and Tubing

   b. Surface Metal Raceway and Accessories

   c. Underfloor Raceway and Accessories

   d. Wireways and Auxiliary Gutters

END OF APPENDIX "A"

DIVISION 16

SECTION 16114

CABLE TRAYS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies the requirements for metallic and non-metallic cable trays and their accessories.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM A 153	Standard Specification for Zinc Coatings (Hot Dip) on Iron and Steel Hardware
ASTM A 123	Standard Specification for Zinc Coatings (Hot Dip) on Assembled Steel Products
ASTM A 653	Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
ASTM A 568	Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low Alloy, Hot-Rolled and Cold-Rolled Sheet, General Requirements for
ASTM D 150	Standard Test Methods for AC Loss Characteristics and Permitivity (Dielectric Constant) of Solid Electrical Insulation
ASTM D 696	Standard Test Methods for Coefficient of Linear Thermal Expansion of Plastics
ASTM D 2583	Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM E 84	Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E 162	Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source
ASTM E 662	Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
ASTM A 924	Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

Military Specification (MIL)

MIL C 24643	Cable and Cord, Electrical, Low Smoke for Shipboard use, General Specification

National Electrical Manufacturers' Association (NEMA)

NEMA FG 1	Fiberglass Cable Tray Systems
NEMA VE 1	Metallic Cable Tray Systems

National Fire Protection Association (NFPA)

NFPA 70	National Electrical Code
NFPA 258	Standard Research Method for Determining Smoke Generation of Solid Materials

Underwriters Laboratories (UL)

UL 94	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

The cable trays shall be designed, manufactured, and tested in accordance with the latest revision of the applicable ASTM, NEMA, NFPA, UL and MIL. SPEC. Standards. Where a discrepancy exists between the various standards, the most stringent requirements shall apply.

1.04 QUALITY ASSURANCE

Cable trays of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver material in manufacturer's original, unopened, protective packaging.

B. Store materials in a clean, dry space and protect them from weather.

C. Handle in a manner to prevent damage to finished surfaces.

D. Where possible, maintain protective coverings until installation is complete and remove such coverings as part of final cleanup.

E. Touch up any damage to finishes to match adjacent surfaces.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURER

Subject to compliance with requirements of this Section, provide cable tray products of one of the manufacturers listed on the Contract Drawings.

2.02 CONSTRUCTION FEATURES

A. Cable trays shall be furnished as a complete system, including, but not limited to, all necessary fasteners, old-down clips, connectors, support systems, barrier strips, covers, horizontal and vertical fittings including elbows, reducers, tees and crosses. The cable tray system shall be in accordance with the requirements of NFPA 70.

B. Cable tray fittings shall be fully assembled by the manufacturer.

C. As shown on the Contract Drawings, cable tray shall be ventilated or non-ventilated, and of the ladder, trough, solid bottom or channel-type, with or without covers of the ventilated or non-ventilated type.

D. Cable tray size shall be as shown on the Contract Drawings. The minimum size shall be:

1. Width: 12 inches (inside)
2. Depth: 4 inches (outside)
3. Radii of Fitting: 24 inches (inside)

2.03 METALLIC CABLE TRAYS

A. Material

As shown on the Contract Drawings, the material shall be:

1. Galvanized Steel
   a. Ladder, trough and solid bottom cable trays
      (1) Hot dipped after fabrication
      (2) Minimum 16 gauge
      (3) The material and galvanizing process shall be in accordance with the following: ASTM A 123 ASTM A 153 ASTM 568ASTM A 653 ASTM A 924
2. Aluminum
   a. Ladder and trough cable trays
      (1) Aluminum alloy shall be 6063-T6
   b. Solid bottom cable trays
      (1) Aluminum alloy shall be 5052
      (2) Corrugated construction
   c. Cover
      (1) Aluminum alloy shall be 3003
      (2) Solid flanged construction

B. Connectors

Connectors for tray sections shall be universal for use on straight sections and fittings. Connectors shall be of the high pressure, bolted type with the required number of bolts.

2.04 NON-METALLIC CABLE TRAYS

A. Splice plate fasteners shall be fiberglass encapsulated stainless steel. Fasteners must be capable of withstanding torque of 10 foot-pounds, without damage to threads or encapsulated coating.

B. Material

1. Cable trays shall be of pultruded glass reinforced polyester, meeting the following standards:

   ASTM D 2583, ASTM D 696, ASTM D 150ASTM E 162, ASTM E 84

2. The completed assembly shall pass the smoke generation test for both flaming and non-flaming when tested in accordance with ASTM E 662 and NFPA 258.Smoke density shall be measured by using the Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials in NFPA 258.

3. Halogen content not to exceed 0.2 percent when tested in accordance with MIL C 24643.

4. Flammability classification in accordance with UL 94.

C. Physical Properties

The manufacturer shall provide values for Mechanical, Electrical, Fire Retardant, Thermal Bending and Other Properties of the cable tray products in reference to related ASTM, NEMA, NFPA, UL, MIL SPEC Standards for the Purchaser's review

D. Veil

Glass reinforced polyester components shall have a dacronnexus veil applied to exterior surfaces to improve weatherability and inhibit ultraviolet degradation. An ultraviolet stabilizer shall be incorporated into the resin formulation in order to further inhibit ultraviolet degradation.

2.05 STRUCTURAL DESIGN

A. Cable tray shall be of ladder type design having "C" or "I" shaped side rails for metallic tray and "C" or "E" shaped side rails for non-metallic tray, as shown on the Contract Drawings.

B. Rungs shall be of the same material as the side rail and securely bonded in place. Rungs shall be mechanically locked into place by means of an intermediate side rail flange to prevent rollover when cables are pulled into the tray.

C. Unless otherwise shown on the Contract Drawings, cable tray sections shall be 20 feet in length (+/- 1/8 inch) excluding splice plates. Each straight section shall be furnished with pre-punched holes for splice plate attachment.

D. Tray system design shall meet or exceed loading capabilities in accordance with NEMA VE 1 and NEMA FG 1for Metallic and Non-metallic trays, respectively.

E. The fully loaded tray shall also be capable of supporting a 200 lb. concentrated static load at mid-span without failure or permanent deflection.

F. Manufacturer shall provide certified test data to verify compliance with above loading and deflection data.

2.06 WARNING SIGNS

Furnish and install warning signs, wording and layout as shown on the Contract Drawings.

PART 3. EXECUTION

3.01 INSTALLATION

A. Install cable tray in conformance with NEMA VE 1, NEMA FG 1 and NFPA 70 requirements, in accordance with the manufacturer's instructions and the following minimum requirements:

1. Cable tray shall be installed as a complete and continuous system, using the manufacturers standard fittings, from source to termination.

2. Drop-offs, take-offs, or extensions from cable tray system shall be via raceways approved by the Engineer. Raceways shall be fastened to the cable tray system using fittings approved or listed by a qualified electrical testing laboratory. Open or exposed cable leaving a cable tray system without a raceway is not permitted.

B. Support cable tray at each connection point, at the end of each run, and at other points to maintain spacing between supports of 10 feet, maximum.

C. Use expansion connectors where indicated in NEMA VE 1 and NEMA FG 1.

D. Cut standard straight sections to length in field.

E. Install warning signs, not to exceed 50 foot on center, on each side of the cable tray, along the route of the cable tray, located to be visible from the floor level.

F. Provide bonding continuity between metallic cable tray sections and fittings in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 16114

CABLE TRAYS

APPENDIX "A"

A. Submittal Requirements

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Shop Drawings

   a. Outline drawings showing straight sections, horizontal and vertical fittings, connectors, covers and supports.

   b. Outline drawings showing dimensions, support points and weights of the sections and fittings.

   c. Bill of material for all equipment including description and part number

   d. Installation instruction including list of special tools required for field installation.

B. Test Reports

Submit data on the physical properties of the cable tray system as specified in 2.04 of this Section.

END OF APPENDIX "A"

DIVISION 16

SECTION 16115

UNDERGROUND CONDUIT SYSTEMS

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for underground conduits, manholes, handholes, vaults and accessories.

B. Definitions

1. Conduit: A single enclosed raceway for wires or cables; duct.
2. Ductbank: A structure containing one or more ducts or conduits.
3. Conduit System: A combination of conduit, conduits, manholes, handholes and vaults joined to form an integrated whole.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American National Standards Institute (ANSI)
ANSI C 2	National Electrical Safety Code
ANSI C 80.1	Rigid Steel Conduit - Zinc Coated
	American Society for Testing and Materials (ASTM)
ASTM A 185	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
	Institute of Electrical and Electronics Engineers, Inc. (IEEE)
IEEE 837	Standard for Qualifying Permanent Connections Used in Substation Grounding
	National Electrical Manufacturers Association (NEMA)
NEMA RN 1	Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	Electric Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
NEMA TC 14	Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings
	National Fire Protection Association (NFPA)
NFPA 70	National Electrical Code
OSHA	Occupation Safety and Health Administration
	Underwriters Laboratories Inc. (UL)
UL 6	Rigid Metal Conduit
UL 514B	Fittings for Conduits and Outlet Boxes

UL 467	Electrical Grounding and Bonding Equipment
UL 651	Schedule 40 and 80 Rigid PVC Conduit
UL 651A	Type EB and A Rigid PVC Conduit and HDPE Conduit

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

The underground conduit system shall be furnished and installed in accordance with this Section and as specified on the Contract Drawings.

A. Components of the underground conduit system manufactured, supplied, and installed shall comply with the requirements of NFPA 70, all local codes, and the requirements of OSHA.

1.04 QUALITY ASSURANCE

A. The manufacturer shall have had a minimum of three years experience within the last five years in manufacturing the products of the type(s) and size(s) described in this Section. Those products shall have been satisfactorily used for purposes similar to those intended herein. The Contractor shall provide a list of installations and contracts for which the manufacturer has produced such materials.

B. All electrical materials and equipment for which there is a nationally recognized standard, shall bear the conformance label of the nationally recognized third party inspection authority, such as Underwriters Laboratories Inc. (UL), Factory Mutual (FM) or ETL.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, protective packaging. Protective caps shall be removed immediately prior to installation of conduit.

B. Store materials in a clean, dry space and protect them from weather.

C. Handle in a manner to prevent damage to finished surfaces.

1.06 SUBMITTALS

For submittal requirements, see Appendix "A".

PART 2. PRODUCTS

2.01 MATERIALS

A. General

1. Location, types and sizes of conduits and conduit systems are shown on the Contract Drawings.

2. Conduits shall be supplied in standard lengths in accordance with applicable UL standards.

3. Unless otherwise shown on the Contract Drawings, conduit or duct shall be type RGS as specified in this Section.

B. Rigid Metal Conduit

1. RGS - Galvanized steel conduit (heavy-wall) shall be hot dipped galvanized after cutting and threading and shall conform to UL 6 and ANSI C 80.1.

2. RGS-PV - PVC coated, galvanized steel conduit (heavy-wall) shall be hot dipped galvanized after cutting and threading, shall be coated with 40 mils of PVC and shall conform to NEMA RN 1, Type A 40.

3. All preformed elbows shall be similar in construction to and of a type designed for use with the appropriate conduit and shall conform to UL 6.

4. All fittings shall be threaded.

C. Rigid Nonmetallic Conduit

1. PVC-T - Schedule 20 (thin-wall) polyvinyl chloride (PVC) conduit shall conform to UL 651A.

2. PVC-H - Schedule 40 (standard-wall) polyvinyl chloride (PVC) conduit shall conform to UL 651.

3. PVC-80 - Schedule 80 (extra heavy-wall) polyvinyl chloride (PVC) conduit and elbows shall conform to NEMA TC 2 and UL 651.

4. Fiberglass reinforced epoxy conduit shall be glass filament wound, embedded in ultra-violet resistant epoxy. Conduit fittings and elbows shall conform to NEMA TC 14 and the following:

   a. FGS-T - Standard-wall conduit, wall thickness shall be not less than 70 mils for all sizes. Type FGS-T conduit shall be used only where encased in concrete.

   b. FGS-S - Heavy wall conduit, UL listed, with a wall thickness not less than 70 mils for conduits less than 4 inch trade size, not less than 90 mils for conduits 4 inch trade size and not less than 110 mils for conduits larger than 4 inch trade size. Type FGS-H shall be used where direct buried, encased in concrete, or where conduit risers extend to above grade, in accordance with the requirements of the UL listing.

   c. FGS-E - Extra-heavy wall conduit, with a wall thickness not less than one-quarter inch. Type FGS-E conduit shall be used for exposed exterior conduit runs on bridges and elevated structures.

5. Elbows, fittings, offsets, etc. shall be preformed and similar in materials and construction to the conduit.

6. Couplings shall be of a type to provide a watertight installation of the conduit system.

D. Manholes, Handholes, and Vaults

1. Precast manholes, handholes and vaults shall be as shown on the Contract Drawings. Concrete shall be in accordance with the requirements of Division 3 Section on concrete.

2. Cast-in-place manholes, handholes and vaults conforming in size and strength to the precast manholes, handholes and vaults shown on the Contract Drawings may be substituted, subject to the approval of the Engineer.

3. Continuous inserts shown on the Contract Drawings shall be hot-dipped galvanized steel, and shall be supplied complete with end caps and waxed cardboard closure strips. All metallic parts shall have a hot-dipped galvanized finish.

4. Racking assemblies shall be capable of being mounted on the continuous inserts supplied in manhole, handhole and vault walls, without modification, utilizing hot-dipped galvanized spring nuts and bolts.

   a. The racking assemblies shall, at a minimum, include supports on each wall of the manhole, handhole or vault, with arms on each support for each cable or arc-proofed cable group. Each arm shall have insulators to support each cable or cable group. Provide additional arms and insulators as shown on the Contract Drawings.

   b. Racking assembly arms and insulators, for installation on existing supports, shall match the existing supports without modification.

5. Manhole, handhole and vault frames and covers shall be as shown on the Contract Drawings.

6. Provide pulling hooks shall be Hubbard Co. No. 9119, or approved equal.

E. Grounding Assemblies

1. Grounding bushings shall be plated malleable iron body, insulated type, rated 150 degrees C.

2. Ground rods shall be minimum 3/4-inch diameter, copper-clad steel. Unless otherwise shown on the Contract Drawings, ground rods shall be 10 feet long.

3. Unless otherwise shown on the Contract Drawings, conductors for grounding assemblies within manholes, handholes, or vaults shall be copper, minimum #4 AWG.

4. Ground rod connections shall be either exothermic welds, or high-strength compression-crimp system conforming to the requirements of IEEE 837 and UL 467, or approved equal.

5. Ground cable clamps shall be split-bolt, high strength, copper alloy connectors.

PART 3. EXECUTION

3.01 EXAMINATION

A. Inspect all conduit, equipment and accessories prior to installation. Replace any damaged items.

3.02 PREPARATION

A. The Contractor shall be responsible for field verification of dimensions and existing underground utilities.

3.03 INSTALLATION

A. General

Underground conduit systems shall be installed in accordance with the requirements of ANSI C 2, NFPA 70 and as shown on the Contract Drawings.

B. Excavation and Backfill

Excavation and backfill for underground conduits, handholes, manholes and shall be in accordance with the applicable requirements of the Section entitled "EXCAVATION, BACKFILLING AND FILLING" of these Specifications.

C. Concrete Encased Conduit

1. Concrete encasement of conduit shall conform to the details shown on the Contract Drawings and the requirements of Division 3 Section on concrete.
2. The dead-ending of conduit shall be accomplished as shown on the Contract Drawings.
3. No variation from a straight line of greater than 1/2 inch in fifty feet will be permitted when installing a concrete encased conduit.
4. Reinforce junctions with existing concrete encased conduit, or existing systems, with W8 x W4 - 10 x 10 welded wire fabric, conforming to ASTM A 185, encased in four inches additional thickness of concrete around each set of conduits. The additional encasement shall extend at least four feet in each direction from the junction.
5. Where the placing of concrete is interrupted for one hour or more, reinforce the concrete encasement at the point of interruption with W4 x W4 - 10 x 10 welded wire fabric, conforming to ASTM A 185.
6. Preformed or precast conduit may be substituted for the field-encased type, subject to the approval of the Engineer. All precast conduit shall meet the same requirements specified herein or shown on the Contract Drawings.
7. All conduits shall leave or enter structures perpendicularly.
8. Changes in direction of conduits shall be made by bends having a minimum radius of 15 feet. Elbows or sweeps to equipment or foundations shall have a radius not less than 10 times the trade diameter of the conduit.
9. Conduits shall be installed in true alignment and shall be sloped for drainage toward manholes or handholes. All free ends of empty conduits shall be sealed to prevent water entrance.
10. Openings for conduits in manhole construction shall be sealed and made watertight in an approved manner.
11. Transitions between conduits of different materials shall be made using the manufacturer's standard adapters.
12. Terminations of rigid nonmetallic conduits in manholes, handholes, and other concrete structures, shall be made with end bells, set flush with the inside face of the concrete.

13. Terminations of rigid metal conduits in manholes, handholes, vaults and other concrete structures, shall be made with insulated grounding bushings, projecting 2 inches beyond the inside face of the concrete.

D. Direct-Buried, Rigid Nonmetallic Conduit (PVC-H or FRE)

1. Direct-buried conduits shall be laid on firmly tamped and graded stone-free sand not less than 2 inches deep. Backfill in contact with the conduits shall be sand to a minimum of 3 inches above the conduits and the remainder of the backfill shall be unfrozen, stone-free earth. Buried depth shall be as shown on the Contract Drawings.

2. Conduit entering or exiting manholes, handholes, vaults and other concrete structures shall be a 10-foot length of rigid metal conduit protected with two coats of asphaltic paint.

3. Terminations of conduits in manholes, handholes, vaults and other concrete structures shall be made with insulated grounding bushings projecting 2 inches beyond the inside face of the concrete.

E. Manholes, Handholes, and Vaults

1. Set precast manholes, handholes and vaults so that they are firmly and fully bedded at required grades.

2. Set frames and covers using mortar and masonry as required. Radially laid concrete brick shall have 1/4-inch thick vertical joints at inside perimeter. Lay all concrete brick in a full bed of mortar and completely fill all joints. Where more than one course of concrete brick is required, stagger vertical joints.

3. Set racking assemblies as required so that the unsupported length of wires or cables shall not exceed 30 inches.

F. Vertical Adjustment of Existing Manholes, Handholes, and Vaults

1. Adjust the top elevation of existing structures to suit new finished grades in accordance with the details shown on the Contract Drawings.

2. Existing frames and covers shall be carefully removed, cleaned of all mortar fragments to the satisfaction of the Engineer and reset at the required elevation in accordance with the requirements shown on the Contract Drawings.

G. Grounding

1. Install a complete grounding system in each manhole or vault, and in selected handholes shown on the Contract Drawings. Electrically bond all arm supports, insulated grounding bushings, and ground rods together.

2. After installation, coat all bare surfaces or connections in the grounding system with asphaltic paint.

H. Testing

1. Test conduits, in the presence of the Engineer, by pulling through each conduit a flexible cylindrical mandrel having an outside diameter not more than 1/4 inch smaller than the inside diameter of the conduit, but nominally 85 percent of the trade diameter, whichever is larger. Only nylon cable of adequate strength shall be used to pull the mandrel through the conduit system. The use of rope will not be permitted.

I. Connections to Existing Conduits

1. Where conduits installed under this Contract are connected to existing conduits, test the entire run to the nearest box, manhole, handhole, vault or equipment enclosure, including all existing conduits installed by others, that will be used under this Contract.

2. Where any work shall be performed in conduits emanating from a manhole, handhole, vault or equipment enclosure, all existing spare conduits (conduits containing no electric wire or cable) shall be tested to the nearest manhole, handhole, vault or equipment and a pull line shall be left in place in each such conduit.

3. Report immediately to the Engineer any defect or stoppage found in portions of the conduit system not installed under this Contract. Do not attempt to rectify any defect or stoppage found in conduit not installed under this Contract unless specifically instructed to do so by the Engineer. The Contractor's compensation for the rectifying of such defects or stoppages at the direction of the Engineer will be determined in accordance with the clause of the Contract providing compensation for Extra Work.

4. The Engineer shall be the sole judge as to whether a defect or stoppage exists. Perform all tests required by the Engineer to enable him to make his decision.

3.04 ADJUSTMENTS

A. Conduit Cleaning

After installation of conduits, manholes, handholes, vaults, accessories and completion of all concreting operations, if any, carefully clean and clear all conduits of all obstructions and foreign matter to the satisfaction of the Engineer.

END OF SECTION

SECTION 16115

UNDERGROUND CONDUIT SYSTEMS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

A. Shop Drawings

1. Handholes
2. Vaults
3. Frames and covers
4. Manholes, including "exploded" views with complete details as to the location of all existing and new conduits, wires and cables identified by permanent feeder numbers, racking assemblies and grounding assemblies. Manhole drawing blanks will be furnished by the Engineer.

B. Catalog Cuts

1. Conduit
2. Racking assemblies
3. Grounding assemblies
4. Continuous inserts

END OF APPENDIX "A"

DIVISION 16

SECTION 16120

WIRES, CABLES, SPLICES, TERMINATIONS (600 VOLTS OR LESS)

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for wires, cables, splices, terminations, and appurtenances for electrical systems of 600 volts or less.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM B 1	Hard-Drawn Copper Wire
ASTM B 2	Medium-Hard-Drawn Copper Wire
ASTM B 3	Soft or Annealed Copper Wire
ASTM B 8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 33	Tinned Soft or Annealed Copper Wire for Electrical Purposes
ASTM B 174	Bunch-Stranded Copper Conductors for Electrical Conductors
ASTM B 189	Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes
ASTM D 2802	Ozone-Resistant Ethylene-Propylene-Rubber Insulation for Wire and Cable
ASTM D 3005	Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
ASTM E 662	Standard Test Method for specific Optical Density of Smoke Generated by Solid Materials

Federal Specifications (FS)

HH-I-553	Insulation Tape, Electrical (Rubber, Natural and Synthetic)

Insulated Cable Engineers Association (ICEA)

ICEA S-19-81	Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC 3)

ICEA S-61-402	Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC 5)
ICEA S-66-524	Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC 7)
ICEA S-68-516	Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC 8)
ICEA T-33-655	Guide for Low Smoke, Halogen-Free (LSHF) Polymeric Cable Jackets

Institute of Electrical and Electronics Engineers (IEEE)

IEEE 383	Type Test of Class 1E Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations
IEEE 837	Standard for Qualifying Permanent Connections Used in Substation Grounding

Military Specifications

MIL C-24643	Electrical Cable and Cord for Shipboard Use, Testing for Low Smoke and Halogens

National Fire Protection Association (NFPA)

NFPA 70	National Electrical Code

Naval Engineering Standards

NES 713	Determination of Toxicity Index of Products of Combustion From Small Specimens of Materials

Underwriters Laboratories Inc. (UL)

UL 44	Rubber-Insulated Wires and Cables
UL 62	Flexible Cord and Fixture Wire
UL 83	Thermoplastic-Insulated Wires and Cables
UL 467	Grounding and Bonding Equipment
UL 510	Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 854	Service-Entrance Cables
UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
UL 1685	Standards for Safety Vertical Tray Fire Propagation and Smoke Release Test for Electrical and Optical Fiber Cables

1.03 QUALITY ASSURANCE

A. Wires and cables which have been manufactured more than two years prior to installation shall not be used in the Work of this Section.

B. Tapes for splices or terminations shall be dated by the tape manufacturer to indicate that they have been manufactured no longer than six months prior to use in the Work of this Section.

C. Polyvinyl Chloride (PVC): PVC-insulated power wiring and items containing PVC, except PVC-insulated wiring for communications systems, remote control, signaling, and power-limited circuits, shall not be installed in indoor area. PVC-insulated wiring for communications systems, remote control, signaling, and power-limited circuits shall be furnished and installed in accordance with NFPA 70.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Single conductor wire or cable sizes #4/0 AWG and larger that are to be installed in the same raceway shall be paralleled by the cable manufacturer prior to shipment. Cable assembly overall diameter shall be kept to a minimum.

B. Wire and cable sizes #4/0 AWG and larger shall be provided with fctory-applied caps unless otherwise shown on the Contract Drawings. End seals shall be heat-shrink, irradiated, modified polyolefin, and shall be sized for individual wires and cables.

C. Store material in a clean, dry space and protect it from the weather.

1.05 SUBMITTALS

See Appendix "A" for submittals requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements of this Section, provide wires, cables, wire and cable splicing, terminating and arcproofing materials of manufacturers as shown on the Contract Drawings.

2.02 WIRES AND CABLES

A. General

1. Definitions

a. Wire shall be defined as a solid or stranded conductor smaller than No. 6 AWG with or without insulation.

b. Cable shall be defined as a single conductor No. 6 AWG or larger, or two or more conductors of any size wire under a common covering.

2. Locations, types, sizes and numbers of wires and cables are shown on the Contract Drawings. Where not indicated, provide proper wire and cable selection to comply with this section and NFPA 70 Standards.

3. Unless otherwise shown on the Contract Drawings, solid conductors shall be soft or annealed copper, conforming to ASTM B 33 (tinned), ASTM B 189 (lead-coated or lead-alloy coated), or ASTM B 3 (uncoated). Unless otherwise specified in this Section or unless otherwise shown on the Contract Drawings, stranded copper conductors shall be concentric stranding conforming to ASTM B 8.

4. Unless otherwise shown on the Contract Drawings, cable jackets for interior use shall be low smoke, low toxicity, non-halogen, flame retardant type and shall meet the following performance characteristics:

   a. Cables shall pass the flame propagatory and smoke release criteria according to the test method of UL 1685.

   b. The halogen content of cable jackets shall not exceed 0.2 percent according to the test method of MIL-C-24643. The Authority classifies 0.2 percent or less halogen content as "non-halogen".

   c. The toxicity index of cable jackets shall not exceed 4.0 according to the test method of NES 713.

   d. The cable jackets shall comply with ICEA T-33-655 for smoke generation.

   e. The acid gas content of cable jackets shall not exceed a maximum of 3.0 percent according to the test method of MIL-C-24643.

5. Use the additional performance characteristics for wires and cables which will be installed in subway areas, substations, tunnels, etc. where stringent flame retardency, low smoke, low toxicity, zero halogen and good circuit integrity during a fire are required.

   a. Wires shall pass the flame propagatory criteria according to the test method of VW-1.

   b. The halogen content of both the wire and cable insulation and cable jacket(s) shall not exceed 0.2 percent according to the test method of MIL-C-24643. The Authority classifies 0.2 percent or less halogen content as "non-halogen".

   c. The toxicity index of both the wire and cable insulation and cable jacket(s) shall not exceed 2.0 according to the test method of NES 713.

   d. The acid gas content of both wire and cable insulation and cable jacket(s) shall not exceed a maximum of 2.0 percent according to the test method of MIL-C-24643.

e. The wire and cable insulation materials shall pass the smoke generation test in accordance with ASTM E 662. Wire and cable insulation when tested on a specimen of 80 mils thick slab shall not exceed the following values:

Flaming Avg. Ds (4 minutes)	100
Flaming Avg. Dm (20 Minutes)	200
Non-Flaming Avg. Ds (4 minutes)	100
Non-Flaming Avg. Dm (20 minutes)	350

f. The cable jacket materials shall pass the smoke generation test in accordance with ASTM E 662. Wire and cable jacket when tested on a specimen of 80 mils thick slab shall not exceed the following values:

Flaming Avg. Ds (4 minutes)	50
Flaming Avg. Dm (20 minutes)	150
Non-Flaming Avg. Ds (4 minutes)	50
Non-Flaming Avg. Dm (20 minutes)	250

6. Color-Coding for Power and Lighting Conductors

a. Insulation or covering of wires and cables shall be factory color-coded by the use of colored compounds or coatings. The color-code shall be followed cnsistently throughout the performance of the Work.

b. Upon written request of the Contractor, the Engineer may permit the use of the following methods in lieu of the wire or cable manufacturer's color-coding, when limited quantities of wire and cable are involved, for sizes #8 AWG and larger.

(1) For dry locations only, spiral application of 3/4 inch wide, colored pressure sensitive plastic tape, half lapped for a distance of not less than six inches may be used. To prevent unwinding, the last two wraps of tape shall be applied with no tension.

(2) For wet or dry locations, application of three, 3/16 inch wide, colored, fungus-inert, self-extinguishing, self-locking, nylon cable ties spaced 3 inches apart may be used. The ties shall be snugly applied with a special tool or pliers, and any excess removed.

(3) Each wire and cable shall be color-coded at all terminal points, in all manholes, boxes, or other similar enclosures.

(4) Color markings shall be applied so as not to obliterate the manufacturer's identification markings.

c. Color code chart shall be as follows:

	System Voltage	
Conductor	208Y/120V	480Y/277V
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

7. All wires, cables, splices and terminations, for which there are established UL standards, shall bear the UL label.

B. General-Purpose Wires and Cables

Unless otherwise shown on the Contract Drawings, general purpose wires and cables shall be as follows:

1. General-purpose wires and cables shall be single conductor, ASTMB8, Class B stranded for sizes #8 AWG and larger, and solid for sizes #10 AWG and smaller.

2. Select from the following list of UL wire and cable types:

a. Type XHHW: Flame retarding, Cross-linked-polyolifin insulation, conforming to UL 44, for dry locations only.

b. Type XHHW-2: Flame retardant, Cross-linked-polyolifin insulation, conforming to UL 44.

c. Type THWN: Flame retardant, moisture and heat resistant thermoplastic insulation with a nylon jacket or equivalent; Double rated THHN-THWN gasoline-oil resistant II; conforming to UL 83.

The use of this cable shall be in accordance with the requirements of paragraph 1.03C of this Section.

d. Type USE: Heat and moisture resistant ethylene- propylene-rubber insulation with heavy duty thermosetting chlrosulphanated polyethylene or heavy- duty neoprene jacket; multiple rated "USE-RHH-RHW"; conforming to ASTM D 2802, ICEA S-68-516, UL 44 and UL 854. Unless otherwise indicated, Type USE shall be the only wire and cable used for underground installations.

C. Overhead Service Cables

Unless otherwise shown on the Contract Drawings, overhead service cables shall be two or more type SE, ASTM B 8, Class B or Class C stranded, hard-drawn copper conductors, ethylene-propylene-rubber insulation, with heavy duty neoprene or heavy duty thermosetting chloro-sulphonated polyethylene jacketed, marked "sunlight resistant", conforming to ASTM D 2802, UL 44 and UL 854. Cable shall be factory assembled with copper-clad messenger conforming to ICEA S-68-516.

D. Portable Cords

Unless otherwise shown on the Contract Drawings, portable cords shall be as follows:

1. Type S shall be 60 degrees C rated, with heavy-duty thermosetting insulation and jacket, conforming to UL 62, 600-volt rated.
2. Type SO shall be oil resistant, 60 degrees C rated, with heavy-duty thermosetting insulation and jacket, conforming to UL 62, 600-volt rated.
3. Type G or Type W shall be 90 degrees C rated, with ethylene-propylene-rubber insulation and Hypalon jacket, 600-volt rated.
4. Special types shall be used only where shown on the Contract Drawings.

E. Lighting Fixture Wires

Unless otherwise shown on the Contract Drawings, lighting fixture wires shall be stranded only, and shall be Type SF-2, silicone rubber insulated conforming to UL 62.

F. Grounding Wires and Cables

Unless otherwise shown on the Contract Drawings, grounding wires and Cables shall be as follows:

1. Insulated
   a. Solid for sizes #8 AWG and smaller; ASTM B 8, Class B stranded for sizes #6 AWG and larger; and of the same insulation type as the power conductors.
   b. Covering shall be a continuous green color and conform to ASTM B 33 and UL 44.
2. Uninsulated
   a. General

      Solid for sizes #8 AWG and smaller; ASTM B8, Class B stranded for sizes #6 AWG and larger.

   a. In raceways

      Soft-drawn and conforming to ASTM B 3.

   b. Direct buried or encased in concrete

      Soft-drawn, medium-hard-drawn, or hard-drawn and conforming to ASTM B 1, B 2 or B 3, respectively.

G. Control Wires and Cables

Unless otherwise shown on the Contract Drawings, control wires and cables shall be as follows:

1. Single conductor wires and cables shall be ASTM B 8, Class B stranded, type XHHW or XHHW-2 flame retardent, cross-linked-polyolifin insulation. Both shall conform to UL44 and ICEA S-66-524.

2. Multiconductor cables shall be ASTM B 8, Class B or Class C stranded, Control Cable Type B, conforming to ICEA S-61-402. Color-coded as per ICEA S-61-402, Method No. 1 for NFPA 70 applications (with white and green) or ICEA S-19-81, for paired conductor cables. Select from the following list of cable types.

   a. Individual ethylene-propylene rubberinsulation with overall flame retardent, cross-linked-polyolifin jacket; conforming to ICEA S-68-516, UL 44, and UL 1581.

   b. Individual ethylene-propylene-rubber insulation with individual and overall flame-retardent, cross-linked polyolifin jackets; conforming to ICEA S-68-516 and UL 44.

   c. Individual flame retardent, cross-linked-polyolifin insulation with and overall flame retardent, cross-linked-polyolifin jacket; conforming to ICEA S-66-524.

   d. Individual cross-linked-polyolifin insulation with overall polyvinyl chloride jacket conforming to ICEA S-66-524.

   e. Individual polyolifin insulation with individual and overall polyvinyl chloride jackets conforming to ICEA S-61-402.

H. Switchboard Wires and Cables

Unless otherwise shown on the Contract Drawings, switchboard wires and and cables shall be as follows:

1. Switchboard wires and cables shall be single conductor, ASTM B 8, Class B stranded, except that for wires and cables crossing hinged joints and swinging panels, and where "Extra Flexible" wire or cable is shown on the Contract Drawings, conductors shall be ASTM B 174, Class K stranded.

2. Wires and cables shall be Type SIS, cross-linked-thermosetting-polyethylene insulation, conforming to ICEA S-61-402, IEEE383 and UL 44.

I. Cable Tags

1. Dry Locations

   a. Fiberglass tags, 1/16 inch thick and 3/4 inch wide, indented with letters and numbers 5/16 inch high, with #14 AWG copper or nylon, weather-resistant cable ties.

   b. Lighting branch circuit wiring and single conductor signal and control wiring may be identified with "Quiklables" manufactured by W. H. Brady Company, or approved equal.

2. Wet Locations

   Stainless steel metal tags, No. 28 gauge and 3/4 inch wide, embossed with letters and numbers 5/16 inch high, with #14 AWG copper or nylon, weather-resistant cable ties, or stainless steel cable ties.

2.03 SPLICING, TERMINATING AND ARCPROOFING MATERIALS

A. General

1. All splicing, terminating and arcproofing materials shall be compatible so that no one material will adversely affect the physical or electrical properties of any other, or of the wire or cable itself.

2. All materials for making splices and terminations shall be specifically designed for use with the type of wire or cable, insulation and installation and operating conditions of the specific application.

B. Connectors

Subject to compliance with requirements of this Section, provide connectors of the following types:

1. Solderless, uninsulated, high conductivity, corrosion resistant, compression connectors conforming to UL 467 and IEEE 837;

2. Insulated, indenter type compression butt connectors;

3. Insulated, integral self-locking flexible shell, expandable spring connectors;

4. Uninsulated, indenter type compression pigtail connectors;

5. Welded type connectors.

C. Terminals

Subject to compliance with requirements of this Section, provide terminals of the following types:

1. Solderless, uninsulated, high conductivity, corrosion resistant, compression terminals conforming to UL 467 and IEEE 837;

2. Insulated, compression terminals;

3. Solderless, high conductivity, corrosion resistant, hex screw type, bolted terminals;

4. Welded type terminals.

D. Shrinkable Tubing

Subject to compliance with requirements of this Section, provide shrinkable tubing of the following types:

1. Either irradiated modified polyvinyl chloride or irradiated modified polyolefin heat shrinkable tubing;

2. Cold shrinkable tubing.

E. Tapes and Sealers

1. Vinyl Tapes

Flame-retardent, cold and weather-resistant, 3/4 inch or 11/2 inches wide, as required, and conforming to UL 510 and ASTM D 3005.

a. For interior, dry locations, provide 7 mils, conforming to ASTM D 3005 (Type I); Scotch (3M) No. 33, or approved equal.

b. For exterior or damp and wet locations, provide 8.5 mils, conforming to ASTM D 3005 (Type II); Scotch (3M) No. 88, or approved equal.

2. Rubber Tapes

Ethylene-propylene, rubber-based, 30-mil splicing tape, rated for 130 degrees C operation; 3/4inch and wider (1, 1 1/2, 2 inches) as shown on the Contract Drawings or approved by the Engineer, conforming to Federal Specification HH-I-553 (Grade A); Scotch (3M) No. 130C, or approved equal.

3. Insulating Putty

Rubber-based, 125-mil elastic filler putty; 1 1/2 inches wide; Scotch (3M) Scotchfil, or approved equal.

4. Silicone Rubber Tapes

Inorganic silicone rubber, 12-mil, 130 degrees C rated, anti-tracking, self-fusing tape; 1 inch wide; Scotch (3M) No. 70, or approved equal.

5. Sealer

Liquid applied, fast-drying sealant; Scotch (3M) Scotchkote, or approved equal.

F. Resin Filled Splices

1. Epoxy Molded Type

Two-piece, snap-together molded bodies, sized for wire or cable, with two-part low viscosity polyurethane insulating and sealing compound, rated for 600 volts, using crimp-type wire connector; Scotch (3M) No. 82-A1, 82-A2 or 82-A3 compound, or approved equal.

2. Re-Enterable Type

Transparent, molded bodies clamped with stainless steel strain-relief bar and shield continuity connectors, sized for wire or cable, with loosely woven polyester spacer web and jelly-like urethane formulation for permanent re-entry capability; Scotch (3M) No. 78-R1 thru 78-R5, with No. 2114 compound, or approved equal.

G. Arcproofing Materials

1. Fire resistant tapes shall be Scotch (3M) No. 77, or approved equal.

2. Glass cloth binding tapes shall be Scotch (3M) No. 69, or approved equal.

H. Special splicing materials and methods shall be as shown on the Contract Drawings.

2.04 SHOP TESTS

A. For quantities as shown on the Contract Drawings, regular dielectric-withstand and insulation-resistance in water tests for wires and cables shall be performed in accordance with UL44.

B. Flame tests for wires and cables shall be performed in accordance with IEEE 383.

C. The test results shall be certified for each reel/coil/box of wire or cable.

D. Factory inspection and witnessing of tests by the Engineer shall be required for all wires and cables furnished under this Contract. The Engineer reserves the right to require additional testing, or to waive factory inspection or witnessing of tests. The Contractor shall notify the Engineer 14 days in advance of the scheduling of such factory tests.

PART 3. EXECUTION

3.01 PREPARATION

A. Prior to pulling wires and cables, clean raceway systems of all foreign matter and perform all operations necessary so as not to cause damage to wires and cables while pulling.

B. Prior to pulling wires and cables into underground conduit systems, place a feeding tube approved by the Engineer at the entrance end of such systems.

3.02 INSTALLATION

A. Wire and Cable Installation

1. General

a. Keep wires and cables dry at all times.

b. Seal wire and cable ends with watertight end seals if splicing or terminating does not follow at once.

c. Before splicing or terminating wires and cables, make a thorough inspection to determine that water has not entered the wires and cables or that the wires and cables have not been damaged.

d. Use adequate lubrication when installing cables in conduits or raceways. Any pulling compounds shall be compatible with the finish of the wires and cables furnished.

2. General Purpose Wires and Cables

a. Minimum wire or cable size shall be #12 AWG for light and power service.

b. Wires or cables shall be at least #10 AWG for the entire length of branch circuits, where distances to first outlets are as follows:

(1) 100 feet or more on 480Y/277 Volt systems.

(2) 70 feet or more on 208Y/120 Volt systems.

3. Lighting Fixture Wires

a. For wiring within lighting fixtures only, where sizes #14 AWG or smaller are required, use Type SF-2 fixture hookup wire. Type SF-2 wire shall not be used for wiring end-to-end connected fluorescent fixtures.

b. For connecting lighting fixtures to branch circuit conductors, use either Type RHH-VW-1, XHHW or USE, up to 90 degrees C, in dry locations.

4. Grounding Wires and Cables

a. Use bare, uninsulated wire and cable only where shown on the Contract Drawings or where approved by the Engineer.

b. Insulated grounding cable shall be of the type specified in this Section or as shown on the Contract Drawings.

5. Control Wires and Cables

Control wires and cables shall not be smaller than #14 AWG unless otherwise shown on the Contract Drawings.

B. Splicing and Terminating

1. General

Splicing and terminating shall be as specified in this Section. Details of special splicing and terminating shall be as shown on the Contract Drawings. Any splicing or terminating methods other than those specified below, for which the components are in accordance with the requirements of this Section, shall be submitted to the Engineer for approval.

2. General Purpose Wires and Cables

a. Splices in dry locations for sizes #10 AWG and smaller

Splicing shall be completed using one of the following:

(1) Insulated, integral, self-locking flexible shell, expandable spring connectors shall be applied to the twisted conductors. Two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.

(2) Compression type, insulated butt connectors shall be applied to the butted conductors by means of an appropriate crimping tool, providing controlled indentation. Two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.

(3) Compression type, pigtail connectors shall be applied to the conductors by means of an appropriate crimping tool, providing controlled indentation. The connector shall be covered with a polyamide cap and two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.

b. Splices in dry locations for sizes #8 AWG and larger

Splicing shall be completed using all of the following:

(1) Connectors shall be split sleeve solderless type or solderless compression type.

(2) Fill indents of connectors with Scotchfil insulation putty.

(3) Apply rubber splicing tape equal to the original insulation rating.

(4) Apply two, half-lapped layers of vinyl tape, or a shrinkable tubing.

c. Splices in wet locations

(1) Same as dry locations specified in 3.02B.2.a and 2.b, except that after vinyl tape is applied, cover with two coats of sealer or shrinkable tubing.

(2) Resin-filled splice shall be covered with two, half-lapped layers of vinyl tape and two coats of sealer or shrinkable tubing.

d. Terminations in dry locations for sizes #10 AWG and smaller

Terminations shall be compression terminals, insulated or uninsulated.

e. Terminations in dry locations for sizes #8 AWG through #3/0 AWG

(1) Ring tongue terminals shall be solderless, uninsulated compression crimp type.

(2) Ring tongue lugs shall be bolted hex screw type.

f. Terminations in dry locations for sizes #4/0 AWG and larger.

Ring tongue terminals shall be solderless, uninsulated compression crimp type.

g. Terminations in wet locations

In addition to the dry location terminations specified in 3.02 B.2.d, 2.e and 2.f, cover the entire termination area with two, half-lapped layers of vinyl tape and apply two coats of sealer over the tape.

3. Overhead Service Cables

Splices and terminations in overhead service cables shall be the same as specified in 3.02 B.2.c and 2.g, respectively, appropriate for overhead service.

4. Portable Cords

   a. Splices shall not be made in portable cords.

   b. Terminations shall be made only at apparatus to be served or at branch circuit connection by means of any of the following:

      (1) Insulated, integral, self-locking flexible shell, expandable spring, or crimp type connectors;

      (2) Insulated, crimp type, compression connectors;

      (3) Uninsulated, ring tongue terminals for connection to wire terminal strip block.

5. Lighting Fixture Wires

   Connections to branch circuit and to fixture wiring shall be made by either insulated, integral, self-locking flexible shell, expandable spring, or crimp type connectors.

6. Grounding Wires and Cables

   a. Splices and terminations shall be installed in accordance with the manufacturer's recommendations.

   b. In hazardous or classified locations, splices and terminations shall be solderless high conductivity, corrosion resistant, compression type connectors and terminations shall be clamp type pressure connectors, suitable for such use.

   c. All underground connections shall be covered with two coats of asphalt base paint.

7. Control Wires and Cables

   a. Splices shall be made in accordance with the requirements specified in 3.02 B.2.c and shall be enclosed in a re-enterable splicing case. Where shielded cable is shown on the Contract Drawings, the shielding shall be continued through the splice. Shields shall be grounded at one location only unless otherwise shown on the Contract Drawings.

   b. Terminations shall be insulated, indenter type ring tongue terminals.

8. Switchboard Wires

   a. No splices are permitted.

   b. Terminations shall be insulated, indenter type ring tongue terminals.

C. Arcproofing

1. Arcproofing shall be applied where shown on the Contract Drawings.

2. Arcproofing, which has been disturbed for any reason, shall be reinstalled as soon as possible after the disturbance.

3. Arcproofing shall be installed as follows:

a. Wires and cables shall be grouped by circuit and arcproofing applied over the group of wires and cables comprising one circuit. Splices shall be arcproofed individually and the taping shall join with and be overlapped by the group taping.

b. Arcproofing shall be applied in two wrappings of half-lapped tape, bound with glass cloth tape applied at the ends of the fire resistant tape, and at intervals not to exceed 24 inches along the entire length of the cables. The two wrappings shall be applied with opposing-lays.

c. Arcproofing shall be extended into the conduit opening or end bell of the raceway entering a handhole, manhole or box.

d. Arcproofing tape shall be 1 1/2 inches wide where the diameter of the individual cable, or of the circumscribed circle for the circuit group, is less than 1 3/4 inches. For larger diameters, the tape shall be 3 inches wide.

D. Identification of Wires and Cables

1. Each wire and cable shall be identified by its circuit in all cabinets, boxes, manholes, handholes, wireways and other enclosures and access locations, and at all terminal points.

2. The circuit designations shall be as shown on the Contract Drawings. Tags shall be attached to wires and cables in such a manner as to be readily visible.

3. The tag ties shall be wrapped around all conductors comprising the circuit or feeder to be identified.

4. Wires and cables which are arcproofed shall also be identified outside the applied arcproofing.

3.03 FIELD TESTS

Test all wires and cables up to equipment installed under this Contract with a 1000-volt Megohmmeter. Furnish the Engineer with a copy of the "Megger" readings together with an outline of the method used. If, in the opinion of the Engineer, any reading is lower than that required by applicable codes, promptly replace the materials involved, at the Contractor's expense, and retest.

END OF SECTION

SECTION 16120

WIRE, CABLES, SPLICES, TERMINATIONS (600 VOLTS OR LESS)

APPENDIX "A"

SUBMITTALS

A. Submit Catalog Cuts for the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

1. Wires and cables for each type and size;
2. Splice kit materials and installation procedures.

B. Submit certified shop test reports for wires and cables.

C. Submit field test results for wires and cables, including "Megger" readings with the test method used.

END OF APPENDIX "A"

SECTION 16126

FIBER OPTIC CABLING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for the following types of Control and Signal transmission media:
   1. Multimode Optical fiber cabling.
   2. Singlemode Optical fiber cabling.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling systems shall comply with transmission standards in TIA/EIA-568, when tested according to test procedures of this standard.

B. All cable installation, including all components of the optical fiber cable system shall be manufactured and installed with the requirements of NFPA 70.

C. Project Conditions
   1. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and system is operating and maintaining conditions as defined in paragraph 1.02-C-2 below.
   2. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability.
      a. Interior, Controlled Environment: System components installed in temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 30 to 90 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing.
      b. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient temperatures of 0 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing. Use NEMA 250, Type 3R enclosures.
      c. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient temperatures of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation when exposed to rain as specified in NEMA 250, winds up to 85 mph (137 km/h) Use NEMA 250, Type 4X enclosures.

1.03 REFERENCES

A. The following is a listing of the publications referenced in this section:

1. Building Industry Consulting Service International (BICSI)
   a. Telecommunications Design Methods Manual, Latest Revision
2. Insulated Cable Engineering Association (ICEA)
   a. ICEA T-33-655 Guide for Low Smoke, Halogen-Free (LSHF) Polymeric Cable Jackets.
3. International Telecommunications Union (ITU)
   a. T G.651-Characteristics of a 50/125um multimode graded index optical fiber cable.
   b. T G.652-Characteristics of a single-mode optical fiber and cable.
   c. T G.653-Characteristics of a dispersion-shifted single-mode optical fiber and cable.
   d. T G.654-Characteristics of a cut-off shifted-mode optical fiber and cable.
   e. T G.655-Characteristics of a non-zero dispersion-shifted single-mode optical fiber and cable.
   f. T G.656-Characteristics of a fiber and cable with non-zero dispersion for wideband transport.
4. Insulation Cable Engineers Association (ICEA)
   a. T-33-655-Guide for Low Smoke, Halogen-Free (LSHF) Polymeric Cable Jackets.
5. National Fire Protection Association (NFPA)
   a. NFPA 70 National Electrical Code
   b. NFPA 130 National Electrical Code
   c. NFPA 502-Standard for Road Tunnels, Bridges, and Other Limited Access Highways.
6. Naval Engineering Standards
   a. NES 713 Determination of Toxicity Index of Products of Combustion From Small Specimens of Materials
7. International Electrical Testing Association (NETA)
   a. Acceptance Testing Specifications, Section 7.25.
8. Telecommunications Industry Association (TIA) / Electronics Industries Alliance (EIA)
   a. 455-25C-FOTP-25 Impact Testing of Optical Fiber Cables.
   b. 455-26A-FOTP-26 Crush Resistance of Fiber Optic Interconnecting Devices.
   c. 455-33A-FOTP-33 Fiber Optic Cable Tensile Loading and Bending Test.
   d. 455-41A-FOTP-41 Compressive Loading Resistance of Fiber Optic Cables.
   e. 455-82B-FOTP-82 Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable.
   f. 455-98A-FOTP-98 Fiber Optic Cable External Freezing Test.
   g. 455-14A-OFSTP-14 Fiber Optic Cable Cyclic Flexing Test.
   h. 526-14A-OFSTP-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
   i. 526-7-OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
   j. 568-C.3-Optical Fiber Cabling Components Standard.
   k. 598-C-Optical Fiber Cable Color Coding.
   l. 604-Fiber Optic Cabling Intermateability Standard (FOCIS).
   m. 606-A-Administration Standard for Commercial Telecommunications Infrastructure.
   n. 607-A-Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
9. Underwriters Laboratories Inc.
   a. UL 910 Test for Flame - Propagation and Smoke - Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air

b. UL 1651-Standard for Safety for Optical Fiber Cable.
c. UL 1666 Test for Flame Propagation Height of Electrical and Optical – Fiber Cables Installed Vertically in Shafts
d. UL 1685 Standards for Safety Vertical Tray Fire Propagation and Smoke Release Test for Electrical and Optical Fiber Cable.
e. UL 2024-Optical Fiber Cable Raceway.

1.04 SUSTAINABLE DESIGN REQUIREMENTS

A. Not Applicable.

1.05 QUALITY ASSURANCE

A. Cable Manufacturer Qualification:

1. The cable manufacturer shall be a company specializing in the manufacture of fiber optic cables and shall be ISO 9001/Q9001 certified for a Quality System for Fiber Optic Cables.

B. All optical fiber materials for which there are established UL standards shall bear the UL label.

C. Wires and cables which have been manufactured more than two years prior to installation shall not be used in the Work of this Section.

D. Where cables specified in this Section are used to provide signal paths for systems specified in other Sections of the Specifications, or for systems shown on the Contract Drawings, review the cable characteristics provided by this Section for compatibility and use with the system equipment to be connected to the fiber optic cables.

E. All optical fiber cable installations, splices and terminations shall be performed by qualified workers with prior experience in installing optical fiber cables and working on optical fiber systems. Work experience shall include the successful installation of at least three other optical fiber systems of similar complexity to the work of this Section. Installer qualifications shall include successful completion of training classes covering optical fiber cable installation, termination, splicing and connectorizing.

F. Cable manufacturers shall be regularly engaged in manufacturing optical fiber cables of the types, sizes, and characteristics specified in this Section and on the Contract Drawings. Cable manufacturer's products shall have been in satisfactory use in similar service for not less than 3 years.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver to the construction site cable properly packaged in factory-fabricated type or wound on NEMA specified type cable reels.

B. Store cable in clean dry space in original containers, protected from weather, theft, vandalism, damaging fumes, construction debris and traffic.

C. Handle cable to avoid braising, puncturing and tearing cable insulation and sheathing. Ensure that dielectric resistance and characteristic impedance integrity of transmission media are maintained.

D. Test cables upon receipt at construction site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use an Optical Test Set or OTDR (Optical Time Domain Reflectometer)
2. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.

1.07 SUBMITTALS

A. See Appendix A for submittal requirements.

PART 2 - PRODUCTS

2.01 CABLE – GENERAL

A. Locations, types, sizes and numbers of cables as shown on the Contract Drawings.

B. Unless otherwise shown on the Contract Drawings, cables that will be installed in riser areas shall pass the flame propagatory and smoke release criteria according to the test method of UL 1666.

C. Unless otherwise shown on the Contract Drawings, cables that will be installed in plenum areas shall pass the flame propagatory and smoke release criteria according to the test method of UL 910.

D. Unless otherwise shown on the Contract Drawings, use the following performance characteristics for cables which will be installed in subway areas, substations, tunnels, etc. where flame retardency, low smoke, low toxicity, zero halogen and good circuit integrity during a fire are required.
   1. Cables shall pass the flame propagatory and smoke release criteria according to the test method of UL 1685.
   2. The halogen content of the cable shall not exceed 0.2 percent according to the test method of MIL-C-24643. The Authority classifies 0.2 percent or less halogen content as "non-halogen".
   3. The cable shall comply with ICEA T-33-655 for smoke generation.
   4. The toxicity index of the cable shall not exceed 2.0 according to the test method of NES 713.
   5. The acid gas content of the cable shall not exceed a maximum of 2.0 percent according to the test method of Mil-C-24643.
   6. All cables, splices and terminations, for which there are established UL standards shall bear the UL label.
   7. Surface-Burning Characteristics shall be as determined by testing identical products according to ASTM E 84 by a qualified testing agency as defined in paragraph 1.5 above. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 50 or less.

2.02 OPTICAL FIBER CABLE (OFC)

A. Manufacturers: Subject to compliance with requirements.

B. OFC General Requirements
   1. Optical fiber cables shall be factory-fabricated, single channel, low-loss, glass, graded index type. The number of fibers and optical requirements shall be as shown on the Contract Drawings.
   2. The optical fibers shall be incorporated in the cable construction using either the loose buffer tube or tight buffer tube method. The optical fibers shall be individually cladded, jacketed, and identified within the buffer tubes.

3. Each fiber shall be distinguishable by means of a continuous color code, continuous numbering, continuous lettering, or a combination of methods. Color coding of optical fiber cables shall be in compliance with EIA/TIA-598.
4. Optical fiber cables shall conform to EIA FOTP-25 standard for impact resistance.
5. Optical fiber cables shall conform to EIA FOTP-33 standard for maximum pulling load.
6. Optical fiber cables shall conform to EIA FOTP-41 standard for crush resistance.
7. Optical fiber cables shall conform to EIA FOTP-104 standard for flexibility.
8. Optical fiber cables with PVC jackets are acceptable in indoor, general purpose and riser areas. Optical fiber cables with PVC jackets are not acceptable in indoor plenum areas.
9. Optical fiber cable for outdoor use shall be able to sustain the traffic-induced vibrations at all sites without damage to the physical and optical characteristics of the optical fiber.
10. Optical fiber cable for outdoor use shall be moisture resistant as per EIA FOTP-892 standards.
11. Patch Cords: Factory-made, dual-fiber cables conforming to types as called out on Contract Drawings and Specifications as defined herein while maintaining a minimum 48-inch length.
12. Fiber Optic Innerduct:
    a. Furnish and install fiber optic innerduct of the type, characteristics and size and at the locations indicated on the Contract Drawings. The innerduct shall be plenum-rated, low smoke, zero halogen type, corrosion resistant and, unless otherwise indicated on the Contract Drawings, shall be constructed of flexible polyethylene.
13. All materials used in the optical fiber cable shall be suitable for use under the following climatic conditions:
    a. Temperatures of -40 to +70 degrees centigrade
    b. Relative humidity of 5% to 100% condensing
14. Optical fiber cable for outdoor use shall be resistant to the following chemicals:
    a. Petroleum products (gasoline, diesel fuel, lubricants, etc.)
    b. Atmospheric nitric acid
    c. Carbon dioxide
    d. Carbon monoxide
    e. Nitrous oxides
    f. Atmospheric sulfuric acid

C. OFC Technical Requirements:
1. Multimode Fiber Optic Cable
    a. Description: Multimode, 62.5/125-micrometer, fiber strand count as depicted on Contract Drawings, nonconductive, optical fiber cable.
        1) Comply with ICEA S-83-596 for mechanical properties.
        2) Comply with TIA/EIA-568-B.3 for performance specifications.
        3) Comply with TIA-492AAAB for detailed specifications.
        4) Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
            a) General Purpose, Nonconductive: Type OFN or OFNG
            b) Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
            c) Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
            d) General Purpose, Conductive: Type OFC or OFCG
            e) Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
            f) Riser Rated, Conductive: Type OFCR, complying with UL 1666.
        5) Conductive cable shall be steel armored type.
    b. Jacket:

1) Jacket Color: Orange for 62.5/125-micrometer cable.
2) Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
3) Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2. Singlemode Fiber Optic Cable
   a. Description: Singlemode, 50-micrometer, fiber strand count as depicted on drawings, nonconductive, optical fiber cable.
      1) Comply with ICEA S-83-596 for mechanical properties.
      2) Comply with TIA/EIA-568-B.3 for performance specifications.
      3) Comply with TIA-492AAAB for detailed specifications.
      4) Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
         a) General Purpose, Nonconductive: Type OFN or OFNG
         b) Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
         c) Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
         d) General Purpose, Conductive: Type OFC or OFCG
         e) Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
         f) Riser Rated, Conductive: Type OFCR, complying with UL 1666.
      5) Conductive cable shall be steel armored type.
   b. Jacket:
      1) Jacket Color: Yellow for 50/125-micrometer cable
      2) Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
      3) Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.03 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements.

B. Cable Connecting Hardware: Meet the Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.

1. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.75 dB.
2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.04 IDENTIFICATION PRODUCTS

A. Requirements listed in this paragraph are for all cables within Section 16127.

B. Manufacturers: Subject to compliance with requirements.

C. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

D. Provide a labeling plan and format to Engineer for approval prior to work.

PART 3 - EXECUTION

3.01 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA-569-B.

B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Division 16 Section "Raceways and Boxes" for installation of conduits and wireways.

D. Install manufactured conduit sweeps and long-radius elbows whenever possible.

E. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches (75 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.02 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements in Division 16 Section "Hangers and Supports for Electrical Systems" for installation of supports for pathways, conductors and cables.

3.03 CABLE INSTALLATION REQUIREMENTS

A. Cable in Raceways and Enclosures;
1. Install cable in conduit. Conceal conduit except in unfinished spaces and as indicated on Contract Drawings. Minimum conduit size shall be 1”. Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Pulling Requirements
1. Install cable as indicated in accordance with NFPA 70 requirements and manufacturer's written instructions.
2. Install transmission media without damaging conductors, shield, or jacket.
3. Do not bend cable, in handling or installation, to smaller radii than minimum recommended by manufacturer.
4. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
5. Pull cables simultaneously where more than one is being installed in same raceway.

6. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
7. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway.

C. Splicing Of Cable
1. Splicing of optical fiber cable shall be permitted only when the length of the cable run exceeds those of the cable manufacturers pulling distance restrictions.
2. The number of splices per cable shall be kept to a minimum. Splicing is permitted only in electrical closets. Splicing of cable runs in roadway or ramp areas is not permitted.
3. Splicing of optical fiber cable shall be performed by means of fusion splicing. The Contractor shall submit, for approval, a detailed written procedure, prior to start of work, which shall include:
   a. The number of splices per fiber, and location of each splice, for all optical fiber cables.
   b. The means to support the splice.
   c. Covering or sheathing of splice
4. Splicing shall be performed in a professional manner by experienced workers.
5. Splices shall not have losses exceeding 0.2 dB per splice.
6. All splices shall be enclosed in a splice organizer and then placed in a splice enclosure box to be mounted in the electrical closet. Submit catalog cuts for splice organizers and enclosures to the Engineer for approval.
7. Use splice and tap connectors that are compatible with cable material. All splice locations shall be approved by the Engineer.

3.04 INSTALLATION OF CABLES

A. General Requirements for Cabling Installation:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all cable strands; no cable shall contain unterminated elements. Make terminations only at indicated outlets and cross-connect and patch panels.
4. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
5. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
6. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

B. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.

C. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.

3. Coil cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (300 mm) in diameter below each feed point.

3.05 TESTING

A. Conduct tests as described in following for cables provided under this Section.

B. Factory Test.
   1. Testing Agency:
      a. Engage a qualified testing agency as defined in paragraph 1.5 in this section.
   2. Factory Inspection
      a. The Authority shall have the right to inspect the manufacturer's quality control, manufacturing, and testing facilities at any time during the procurement process. Inspection by the Authority will include visual examination of the cables, and all related documentation to ensure that the cables are being fabricated in accordance with the Specifications.
   3. Factory Test Plan
      a. The Contractor shall submit a test plan for each type of cable shown on the Contract Drawings. The test plan shall be approved prior to the start of the factory test. The test plan shall include test schedule, lists of test to be conducted, test equipment to be used, expected test results and test documents produced, and copies of any certified test data to be used in lieu of testing.
   4. Factory Test
      a. For those tests that are not conducted during factory tests, the Contractor shall submit certification by a recognized independent testing laboratory, showing the complete test results. The Contractor shall notify the Engineer 14 days in advance of the scheduling of such factory tests. The Engineer reserves the right to require additional testing, or to waive factory inspection or witnessing of tests.
      b. If factory tests are required by the Engineer, the cables shall not be shipped until after the factory tests have been satisfactorily completed and the cables are approved by the Authority.
      c. Factory tests for optical fiber cable shall include, but not necessarily be limited to, the following:
         1) Attenuation of each fiber
         2) Bandwidth of each fiber
         3) OTDR (Optical Time Domain Reflectometer) image of each fiber
         4) Factory test optical fiber cables on reels according to TIA/EIA-568-B.1.
         5) Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3
      d. Cable will be considered defective if it does not pass tests and inspections.
      e. Prepare test and inspection reports.

C. Field Test.
   1. Testing Agency:
      a. Engage a qualified testing agency as defined in paragraph 1.5 in this section.
      b. Perform tests and inspections as follows.
   2. Tests and Inspections:
      a. Visually inspect all cable jacket materials for NRTL certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and

inspect cabling connections to confirm compliance with TIA/EIA-568-B as applicable..

3. Test instruments:
   a. Instruments shall meet or exceed applicable requirements in TIA/EIA-568-B. Perform tests with a tester that complies with performance and accuracy requirements in TIA/EIA-568-B. Use only test cords and adapters that are qualified by test equipment manufacturer.
4. Test parameters
   a. Optical Fiber Cable Tests:
      1) Test settings:
         a) Multimode Link Measurements: Test at 850 or 1310 nm in 1 direction according to TIA-526.
         b) Singlemode Link Measurements: Test at 1310 or 1550 nm in 1 direction according to TIA-526.
      2) Attenuation of each fiber
         a) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
      3) Bandwidth of each fiber
      4) OTDR (Optical Time Domain Reflectometer) image of each fiber
      5) Factory test optical fiber cables on reels according to TIA/EIA-568-B.1.
      6) Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.
      7) Link End-to-End Attenuation Tests:
5. Test Results
   a. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
   b. End-to-end cabling will be considered defective if it does not pass tests and inspections.

3.06 FIRESTOPPING

A. Comply with requirements in Division 7 Section "Firestopping."

B. Comply with TIA-569-B, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

END OF SECTION 16126

SECTION 16126

FIBER OPTIC SYSTEMS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

1. Catalog cuts for cable
2. Cable certificates, acknowledged by the communication system manufacturers, certifying that the cables are suitable for the connected equipment as described in Section 1.04 "Quality Assurance".
3. One (1) foot sample of each type of cable for approval.
4. Sample splice kit materials and installation procedures.
5. Certified shop test reports for cable.
6. Field test reports indicating and interpreting test results.
7. Qualification data for manufacturers as per Section "Quality Assurance" stating their capabilities and experience. Include list of completed projects and other information specified.
8. Maintenance requirements for cables.
9. Test plan
10. Record Documents:
    a. One reproducible set and four sets of prints of the Shop Drawings that reflect the actual as built condition of the entire cable system.
    b. Cable Schedule: A listing of all installed cables runs including but not limited to the following cable run number, cable origin point and cable destination point
    c. Final Test Report for all installed cable.

END OF APPENDIX “A”

DIVISION 16

SECTION 16127

CONTROL/SIGNAL TRANSMISSION MEDIA

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for the following types of control and signal transmission media:

A. Coaxial Cable

B. Twisted Pair Cable

C. Video - Pair Cable

D. Optical Fiber Cable

E. Optical Fiber Connectors and Couplers

1.02 REFERENCES

The following is a listing of the publications referenced in this section:

	American Society for Testing and Materials (ASTM)
ASTM B 3	Soft or Annealed Copper Wire
ASTM B 8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B 33	Tinned Soft or Annealed Copper Wire for Electrical Purposes
ASTM E 662	Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
	Electronics Institute of America (EIA)
EIA FOTP-25	Fiber Optic Test Procedures for Impact Resistance
EIA FOTP-33	Fiber Optic Test Procedures for Maximum Pulling Load
EIA FOTP-41	Fiber Optic Test Procedures for Crush Resistance
EIA FOTP-104	Fiber Optic Test Procedures for Flexibility
EIA TIA-598	Optical Fiber Cable Color Coding Standards
	Insulated Cable Engineering Association (ICEA)
ICEA T-33-655	Guide for Low Smoke, Halogen-Free (LSHF) Polymeric Cable Jackets
	Military Standards
MIL-C-17	Standards for Radio Frequency Coaxial Cables
MIL-C-24643	Electrical Cable and Cord for Shipboard Use, Testing for Low Smoke and Halogens

National Fire Protection Association (NFPA)

NFPA 70	National Electrical Code

Naval Engineering Standards

NES 713	Determination of Toxicity Index of Products of Combustion From Small Specimens of Materials

Underwriters Laboratories Inc.

UL 910	Test for Flame - Propagation and Smoke - Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air
UL 1666	Test for Flame Propagation Height of Electrical and Optical - Fiber Cables Installed Vertically in Shafts
UL 1685	Standards for Safety Vertical Tray Fire Propagation and Smoke Release Test for Electrical and Optical Fiber Cables

1.03 QUALITY ASSURANCE

A. Wires and cables that have been manufactured more than two (2) years prior to installation shall not be used in the Work of this Contract.

B. Where cables specified in this Section are used to provide signal paths for systems specified in other Sections of these specifications, or for systems shown on Contract Drawings, the Contractor shall obtain review of the cable characteristics and certification for use with the connected system equipment by the connected equipment manufacturer.

C. All optical fiber cable installations, splices and terminations shall be performed by qualified workers with prior experience in installing optical fiber cable and working on optical fiber systems. Work experience shall include the successful installation of at least 3 other optical fiber systems of similar complexity to the Work of this Contract. Qualifications shall include successful completion of training classes covering optical fiber cable installation, termination, splicing and connectorizing.

D. Cable manufacturers shall be regularly engaged in manufacturing control/signal transmission media products of the types, sizes, and characteristics specified in this section and on the Contract Drawings. Cable manufacturers' products shall have been in satisfactory use in similar service for not less than 3 years.

E. The Contractor shall comply with NFPA 70 "National Electric Code" for components and installation.

F. All cable of each kind shall be the product of a single manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall deliver to the worksite cable properly packaged in factory-fabricated type or wound on NEMA specified type cable reels.

B. The Contractor shall store cable in clean dry space in original containers, protected from weather, theft, vandalism, damaging fumes, construction debris and traffic.

C. The Contractor shall handle cable carefully to avoid braising, puncturing and tearing cable insulation and sheathing. Ensure that dielectric resistance and characteristic impedance integrity of transmission media are maintained.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements of this Section, the Contractor shall provide wires and cables and wire and cable splicing and terminating products of manufacturers as shown on the Contract Drawings.

2.02 Control/ Signal Transmission Media

A. General

1. Locations, types, sizes and numbers of wires and cables are shown on the Contract Drawings.

   Where not indicated, the Contractor shall provide proper wire and cable selection to comply with this section, contract requirements and NFPA 70 Standards, or approved by the Engineer.

2. Unless otherwise shown on the Contract Drawings, solid conductors shall be soft, or annealed copper, conforming to ASTM B 33 (tinned), or ASTM B 3 (uncoated). Unless otherwise specified in this Section or unless otherwise shown on the Contract Drawings, stranded copper conductors shall be concentric stranding conforming to ASTM B 8.

3. Unless otherwise shown on the Contract Drawings, wires and cables that will be installed in riser areas shall pass the flame propagatory and smoke release criteria according to the test method of UL 1666.

4. Unless otherwise shown on the Contract Drawings, wires and cables that will be installed in plenum areas shall pass the flame propagatory and smoke release criteria according to the test method of UL 910.

5. Unless otherwise shown on the Contract Drawings, use the following performance characteristics for wires and cables which will be installed in subway areas, substations, tunnels, etc. where flame retardency, low smoke, low toxicity, zero halogen and good circuit integrity during a fire are required.

   a. Wires shall pass the flame propagatory criteria according to the test method of VW-1.

   b. Cables shall pass the flame propagatory and smoke release criteria according to the test method of UL 1685.

   c. The halogen content of the cable shall not exceed 0.2 percent according to the test method of MIL-C-24643. The Authority classifies 0.2 percent or less halogen content as "non-halogen".

   d. The cable shall comply with ICEA T-33-655 for smoke generation.

e. The toxicity index of the cable shall not exceed 2.0 according to the test method of NES 713.

f. The acid gas content of the cable shall not exceed a maximum of 2.0 percent according to the test method of Mil-C-24643.

6. All wires, cables, splices and terminations, for which there are established UL standards shall bear the UL label.

7. Cable Jacket Labeling

a. The cable jackets shall be labeled using environmental resistant printing in the range of 2 to 4 foot intervals.

b. The label shall indicate:

(1) The length to the end of the cable in feet

(2) The number of wires or optical fibers in the cable

(3) The date of manufacture

(4) The manufacture's name and part number

B. Electronic Cable

1. Single Conductor Coaxial

75-ohm characteristic impedance, solid polyethylene core 97 percent coverage, copper-braid shield, polyethylene jacket; conforming to MIL-C-17.

2. Single Conductor Plenum Coaxial

75-ohm characteristic impedance, solid base copper, central conductor, foamed Teflon dielectric, 100 percent coverage tinned-copper, double-braid shield, Teflon jacket, suitable for installation in air-handling spaces; conforming to MIL-C-17.

3. Direct Burial Coaxial

Single conductor, 75-ohm characteristic impedance, 18 AWG copper clad, steel-center conductor, solid polyethylene dielectric, 34 AWG bare copper-braid outer conductor shield with 95 percent coverage, polyvinyl chloride (PVC) jacket.

4. Aerial Coaxial

Single conductor, 75-ohm characteristic impedance, 18 AWG copper-clad, steel-center conductor, cellular expanded polyethylene dielectric, 34 AWG bare, copper-braid outer conductor shield with 95 percent coverage, ultraviolet-resistant polyvinyl chloride (PVC) jacket.

5. Multiconductor Cable

Quantity and size of conductors shall be as indicated on the Contract Drawings; color coded, low-loss polyvinyl chloride (PVC) insulation; aluminum/mylar shield and 22 AWG tinned-copper drain wire; PVC jacket.

6. Single Twisted Pair

Single-twisted pair, tinned-copper conductors , size of conductors shall be as indicated on the Contract Drawings; color-coded, low-loss polyethylene insulation; unshielded.

7. Multiple Twisted Pair

Quantity of twisted pairs and size of conductors shall be as indicated on the Contract Drawings; tinned-copper conductors; color-coded, low-loss polyethylene insulation; unshielded, polyvinyl chloride (PVC) jacket.

8. Multiple Shielded Twisted Pair

Quantity of twisted pairs and size of conductors shall be as indicated on the Contract Drawings; tinned-copper conductors; color-coded, polyvinyl chloride (PVC) insulation; overall aluminum/polyester shield and 22 AWG tinned-copper drain wire; PVC jacket.

9. Twisted Pair Plenum

Quantity of twisted pairs and size of conductors shall be as indicated on the Contract Drawings; 7-strand, tinned-copper conductors; Teflon insulation; overall aluminum/polyester shield and 22 AWG tinned-copper drain wire; Teflon jacket; suitable for use in air-handling spaces.

10. Video Pair

Balanced pair coaxial cable, 125-ohm characteristic impedance, 16 AWG soft-drawn, bare copper conductors twisted to form pairs, expanded polyethylene core insulation, copper shielding tape, expanded polyester film covering.

C. Optical Fiber Cables

1. Optical fiber cables shall be factory-fabricated, single channel, low-loss, glass, graded index type. The number of fibers and optical requirements shall be as shown on the Contract Drawings.

2. Unless otherwise shown on the Contract Drawings, the optical fibers shall have a 62.5-micron core diameter, 125-micron cladding diameter and 250 micron (nominal) coat diameter.

3. The optical fibers shall be incorporated in the cable construction using either the loose buffer tube or tight buffer tube method. The optical fibers shall be individually cladded, jacketed, and identified within the buffer tubes.

4. Each fiber shall be distinguishable by means of a continuous color code, continuous numbering, continuous lettering, or a combination of methods. Color coding of optical fiber cables shall be in compliance with EIA/TIA-598.

5. Unless otherwise shown on the Contract Drawings, the optical fibers shall have an attenuation of no more than 3.75 dB/Km at a wavelength of 850 nm, and 1.0 dB/Km at a wavelength of 1300 nm.

6. Unless otherwise shown on the Contract Drawings, the optical fibers shall have a minimum bandwidth of 200 MHz-Km at a wavelength of 850 nm, and a minimum bandwidth of 600 MHz-Km at a wavelength of 1300 nm.

7. Optical fiber cables shall conform to EIA FOTP-25 standard for impact resistance.

8. Optical fiber cables shall conform to EIA FOTP-33 standard for maximum pulling load.

9. Optical fiber cables shall conform to EIA FOTP-41 standard for crush resistance.

10. Optical fiber cables shall conform to EIA FOTP-104 standard for flexibility.

11. Optical fiber cables with PVC jackets are acceptable in indoor, general purpose and riser areas. Optical fiber cables with PVC jackets are not acceptable in indoor plenum areas.

12. Optical fiber cable for outdoor use shall be able to sustain the traffic-induced vibrations at all sites without damage to the physical and optical characteristics of the optical fiber.

13. Optical fiber cable for outdoor use shall be moisture resistant as per EIA FOTP-892 standard.

14. All materials used in the optical fiber cable shall be suitable for use under the following climatic conditions:

    a. Temperatures of -40 to +70 degrees centigrade

    b. Relative humidity of 5% to 100% condensing

15. Optical fiber cable for outdoor use shall be resistant to the following chemicals:

    a. Petroleum products (gasoline, diesel fuel, lubricants, etc.)

    b. Atmospheric nitric acid

    c. Carbon dioxide

    d. Carbon monoxide

    e. Nitrous oxides

    f. Atmospheric sulfuric acid

D. Optical Fiber Connectors

Where shown on the Contract Drawings, Contractor shall install stainless-steel optical fiber cable connectors, capable of terminating optical fiber glass cables. Optical fiber connectors shall have an insertion loss of not greater than 1.0 dB.

2.03 FACTORY TEST

A. Factory Inspection

The Authority shall have the right to inspect the manufacturer's quality control, manufacturing, and testing facilities at any time during the procurement process. Inspection by the Authority will include visual examination of the cables, and all related documentation to ensure that the cables are being fabricated in accordance with the Specifications.

B. Test Plan

Where required by the Contract Drawings, the Contractor shall submit a test plan for each type of cable shown on the Contract Drawings. The test plan shall be approved prior to the start of the factory test. The test plan shall include test schedule, lists of test to be conducted, test equipment to be used, expected test results and test documents produced, and copies of any certified test data to be used in lieu of testing.

C. Factory Test

1. For those tests that are not conducted during factory tests, the Contractor shall submit certification by a recognized independent testing laboratory, showing the complete test results. The Contractor shall notify the Engineer 14 days in advance of the scheduling of such factory tests. The Engineer reserves the right to require additional testing, or to waive factory inspection or witnessing of tests.
2. If factory tests are required by the Engineer, the cables shall not be shipped until after the factory tests have been satisfactorily completed and the cables are approved by the Authority.
3. Factory tests for optical fiber cable shall include, but not necessarily be limited to, the following:
    a. Attenuation of each fiber
    b. Bandwidth of each fiber
    c. OTDR (Optical Time Domain Reflectometer) image of each fiber
4. For all cable the following items shall be tested on a sample basis per the applicable test method:
    a. Consistency of color coding
    b. Cable length
    c. Dimensional tolerances

PART 3. EXECUTION

3.01 PREPARATION

Examine raceways and other elements to receive cable for compliance with installation tolerances and other adverse conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install cable as indicated in accordance with NFPA 70 requirements and manufacturer's written instructions. Cable shall be installed in locations as shown on the Contract Drawings by experienced workers in a careful professional manner.
    1. Install transmission media without damaging conductors, shield, or jacket.
    2. Do not bend cable, in handling or installation, to smaller radii than minimum recommended by manufacturer.

B. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
    1. Pull cables simultaneously where more than one is being installed in same raceway.
    2. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
    3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway.

C. Splicing Of Cable

1. Splicing of optical fiber cable shall be permitted only when the length of the cable run exceeds those of the cable manufacturers pulling distance restrictions.

2. The number of splices per cable shall be kept to a minimum. Splicing shall be permitted only in electrical closets. Splicing of cable runs in roadway or ramp areas shall not be permitted.

3. Splicing of optical fiber cable shall be performed by means of fusion splicing. The Contractor shall submit, for approval, a detailed written procedure, prior to start of work, which shall include:

   a. The number of splices per fiber, and location of each splice, for all optical fiber cables.

   b. The proposed means to support the splice.

   c. Covering or sheathing of splice

4. Splicing shall be performed in a professional manner by experienced workers.

5. Splices shall not have losses exceeding 0.5 dB per splice.

6. All splices shall be enclosed in a splice organizer and then placed in a splice enclosure box to be mounted in the electrical closet. The Contractor shall submit catalog cuts for splice organizers and enclosures to the Engineer for approval.

D. Use splice and tap connectors that are compatible with cable material. All splice locations shall be approved by the Engineer.

E. Bond shields and drain conductors to ground at only one point in each circuit.

F. Connect components to wiring system and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.03 FIELD TESTS

After installation of cable and before energizing, the Contractor shall perform the following field tests:

A. Copper cable procedures

Inspect for physical damage and test cable for continuity and shorts. Use time domain reflectometer with strip chart recording capability and anomaly resolution to within 12 inches (300 mm) in runs up to 1000 feet (300 m) in length. Test cable segments for faulty connectors, splices, terminations, and the integrity of the cable and its component parts.

B. Optical fiber cable procedures

Perform each visual and mechanical inspection and electrical test, including optional procedures, stated in NETA Standard ATS, section 7.25. Certify compliance with test parameters and manufacturer's recommendations. The attenuation of each fiber of each cable shall be tested after the cable has been installed. The Authority reserves the right to require:

1. OTDR (Optical Time Domain Reflectometer) tests to be repeated in the field on any fibers that show evidence of physical damage or out-of-specification attenuation. If the field test results indicate that one or more fibers in any segment do not meet the attenuation requirements of this specification, the segment shall be replaced at no cost to the Authority.

C. Operate control/signal systems to demonstrate proper functioning. Replace malfunctioning cable with new materials, and then retest and recommission until satisfactory performance is achieved.

D. All equipment, and personnel, and supervision necessary to conduct the field test shall be provided by the Contractor.

END OF SECTION

SECTION 16127

CONTROL/ SIGNAL TRANSMISSION MEDIA

APPENDIX "A"

SUBMITTAL REQUIREMENTS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

A. Catalog cuts for control/ signal transmission media.

B. Cable certificates, acknowledged by the Communication System Manufacturers, certifying that the cables are suitable for the connected equipment as described in Section 1.03 "Quality Assurance".

C. One (1) foot sample of each type of control/signal transmission media for approval.

D. Sample splice kit materials and installation procedures.

E. Certified shop test reports for control/signal transmission media.

F. Field test reports indicating and interpreting test results.

G. Qualification data for manufacturers as per Section 1.03 "Quality Assurance" stating their capabilities and experience. Include list of completed projects and other information specified.

H. Maintenance requirements for cables.

END OF APPENDIX "A"

DIVISION 16

SECTION 16133

CONTROL PANELS, ENCLOSURES/CABINETS, AND TERMINAL BOXES

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for control panels, electrical enclosures and cabinets.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American National Standards Institute (ANSI)
ANSI Z 55.1	Gray Finishes for Industrial Apparatus and Equipment
	National Electrical Manufacturers Association (NEMA)
NEMA ICS 1	Industrial Control and Systems. General Requirements
NEMA ICS 1.1	Industrial Control and Systems. Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control
NEMA ICS 2	Industrial Control and Systems. Controllers, Contractors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC
NEMA ICS 3	Industrial Control and Systems. Factory Built Assemblies
NEMA ICS	Industrial Control and Systems. Terminal Blocks
NEMA ICS 6	Industrial Control and Systems. Enclosures.
NEMA ICS 9	Industrial Control and Systems. Power Circuit Accessories
NEMA PB 250	Enclosures for Electrical Equipment (1000 Volts maximum)
NEMA Z 535.4	Product Safety Signs and Labels
	National Fire Protection Association (NFPA)
NFPA 70	National Electric Code
	Underwriters Laboratories Inc. (UL)
ANSI/UL 50	Cabinets and Boxes
ANSI/UL 65	Electric Wired Cabinets
ANSI/ UL 486E	Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
ANSI/UL 486A	Wire Connectors and Soldering Lugs for Use with Copper Conductors
ANSI/UL 969	Marking and Labeling systems
UL 1059	Electrical Terminal Blocks
ANSI/UL 467	Electrical Grounding and Bonding Equipment
UL 437	Key Locks
ANSI/UL 508	Electric Industrial Control Equipment

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Control Panels, Enclosures/Cabinets and Terminal boxes shall be designed in accordance with applicable standards of ANSI, NEMA, NFPA, and UL.

B. Unless otherwise shown on the Contract Drawings, enclosures/cabinets shall meet the following environmental requirements:

1. Enclosures/Cabinets located in heated areas shall be NEMA Type 1.
2. Enclosures/Cabinets located in unheated areas or in areas subject to dust or oil, shall be NEMA Type 12.
3. Enclosures/Cabinets located in exterior areas or in areas subject to rain, dripping liquid, or hosing shall be NEMA Type 4X, stainless steel.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Control panels, Enclosures/Cabinets and Terminal boxes shall be delivered to the construction site complete. All electrical devices and accessories shall be in place and wired.

B. Control panels, Enclosures/Cabinets, Terminal boxes and accessories shall be packaged to prevent damage due to vibration, jarring and the like during transportation and handling.

C. If any electrical devices or accessories must be shipped loose they shall be delivered in the manufacturer's original unopened protective packaging and shall be identified with suitable non-corrosive tag.

D. Store components and devices in clean and dry space, protected from weather.

E. Where possible, maintain protective covering until installation is complete and remove such covering as part of final cleanup.

F. Touch up any damage to finishes to match adjacent surfaces.

1.05 SPARE PARTS AND TOOLS

A. One set of all special tools and wrenches required for assembly or disassembly of the panel or cabinet and the installation of devices shall be furnished.

B. Furnish a list of recommended spare parts for each panel or cabinet. This list shall contain the prices and availability of the spare parts recommended.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 GENERAL

A. List of acceptable manufacturers is shown on contract drawings.

B. All Enclosures/cabinets and equipment, for which there are established UL standards, shall bear the UL label.

C. Location of control panels and enclosures/cabinets and their approximate dimensions shall be as shown on the Contract Drawings.

D. Each control panels, enclosures and cabinets shall be factory assembled, wired, tested and shipped as a single complete unit, with all devices, terminal blocks and internal wiring installed, unless written permission is given by the Engineer to disassemble any components or parts for shipment. Shipped loose components must fit and be ready for immediate installation in the field.

E. Devices installed shall be grouped according to their function. 15% spare mounting space shall be provided for future alterations.

F. All indicating devices, instruments, control switches and indicating lights shall be mounted on the door or front panel. Protection relays, if used, shall be semi-flush type with built-in test facilities wherever possible.

G. No polyvinyl chloride (PVC) materials, insulation or products shall be used.

2.02 CONSTRUCTION FEATURES

A. Interior

1. Control panel interior shall be designed and assembled so that individual devices, terminal blocks and other removable components and wiring may be easily accessible in order to add, remove or replace them without disturbing or removing adjacent units. All devices shall be located on two surfaces only - front and rear. No intermediate swing panels are allowed unless specified on Contract Drawings.

2. The distance between devices and wiring ducts and between terminal blocks and wiring ducts shall be sufficient to install and make clearly visible full wire designation, but not less than 1 inch.

3. All control cables shall be installed in gutters and wiring ducts with removable covers. Filling of gutters and ducts shall not exceed 50 %. Wireways shall have 0.06 square inch area for each external connection terminal point. This area shall be in addition to wireways required for internal wiring.

4. All internal connections to door mounted devices shall be made with extra-flexible (19 strand) wiring bundled together into the cable tie harness with sufficient slack for opening/closing of the door. The bundle shall be enveloped with a helical plastic lacing to prevent wire abrasion. The wire bundle shall be carried between supporting clamps on the door and fixed portion of the enclosure.

5. Devices and terminal blocks shall be mounted on a mounting panel to space them away from rear wall of the enclosure/cabinet.

6. Enclosures/Cabinets with terminal blocks only shall include terminal straps and brackets sized for the particular enclosure/cabinet and designed to space the terminal blocks away from rear wall of the enclosures/cabinets. Straps and brackets shall be Hoffman Engineering Co., Bulletin A-80 or approves equal.

7. Thermostatically controlled space heaters with mechanical guards shall be provided for all outdoor-located enclosures and for indoor enclosures if requested on the Contract Drawings. Heaters shall be rated 240 volts and operated at 120 volts, each with an individual circuit breaker of suitable rating. Heaters shall be sized to keep the air inside the cabinet above the dew point.

B. Enclosures and Cabinets

1. Enclosures/Cabinets shall be fabricated of code-gauge, sheet-steel, unless hot-dipped galvanized steel or stainless steel is shown on the Contract Drawings.

2. Enclosures and Cabinets shall have a hinged door unless otherwise indicated on the Contract Drawings. Doors shall be fitted with concealed, continuous, flush piano hinges.

3. Enclosures/Cabinets and trims shall be for surface-mounting, recessed installation or free standing (floor mounting) installation as shown on the Contract Drawings.

4. Trim for recessed or flush-mounted enclosures/cabinets shall consist of a one-piece sheet-steel frame with hinged door, catch and lock. Frame shall extend 3/4-inch beyond each side of the cabinets and shall be set with their backs flush with the finished wall. Rolled lip around all sides of the enclosure shall be provided to exclude liquids and contaminants. Door and body stiffeners shall be provided where required to assure rigid construction.

5. Enclosures/Cabinets for surface mounting shall be provided with the door, hinged directly to enclosures/Cabinets. Door shall be made of one piece of sheet-steel, shall have a 3/4-inch flange around all edges shaped to cover the edge of the box, and shall be provided with a catch and lock. Rolled lip around all sides of the enclosure shall be provided to exclude liquids and contaminants. Door and body stiffeners shall be provided where required to assure rigid construction.

6. Floor mounting (freestanding) enclosures/cabinets shall be fabricated of 10-gauge steel with steel channel base to form a rigid, self-supporting structure. Heavy duty lifting eyes anchor into reinforced top shall be provided.

7. On panels or doors weakened by excessive area punched out for device mounting, reinforcing stiffeners shall be provided for extra rigidity.

8. Enclosures/Cabinets with through wiring shall be provided with side gutters 4 inches wide. Enclosures/Cabinets shall be provided with top and bottom gutters not less than 6 inches wide.

9. All doors shall close against a rabbet placed all around the inside edge of the frame, with a close-fitting joint between the door and frame.

10. Each door shall be furnished with a flush cylinder tumbler lock, with catch, and spring loaded type stainless steel door pull. Doors more than 48 inches high shall be provided with a heavy-duty, three-point latching mechanism with rollers on ends of latch rods for easy door closing. Locks shall be fitted to separate keying for each system. Furnish one key for each cabinet installed and a maximum of 20 keys per system.

11. Fastening door screws or door clamps, where required, shall be stainless steel. Door screws shall be of the captive, tamper proof type.

12. Collar studs shall be provided with internal mounting panel.

13. Provide large removable print pockets, mounted inside of each enclosure/cabinet door.

C. Wiring

1. Wiring shall be sized to the duty required. Control wires shall be # 14 AWG minimum

2. Wiring of all relays, instruments, and other devices shall conform to the arrangement shown on approved wiring diagrams.

3. All control wiring, including all spare contacts of all devices, shall be wired to terminal blocks. Terminals shall be arranged for consecutive connections of conductors which compose a given control circuit or connected device. Number of spare contacts in each device shall be as shown on Contract Drawings.

4. All bus wiring such as 125 V DC, 120 V AC, alarm, etc. shall be insulated wire, run from terminal block to terminal block and not rigid buses.

5. Connections made on terminal blocks and devices shall be by means of insulated locking fork, or insulated ring type crimp terminals. All crimps shall be made with a ratchet type compression tool specifically made for this application to produce optimum mechanical and electrical performance.

6. On devices that do not permit locking fork or ring type terminals, control wiring shall be held by tubular screw-type connectors.

7. Internal wiring shall have no splices, nor shall more than two wires be terminated on one terminal point.

8. Seller is solely responsible for correctness of the internal wiring and proper functioning of the equipment being connected.

D. Terminal blocks

1. Terminal blocks shall be as shown on the Contract Drawings, as follows:

a. Sliding link disconnect terminal blocks shall be rated 600 volt AC and shall be UL recognized, Powerright Products Inc., series SLD-78-S, or approved equal.

b. Add on type terminal blocks with screw terminals and clamps, rated 600 volts, and sized to accept a wire range of #22 to #8 AWG, UL recognized and CSA certified.

c. Solderless tubular terminal blocks add-on type shall be rated 600 volts, and sized to accept a wire range of #22 to #8 AWG, with non-rotating clamping surfaces, UL recognized and CSA certified.

d. Fuse blocks shall be furnished with 600 volt rated fuses and switch-action, blown fuse indicator, pullers.

e. Provide terminal block accessories, including fanning strips, jumpers, marking strips and terminal covers.

2. Terminal block housings shall be molded from flame-retardant Lexan, Nylon or Polypropylene and terminal block accessories shall be made of flame-retardant materials. All terminal blocks shall be barrier type.

3. Each terminal block assembly shall be supported after every twelve points.

4. Terminal blocks rated 600 volts, 30 Amps shall be provided for all external connections by purchaser, unless otherwise shown on the Contract Drawings.

5. At least 20% uniformly distributed spare terminals shall be provided.

E. Identification

1. All devices shall be indelibly identified with legend plates inscribed in accordance with approved schematic diagrams and layout drawings.

2. Each Enclosure/Cabinet shall be provided with large engraved nameplate on its front. Nameplate nomenclature shall be according to a schedule approved by the Engineer.

3. Unless otherwise shown on the Contract Drawings, fabricate nameplates from an approved type of lamacoid plastic with letters engraved on the plate in white on black background. Where letter sizes are not shown on the Contract Drawings, use 1/2-inch high letters.

4. Secure nameplates on equipment with brass or stainless steel screws.

F. Accessories

1. Front of board test facilities shall be provided for all instrument and relay current and potential circuits that cannot be individually tested by test devices inherently built into relays or meter. Auxiliary contacts and switches shall be provided where necessary to form part of the test blocks.

2. Interior lighting with switches and receptacles, 120 volts AC, shall be provided if called for on Contract Drawings.

3. A color-coded mimic bus shall be provided if called for on Contract Drawings.

4. Internal copper ground bus, size 1/4 x 1 inch and extended throughout the structure, shall be provided in free standing enclosures/cabinets if called for on Contract Drawings. Ground bus shall be bolted, brazed or welded to the framework, side sheets, etc.

2.03 PAINTING

A. Surfaces to be painted shall be prepared by the removal of all grease, oil, rust, scale or other foreign material and chemically treated to provide a bond between the paint and metal surface preventing the entrance of moisture and the formation of rust under the paint film.

B. A prime coat of zinc chromate paint and two (2) finish coats of enamel paint conforming to ANSI Z 55.1 shall be applied. The gray prime and finish paints shall be a compatible finish system. In public areas the cabinets shall be painted as above, unless otherwise shown on Contract Drawings.

C. Furnish a can of touch up paint for use after equipment is positioned.

D. Stainless steel panels shall not be painted. Galvanized panels shall be painted if shown on the Contract Drawings.

2.04 SHOP TEST

A. Shop tests shall be in accordance with NEMA, ANSI and IEEE specifications, including:

1. High potential and operating tests on power equipment to demonstrate that this equipment will function correctly and in accordance with the intent of the specifications. Check rating of all protective devices (circuit breakers and fuses).
2. Insulation resistance test for each circuit with equipment connected, except those containing electronic components, using a 1000-volt megger. The insulation resistance shall be no less than 25 megohms.
3. Every control circuit continuity test. Use all schematic diagrams.
4. All control devices functional performance test to determine that all devices are wired and function correctly when energized.
5. Simulated operating test for the entire system.

B. Information outlining the test methods and procedures to be followed shall be submitted to the Engineer for approval during the period of shop drawing submission. A copy of test forms to be used shall be furnished at the time.

C. The Engineer shall be permitted to inspect any equipment, material or work to be furnished under this specification and shall have the right to reject any parts considered defective, unsuitable for the purposes or not in accordance with these specifications. Free entry shall be permitted to the Engineer at all times and to all parts of the works engaged in the manufacturing of this equipment.

D. The Engineer shall be notified in writing at least two weeks before testing. This notification shall list all units to be tested. The Engineer reserves the right to require additional testing or to waive factory inspection or witnessing of tests. The Engineer will advise the Contractor which tests will be witnessed and which will be waived.

E. Facilities for any reasonable tests that may be considered necessary in connection with any inspection shall be furnished free of charge. The shop shall provide equipment, instruments, cables, tools and personnel required and shall bear all expenses incidental to the foregoing tests, including replacement of damaged parts and material.

F. During the witnessing of tests, all original test data shall be initiated by the Engineer, and at the conclusion of the tests he shall be furnished with one copy of all original test data. If any data was modified, the Engineer shall be apprised and such modification shall be subject to the approval of the Engineer.

G. The accuracy of the calibration of all instruments to be employed during the tests shall be ascertained and recorded at the beginning of the tests. All readings shall be directed and visible to the Engineer.

H. Five (5) certified copies of all test results shall be furnished to the Engineer. Certification shall be by a Professional Engineer, licensed in the State in which tests were performed and so stamped.

I. Release of equipment shall not relieve the Contractor of the responsibility of furnishing equipment conforming to all specification requirements.

PART 3. EXECUTION

3.01 EXAMINATION

A. Verify that electrical installations, structural, mechanical and other related Work satisfy the requirements for performance of the work of this Section in accordance with the Contract Documentation.

B. Before delivering the equipment to the site, the Contractor shall investigate the site conditions to determine the best method of shipment, what preparatory Work, if any, will be needed to bring the equipment onto the site, and what will be the best and quickest method of unloading the equipment and setting it in place.

C. Report immediately to the Engineer any electrical, structural or related construction defects in areas where control panels or cabinets are to be installed, and do not attempt to rectify any defect unless specifically instructed to do so by the Engineer.

D. Before unloading the equipment it shall be inspected for damage during shipment. Any damage shall immediately be brought to the attention of the Engineer for resolution.

3.02 PREPARATION

A. Install any channels, angles or other supports that are required to support or mount the control panels and enclosures/cabinets.

B. Use supports and fasteners as specified in the Section of the Specifications entitled "SUPPORTING DEVICES" or as shown on the Contract Drawings.

3.03 INSTALLATION

A. Surface and flush mounted enclosures/cabinets shall be installed with tops 6 feet-6 inches above the floor, unless otherwise shown on the Contract Drawings.

B. Control panels and enclosures/cabinet shall be installed true and plumb on supporting struts and shall not be mounted directly on concrete, concrete block walls, or any other walls subject to moisture. Leave a minimum gap of 1/2 inch between the back of the enclosure/cabinet and the wall, using stainless steel hardware.

C. Where mounting directly on the wall is unavoidable the back of the enclosure shall be painted with two coats, minimum, of a bituminous paint.

D. Cables shall be neatly racked and bundled with nonflammable nylon ties, routed and supported within the enclosures/cabinets, cable ducts or gutters. Minimum bending radii as recommended by cable manufacturers shall not be reduced.

E. After conduits and cables are installed, the enclosures/cabinets shall be inspected for foreign materials and shall be vacuumed clean. Prior to energization, the panels shall be tested as described below.

F. A new set of as-built drawings, neatly bound together in plastic covers, shall be placed in the print pocket of each enclosure/cabinet.

3.04 FIELD TESTS

A. Visually inspect each device in the panel and operate manually.

B. Check all connections for tightness.

C. Check rating of all protective devices (circuit breakers and fuses). To each pole of the circuit breakers apply current 3 times its rating, recording currents and breaker trip times. Apply rapidly increasing currents and record the value that consistently causes instantaneous tripping of the breaker. Compare these recorded times with manufacturer's time current curves.

D. Perform each panel control wiring tests to determine that all devices are function correctly when energized and in accordance with the intent of the Contract Drawings and Specifications.

E. Perform control system functional test. This test shall include step by step procedure to determine that entire control system (this control panel could be just part of it) operate properly.

F. All discrepancies found by the contractor shall be brought to the attention of the Engineer.

G. All testing shall be performed in the presence of and as directed by the Engineer. The Contractor shall notify the Engineer when the equipment is installed and ready for testing.

END OF SECTION

SECTION 16133

CONTROL PANELS, ENCLOSURES AND CABINETS

APPENDIX A

SUBMITTAL REQUIREMENTS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

A. Shop Drawings

Shop drawings for each enclosure/cabinet shall include:

1. Job name
2. Item number
3. Quantity of each enclosure/cabinet configuration
4. Nameplate schedule in accordance with design drawings
5. Complete assembly drawings including plan, elevation and section views with dimensions. Show dimensioned location of all devices, terminal blocks, accessories and details for purchaser cable support. Indicate conduit entrance areas and mounting details.
6. Cabinet/Enclosure construction details, floor plan and channel base detail drawings
7. Specification for enclosure/cabinet mechanical and electrical parts, and assemblies.
8. Wiring interconnection and schematic diagrams as follows:
   a. The elementary diagrams supplied by panel vendor shall contain
      (1) Each device designation corresponding to panel layout drawing and wiring diagrams
      (2) All device terminal numbers corresponding to device vendor information
      (3) Contact development diagrams of all control, selector, and transfer switches, protection and auxiliary relays, pushbuttons, etc. Indicate connections to control panel terminal blocks
      (4) Contact diagrams for all alarm and indication circuits. Indicate connections to control panel terminal blocks
   b. Control panel internal connection wiring diagram shall contain
      (1) Each device designation corresponding to panel layout drawing and elementary diagrams. All device terminals shall be identified identical to device vendor drawing and arranged in correct physical relationship.
      (2) Sufficient information at each wire termination to locate the other termination without recourse to routing sheets, supplementary tabulations, or any other document.

(3) Terminal strips numbered sequentially from top to bottom and left to right. Show terminals requiring external connections. The terminal strips shall be shown on drawings spaced at least 4 inches apart, so as to permit purchaser's external wiring to be shown on the same drawings.

c. External connection diagram between the control panel and the equipment connected to it.

9. Bill of materials: Components shall be identified by manufacturer's catalog number, technical characteristics and settings required for the installation. Bill of materials shall correlate components to panel layout drawing and diagrams.

B. Catalog cuts

1. Enclosures

2. Cabinets

3. Terminal blocks

4. All factory or field mounted devices and equipment shown on the Control panel or Enclosure/Cabinet drawings

C. Schedules

1. Nameplate nomenclature

2. Terminal block designations

D. As-built Documentation

END OF APPENDIX "A"

DIVISION 16

SECTION 16135

BOXES AND FITTINGS

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for electrical boxes and fittings.

B. Types of electrical boxes and fittings specified in this Section are:

1. Outlet Boxes
2. Device Boxes
3. Pull Boxes
4. Junction Boxes
5. Conduit Bodies
6. Fittings

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	National Electrical Manufacturers Association (NEMA)
NEMA OS1	Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
NEMA OS2	Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
	National Fire Protection Association (NFPA)
NFPA 70	National Electrical Code
	Underwriters Laboratories Inc. (UL)
UL 50	Cabinets and Boxes
UL 514A	Metallic Outlet Boxes
UL 514B	Fittings for Conduit and Outlet Boxes
UL 514C	Nonmetallic Outlet Boxes, Flush Device Boxes, and Covers
UL 886	Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations

1.03 QUALITY ASSURANCE

Boxes and fittings, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years. A list of acceptable manufacturers is shown on Contract Drawing.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original, unopened, protective packaging.

B. Store materials in a clean, dry space and protect them from weather.

C. Handle in a manner to prevent damage to finished surfaces.

D. Where possible, maintain protective coverings until installation is complete and remove such coverings as part of final cleanup.

E. Touch up any damage to finishes to match adjacent surfaces.

1.05 SUBMITTALS

"Submittal Requirements" shall be in accordance with APPENDIX A.

PART 2. PRODUCTS

2.01 MATERIALS

A. General

1. Locations, types and sizes of boxes and fittings are shown on the Contract Drawings.

2. Boxes and fittings shall be metallic, unless otherwise shown on the Contract Drawings, and shall conform to NEMA 0S1, NEMA 250, UL 50, UL 514A, UL 514B, and NFPA 70.

3. Nonmetallic boxes and fittings, shown on the Contract Drawings, shall conform to NEMA 0S2, NEMA 250, UL 50, UL 514C, and NFPA 70.

4. Boxes and fittings to be located in hazardous (classified) areas, as shown by "area plans" on the Contract Drawings shall conform to UL 886 & NFPA 70.

5. All electrical materials and equipment, for which there are established UL standards, shall bear the UL label.

6. Where the sizes or dimensions of a box are not shown on the Contract Drawings, all boxes, whether for use on power, communications, signaling, control, telephone, or other purposes, shall be sized as follows:

a. In straight pulls, the length of the box shall not be less than 8 times the trade diameter (nominal inside diameter) of the largest raceway.

b. Where angle or "U" pulls are made, the distance between each raceway entry inside the box and the opposite wall of the box shall not be less than 6 times the trade diameter of the largest raceway. The distance shall be increased for additional entries by the amount of the sum of the diameters of all other raceway entries in any row on the same wall of the box. The distance between raceway entries enclosing the same conductor shall not be less than 6 times the trade diameter of the larger raceway.

c. Where a conduit entry is in the wall of a box opposite a removable cover, the minimum distance between the entry and the cover shall be as follows:

Conduit Size	Distance Between Entry and Cover
Up to 1-1/4”	4”
1-1/4” and 1-1/2”	6”
2” and 2-1/2”	8”
3” and larger	12”

d. The minimum depth of a box shall be not less than two times the trade diameter of the conduit entries in a single row and not less than 1-1/2 times the sum of the trade diameter of the largest raceway in each row for multiple rows.

7. Weatherproof cast boxes shall be used for exterior or damp locations. Weatherproof boxes shall be hot-dipped galvanized cast-steel or cast-aluminum. Cast boxes shall be threaded conduit entrance type provided with mounting lugs. Materials shall match the type of conduit i.e., galvanized steel or aluminum, used in the conduit run.

8. Covers for boxes located in public spaces or where shown on the Contract Drawings shall be furnished with tamper-resistant hardware.

9. Cover plates for outlet boxes are specified in the Section 16140 entitled "WIRING DEVICES".

B. Interior Outlet and Device Boxes

1. Provide galvanized, flat-rolled, sheet-steel interior outlet wiring boxes, of types, shapes and sizes, including box depths, to suit each respective location and installation; construct boxes with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices.

2. Outlet boxes shall be of proper sizes and shapes for conduits and wires entering them, and equipped with plaster ring or cover as necessary for the wiring devices to be installed.

3. Boxes for switches and receptacles shall be 4-inch square, minimum 2 1/8-inch deep, for up to two devices; solid, ganged boxes for over two devices; and installed so that device covers shall be tight and plumb with wall finish.

4. Provide suitable barrier in boxes where two or more 277-volt switches are to be installed, to isolate each on its own phase.

5. Boxes for lighting fixture installation shall be 4-inch square, minimum 2 1/8-inch deep, and provided with 3/8-inch studs.

6. Boxes to be installed in ceilings, plenums, or spaces used for supply or return of environmental air shall be UL listed for such use, without holes, openings or penetrations, and complete with gasketed cover plates.

7. Provide all sheet-steel boxes with suitable knockouts.

C. Exterior Outlet and Device Boxes

1. Provide corrosion-resistant, cast metal, weatherproof outlet wiring boxes, of types, shapes and sizes, including box depths, to suit each respective location and installation.

2. For outlet boxes to be installed flush or recessed in exterior walls, provide galvanized, sheet-steel boxes, with suitable depth and tile, plaster or masonry rings for the wall construction.

3. Provide cast-metal faceplates with spring-hinged, waterproof caps suitably configured for each application, including faceplate gaskets and stainless steel or brass screws or fasteners. Faceplate material shall match the type of box i.e., galvanized steel or aluminum.

D. Junction and Pull Boxes

1. General

a. Unless otherwise shown on the Contract Drawings, provide galvanized, code-gauge, sheet-steel junction and pull boxes and covers for interior locations and cast-metal boxes and covers for exterior locations of types, shapes and sizes to suit each respective location and installation, and equipped with stainless steel hinges, nuts, bolts, screws and washers.

b. Junction or pull boxes having any dimension larger than 36 inches shall contain racks or supports for all cables or conductors.

c. Provide pull boxes with suitable insulating barriers where shown on the Contract Drawings or required by code. Vertical-offset pull boxes shall contain cable supports at turns to prevent cables from resting on corners.

d. Where shown on the Contract Drawings, provide boxes with provisions for padlocking.

e. Special boxes shall be as shown on the Contract Drawings.

f. Where shown on the Contract Drawings, catches or vault handles shall be lockable. Locks shall be keyed alike for the same service, such as power, communications, signal or telephone. Each service type shall be keyed differently.

g. All covers in exposed exterior locations, or other areas as shown on the Contract Drawings, shall be gasketed.

h. For covers heavier than 20 pounds or more than 24 inches in any dimension, provide two replaceable studs, located on each side of the box flange, to support the cover during installation.

i. Boxes containing, or designated for, conductors operating at greater than 600 volts (phase-to-phase) shall be constructed of minimum 12-gauge steel.

2. Interior Junction and Pull Boxes

a. Finished Areas

(1) Junction and pull boxes, located in finished areas and having any dimension larger than 12 inches, shall be furnished with flush-mounting, lockable, hinged covers, similar to adjacent panelboard cabinets. Locks shall be keyed alike for the same service, such as power, communications, signal or telephone. Each service type shall be keyed differently. Hinged covers shall contain catches to keep covers closed. Covers having any dimension larger than 36 inches and all multiple-section doors shall contain 3-point vault handles. Covers shall be furnished shop-primed for field painting, and shall be finished with a color as selected by the Engineer.

(2) Boxes having any cover dimension 12 inches or less shall be furnished with flush-mounting, screw-on covers, unless otherwise shown on the Contract Drawings.

b. Unfinished Areas

Junction and pull boxes, located in electrical or telephone closets or rooms, in mechanical equipment rooms, in areas above hung or accessible ceilings or in areas shown on the Contract Drawings as "unfinished," shall be furnished with screw-on covers for boxes having any cover dimension 24 inches or less, and with either single or multiple-section hinged covers for boxes having any cover dimension larger than 24 inches.

3. Exterior Junction and Pull Boxes

a. Junction and pull boxes, located in sidewalks, decks and in areas shown on the Contract Drawings as "finished", shall be furnished with flush-mounting, screw-on covers.

(1) Boxes having any cover dimension 24 inches or less shall be cast-steel. Boxes shall be furnished with asphaltic paint finish on surfaces to be embedded in earth or concrete.

(2) Covers having any dimension larger than 24 inches shall be cast-steel "sidewalk" frames and covers, suitable for installation on a concrete box or handhole.

b. Unfinished Areas

Junction and pull boxes, located in areas shown on the Contract Drawings as "unfinished", shall be furnished with screw-on covers for boxes having any cover dimension 24 inches or less, and with hinged, bolt-on covers for boxes having any cover dimension larger than 24 inches.

E. Floor Boxes

Provide cast-steel, waterproof, adjustable floor boxes with threaded-conduit entrance hubs, and vertical adjusting rings, gaskets, brass floor plates and flush, screw-on covers. All unused conduit openings shall be closed with appropriate plugs.

F. Conduit Bodies

Provide galvanized, cast-metal, conduit bodies, of types, shapes and sizes to suit each respective location and installation; construct with threaded-conduit entrance hubs, removable covers, and stainless steel or brass screws.

G. Bushings, Locknuts and Knockout Closures

Provide corrosion-resistant knockout closures and conduit locknuts, and insulated, malleable-iron, conduit bushings and offset connectors, of types and sizes to suit each respective use and installation.

H. Supporting Devices

Provide inserts, expansion shield lugs, bolts with nuts and washers, shims or any other type of fastening devices required to secure boxes, in accordance with the Section 16190 entitled "SUPPORTING DEVICES". Unless otherwise shown on the Contract Drawings, all fasteners shall be hot-dipped galvanized and of sizes and types recommended by the equipment manufacturer and as approved by the Engineer.

PART 3. EXECUTION

3.01 INSTALLATION

A. Install boxes and conduit bodies at the locations shown on the Contract Drawings and as required by NFPA 70 at any other location where they are required to facilitate the pulling, supporting or connection of wires and cables.

B. Securely mount all boxes in a manner approved by the Engineer and support the boxes independently of conduits entering them.

C. Install boxes and conduit bodies in classified (hazardous) locations in accordance with their listing or label requirements. Conduit seal fittings shall be packed and filled only after proper operation of equipment and systems has been demonstrated and approved by the Engineer.

D. Paint exteriors of boxes exposed in mechanical equipment rooms or in electrical rooms or closets or spaces shown as "unfinished" on the Contract Drawings, and the exteriors of boxes installed above hung or accessible ceilings, as follows:

1. Emergency: Orange
2. Fire Alarm: Red
3. High Voltage: Red with 1-inch, white block letters reading “HIGH VOLTAGE” on each exposed face and cover.

E. All installations shall conform to NFPA 70.

F. Dissimilar Metals

1. "Dissimilar metals" shall mean those metals which are incompatible with one another in the presence of moisture, as determined from their relative positions in the Electrochemical Series, or from test data.

2. Where dissimilar metals come in contact, paint the joint both inside and out with approved coating to exclude moisture from the joint, or provide a suitable insulating barrier separating the metals.

END OF SECTION

SECTION 16135

BOXES AND FITTINGS

APPENDIX A

SUBMITTAL REQUIREMENTS

Submit the following, for approval in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

A. Catalog Cuts

1. All boxes and fittings.

B. Shop Drawings

1. Special boxes.
2. Boxes larger than 12 inches.
3. Ancillary equipment if shown on Contract Drawings.

END OF APPENDIX "A"

DIVISION 16

SECTION 16140

WIRING DEVICES

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for wiring devices.

1.02 REFERENCES

The wiring devices specified in this Section shall be constructed, installed and tested in accordance with requirements of the following publications:

	Federal Specifications
W-C-596	Electrical Power Connector, plug, Receptacle and Cable
W-S-896	Outlet Toggle and Lock, Flush Mounted Switches
	Institute of Electrical and Electronic Engineers (IEEE)
IEEE 241	Electric Power Systems in Commercial Buildings
	National Electrical Manufacturers Association (NEMA)
NEMA WD 1	General Requirements for Wiring Devices
NEMA WD 6	Wiring Devices - Dimensional Requirement
	National Fire Protection Association (NFPA)
NFPA 70	National Electrical Code
	Underwriters Laboratories Inc. (UL)
UL 20	General Use Snap Switches
UL 498	Electrical Attachment Plugs and Receptacles
UL 917	Clock-Operated Switches
UL 943	Ground Fault Circuit Interrupters
UL 1054	Special - Use Switches

1.03 QUALITY ASSURANCE

Wiring devices, of types and ratings required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original, unopened, protective packaging.

B. Store materials in clean, dry space and protect them from weather.

C. Handle in manner to prevent damage to finished surfaces.

D. Where possible, maintain protective coverings until installation is complete and remove such coverings as part of final cleanup.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements of this Section, provide wiring devices of the acceptable manufacturers as shown on Contract Drawings.

B. All devices for wall system outlets shall be furnished by one manufacturer.

C. All device plates shall be furnished by one manufacturer.

2.02 CONSTRUCTION FEATURES

A. General

1. All wiring devices shall be heavy-duty, specification grade, conforming to the NEMA configurations and requirements of NEMA WD 1 and UL 498, including the requirements for pressure-blade contacts. NEMA configurations shall be as shown on the Contract Drawings and shall match the requirements of the connected appliances.

2. Locations, types and sizes of wiring devices shall be as shown on the Contract Drawings.

3. All devices shall be one gang wide, except as required for devices rated greater than 20 Amp.

4. All devices shall be terminated with screw terminals or screw-driven pressure clamps. Patented spring or torsion pressure clamps shall not be used.

5. All electrical materials and equipment, for which there are established UL standards, shall bear the UL label.

B. Switches

Switches shall be silent operating type, 20 Amp, 120 - 127 Volts AC, T-rated, flush mounted, conforming to requirements of Federal Specification W-S-896 and UL 20, 917 and 1054. Single-pole or double-pole, and 3-way or 4-way devices shall be as shown on Contract Drawings.

C. Receptacles

1. Duplex convenience receptacles shall be 125 V, straight blade, 2-pole, 3-wire grounding type units with break-off terminal ties for two-circuits application. Receptacles shall be 15 Amp or 20 Amp as shown on Contract Drawings.

2. Single receptacles shall be 20 Amp, 125 V, straight blade, 2-pole, 3-wire, grounding type units.

3. Clock outlets shall be single recessed receptacles rated 15 Amp, 125 V, 2-pole, 3-wire grounding type with a combination plate cover and clock hanger bracket.

4. Floor service receptacle outlets shall be furnished with 20A, 125V, 2-pole 3-wire grounding type duplex receptacle. Were shown on contract drawings receptacle shall be flush mounted in floor box or installed in metallic above-floor service fitting.

5. Factory assembled "poke through" assembly device shall be furnished with 20A, 125v, 2-pole, 3-wire grounding receptacle and capable of maintaining floor fire rating of 3 hours.

6. Ground fault circuit interrupter receptacle shall be 20A, 125V, 60 Hz heavy duty grounding type duplex receptacle with ground fault circuit interrupter with solid-state ground fault sensing device having 5 (±1) milliampere ground-fault trip level and shall be "feed through" ready, for protecting downstream receptacles on a single circuit; suitable for installation in a 2-1/2" deep outlet box without adapter.

7. Special purpose receptacles as shown on Contract Drawings shall conform to requirements of NEMA WD 6.

D. Device Plates

1. All device plates shall be 0.04" thick minimum with struck-up beveled edges and free of sharp corners and burrs. All device plates shall be one-piece sectional plates shall not be used.

2. Unless otherwise shown on Contract Drawings, all device plates for wall outlets shall be satin finish anodized aluminum.

3. Device plates for wall telephone outlets shall contain a bushed hole.

4. Device plates for exposed work shall be stamped steel.

E. Color Selection

Wiring devices shall be available in standard white, ivory, gray, brown and black. The Engineer will select different colors for various areas and for different devices. No wiring device shall be ordered or installed until the engineer's final color selections have been made.

PART 3. EXECUTION

3.01 INSTALLATION

A. Install wiring devices in accordance with manufacturer's installation procedures and applicable requirements of NFPA 70 and IEEE 241.

B. In areas where exposed conduit is used, receptacles and switches shall be surface mounted as shown on the Contract Drawings.

C. Receptacles and switches located in finished areas, where concealed conduits are used shall be flush-mounted and provided with approved cover plates, installed level and plumb, with all four corners and edges in contact with finish surface.

3.02 FIELD TESTS

Prior to energizing circuitry, test wiring for electrical continuity and short circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements of this Specification.

3.03 PROTECTION

After receptacles and wall plates have been installed, exercise care in use of convenience outlets. Prior to final inspection, replace devices that have been damaged.

END OF SECTION

SECTION 16140

WIRING DEVICES

APPENDIX A

SUBMITTAL REQUIREMENTS

Submit for approval the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

A. Shop drawings

1. Installation details for surface mounted receptacles and switches
2. Installation details for "poke-through" assemblies
3. Installation details for floor service receptacles

B. Catalog cuts

1. Receptacles
2. Switches
3. Wallplates
4. Ground fault circuit interrupter receptacles
5. Poke-through assembly devices

END OF APPENDIX "A"

DIVISION 16

SECTION 16190

SUPPORTING DEVICES

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for hangers and supports, sleeves and fasteners used to support electrical raceways and equipment, except as specified in B below.

B. Supporting devices, furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Sections of the Specifications.

1.02 REFERENCE

The supporting devices, specified in this Section shall be constructed, installed and tested in accordance with requirements of the following publications:

	American Institute of Steel Construction Inc. (AISC)
AISC	Manual of Steel Construction
	American Iron and Steel Institute (AISI)
AISI	Specifications for the Design of Cold-Formed Steel Structural Members
	American Society for Testing and Materials (ASTM)
ASTM A 36	Structural Steel
	American Welding Society (AWS)
AWS D1.1	Structural Welding Code, Steel
	National Electrical Contractors Association (NECA)
NECA 5055	Standard of Installation
	National Fire Protection Association (NFPA)
NFPA 70	National Electrical Code

1.03 QUALITY ASSURANCE

Supporting devices, of types and sizes required, shall have been satisfactory used for purposes similar to those intended herein for not less than three years.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original, unopened, protective packaging.

B. Store materials in a clean, dry space and protect them from weather.

C. Handle in a manner to prevent damage to finished surfaces.

D. Where possible, maintain protective coverings until installation is complete and remove such coverings as part of final cleanup.

E. Touch up damage to finishes to match adjacent surfaces, including re-coating of galvanized or plated surfaces where damaged, cut or drilled.

1.05 SUBMITTALS

See Appendix "A" For Submittal Requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements of this Section, provide supporting devices of the acceptable manufacturers as shown on Contract Drawings.

2.02 HANGERS AND SUPPORTS

A. General

1. Unless otherwise shown on the Contract Drawings, provide hangers and supports as specified below.
2. Where more than one type of hanger or support is suitable for the intended use, selection is at the Contractor's option, subject to approval by the Engineer.
3. Hangers and supports, for which there are established Underwriters Laboratories Inc. (UL) standards, shall bear the UL label.

B. Raceway Support

1. Clevis Hangers

   For supporting horizontal conduit; galvanized steel; with hole for treaded steel rod.

2. Riser Clamps

   For supporting vertical conduits; galvanized steel; with two or three bolts and nuts, and 4-inch ears.

3. Reducing Couplings

   Steel rod reducing coupling; size as required; galvanized or plated steel

4. C-Clamps

   Black malleable iron or galvanized or plated steel; with hole for threaded rod.

5. I-Beam Clamps

   Galvanized or plated steel, 1-1/4-inch x 3/16-inch stock; 3/8-inch cross bolt; 2-inch flange width

6. Right Angle or Parallel beam Clamps

   Galvanized steel clamps for supporting or fastening conduit up to 2-inch trade size

7. One-Hole Conduit Straps

   For supporting up to 1-inch conduit or electrical metallic tubing (EMT); galvanized steel

8. Two-Hole Conduit straps

   For supporting conduit or EMT larger than 1-inch galvanized steel; 3/4" strap width.

9. Hexagon Nuts: galvanized steel

10. Round Steel Rod: galvanized or plated steel; threaded

11. Trapeze Hangers: Same as Specified in 2.02 C below

12. The following types of hangers and supports shall not be used:

    a. Perforated metal strapping;

    b. Slotted, perforated angles;

    c. Spring pressure or torsion clips, hangers or supports.

C. Equipment Supports

1. U-channel strut system shall be 12-gauge, hot-dipped galvanized steel. Provide with drilled or slotted holes as required for the application and with the following fittings which mate and match with U-channel:

    a. Fixture hangers

    b. Channel hangers

    c. End caps

    d. Beam clamps

    e. Wiring stud

    f. Thin wall conduit clamps

    g. Rigid conduit clamps

    h. Conduit hangers

    i. U-bolts

D. Supporting Steel Sections and Channels

Supporting steel sections and channels shall be fabricated of ASTM A 36 steel in accordance with the appropriate requirements of the AISC, AISI, and AWS publications specified in 1.02, and shall be hot-dipped galvanized after fabrication.

E. Cable Supports

1. Provide cable supports with insulating wedging plug for non-armored type electrical cables in risers. Assembly shall include body of galvanized malleable iron with insulating wedging plug.

2. Provide cable supports for armored type electrical cables in risers. Assembly shall include body and pressure plates of galvanized steel.

2.03 SLEEVES AND SEALS

A. General

1. Unless otherwise shown on the Contract Drawings, provide sleeves and seals as specified below.

2. Where more than one type of sleeve or seal is suitable for the intended use, selection is at the Contractor's option, subject to approval by the Engineer.

3. Sleeves and seals, for which there are established, UL standard, shall bear the UL label.

B. Pipe Sleeves

1. Provide pipe sleeves for conduits penetrating concrete or masonry floor and walls, as follows:

   a. Steel Pipe

      Fabricate from schedule 40, galvanized steel pipe; remove burrs.

   b. Iron Pipe

      Fabricate from cast iron or ductile iron pipe; remove burrs.

   c. Plastic Pipe

      Fabricate from either fiberglass or Schedule 40, PVC plastic pipe; remove burrs. Fiberglass sleeves may be utilized for interior or exterior usages, but PVC sleeves shall be utilized for exterior usage only.

2. Sleeves shall have a minimum inside diameter as shown below, based on the installed raceway diameter.

Raceway Diameter (inches)	Sleeve Inside Diameter (inches)
1 or less	2
1-1/4 to 2	3
2-1/2 to 3	4
3-1/2 to 4	5
5	6
6	7

3. Where a sleeve encloses only one conductor, phase or polarity, or a ground wire or cable, the sleeve shall be non-ferrous.

C. Interlocking Modular Seals

Provide interlocking modular type seals for conduit access located in exterior foundation and pit walls. The seals shall be multi-link, stainless steel bolted connection, high-temperature fittings.

D. Sealing Bushings

Provide sealing bushings for conduit access core-drilled through foundation walls or floors. The bushings shall be molded, one-piece neoprene sealing rings with PVC coated steel or uncoated aluminum pressure plates, stainless steel hex socket head cap screws and flat washers.

E. Fire Seals

Provide UL listed, 3 hour rating, silicone based foam, fire resistive, waterproof joint sealing system to prevent the passage of hot gases and fire.

F. Wall and Floor Seals

Provide watertight and pressure-tight wall and floor seals suitable for sealing around conduit passing through exterior concrete floors and walls. Assembly shall include steel sleeves, galvanized malleable iron body, neoprene sealing grommets and rings, metal pressure rings, membrane clamp were required by foundation design and pressure clamps with type 316 stainless steel hex head cap screws. Seal sizes shall be maximum published size for conduit to be installed therein.

2.04 FASTENERS

A. General

1. Unless otherwise shown on the Contract Drawings, provide fasteners as specified below.
2. Where more than one type of fasteners is suitable for the intended use, selection is at the Contractor's option, subject to approval by the Engineer.

B. Toggle Bolts

Toggle bolts shall be spring head, galvanized or plated steel, 1/4-inch to 1/2-inch sizes, length as required.

C. Expansion Anchors

Expansion anchors shall be metallic expansion anchors or shields, including drop-in anchors, wedge and sleeve anchors, and two-piece and three-piece shields for lag screws or machine screws or bolts.

D. Powder activated Fasteners

Powder activated fasteners shall be steel, pin or stud type, selected for proper length and penetration for the equipment, clamp or strap to be installed, and the base material.

E. Bolts, Nuts, Lockwashers and Washers

1. All hardware shall be galvanized or plated steel, unless otherwise shown on the Contract Drawings.
2. Bolts and nuts, 1/4-inch trade size and larger, shall be hex head or hex socket type, standard American sizes.
3. Lockwashers shall match the finish of the furnished bolts and nuts, and generally be installed one-per-bolt, at the nut end of the assembly.

4. Washers shall be standard or fender type, as required, and sized to match the installed bolts or screws.

F. The following types of fasteners shall not be used:

1. Lead anchors or studs;
2. Wooden plugs or anchors;
3. Plastic anchors;
4. "Nail-in" anchors, either of plastic or metal type.

PART 3. EXECUTION

3.01 EXAMINATION

A. Verify that electrical installations, structural, mechanical and other related Work satisfy the requirements for performance of the Work of this Section in accordance with the Contract Documents.

B. Report immediately to the Engineer any electrical, structural or related construction defects in areas where supporting devices are to be installed, and do not attempt to rectify any defect unless specifically instructed to do so by the Engineer.

3.02 PREPARATION

Before installation the supporting devices, the Contractor shall investigate the site condition to determine, what preparatory work, if any, will be needed.

3.03 INSTALLATION

A. General

1. Install hangers and supports, sleeves and fasteners in accordance with approved printed manufacturer's installation procedures, and as specified.
2. Coordinate all affected trades and all aspects of the electrical work, including installation of raceways and wiring as necessary to interface installation of supporting devices with other work.
3. Install hangers and supports, and attachments to properly support raceways, equipment and accessories from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze hangers where possible. Install hangers and supports with maximum spacing not to exceed that permitted by NFPA 70 and NECA 5055, as applicable, unless otherwise shown on the Contract Drawings.
4. Secure threaded rod couplings, trapeze hangers or supports or similar horizontal elements, using lock washers and jam nuts to prevent loosening.

B. Conduit and Raceway supports

1. Do not support raceways from hung ceiling supports or members, or metal roof deck.
2. Do not support raceways from mechanical ductwork, ductwork supports, piping or piping supports.

3. Threaded rod for the support of conduits, raceways or trapeze hangers of the given size, shall be not less than the following:

Conduit, Raceway, Hanger Size (inches)	Threaded Rod Size (inches)
2 or less	3/8
2-1/2 to 3-1/2	1/2
4 to 5	5/8
6	3/4

4. Where trapeze hangers are used, bolt or clamp the raceways in place to at least every third hanger and to the first hanger on each side of a bend, fitting, junction or pull box or change in direction.

C. Sleeves

1. Unless otherwise shown on the Contract Drawings, extend sleeves for raceways and risers one inch beyond top of finished floor, curb or building element being penetrated.
2. Install sleeves level and plumb, accurately located and positioned to conform to the requirements of the equipment and in accordance with the approved layout drawings.
3. Install interlocking modular seals in tandem, one at the interior and one at the exterior face of the pipe sleeve.
4. Tighten sleeve seal nuts until sealing grommets have expanded to form watertight seal.

D. Fasteners

1. Wood screws, lag screws, carriage bolts or machine screws shall be utilized for wood or materials of similar fibrous nature.
2. Welded or blazed threaded studs, bolts or machine screws or clamps shall be utilized for structural and miscellaneous steel, iron or other metals.
3. Metallic expansion shields, wedge anchors or drop-in anchors, with lag screws, bolts or machine screws shall be utilized for solid masonry or concrete.
4. Sleeve anchors, drop-in anchors or toggle bolts shall be utilized for concrete masonry units (CMU). Do not use powder-activated fasteners in CMU.

E. Dissimilar Metals

1. "Dissimilar metals" shall mean those metals which are incompatible with one another in the presence of moisture, as determined from their relative positions in the Electrochemical Series, or from test data.
2. Where dissimilar metals come in contact, paint the joint both inside and out with approved coating to exclude moisture from the joint, or provide a suitable insulating barrier separating the metals.

END OF SECTION

SECTION 16190

SUPPORTING DEVICES

APPENDIX A

SUBMITTAL REQUIREMENTS

Submit for approval the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

A. Shop Drawings

Submit layout drawings for dimensioned locations of inserts, sleeves and anchors when required by the Contract Drawings.

B. Catalog Cuts

1. Hangers and supports
2. Sleeves
3. Fasteners

C. Submit calculations for the following:

1. Supporting steel sections and channels, properly reflecting installed and future loading, including:
   a. Safety factors of not less than 4 to 1;
   b. Deflection ratio of not greater than 1/240.
2. Special hangers and supports shown on the Contract Drawings
3. Hangers, supports and fasteners when required by but not specifically shown on the Contract Drawings.

END OF APPENDIX "A"

DIVISION 16

SECTION 16450

GROUNDING

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for grounding.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	Administrative Code
	Electrical Code of the City of New York
	American National Standards Institute (ANSI)
ANSI C 2	National Electrical Safety Code
	Institute of Electrical and Electronics Engineers (IEEE)
IEEE Std 142-1991	Recommended Practice for Grounding of Industrial and Commercial Power Systems
IEEE Std 1100-1992	Recommended Practice for Powering and Grounding Sensitive Electronic Equipment
	National Fire Protection Agency (NFPA)
NFPA 70	National Electrical Code
	Underwriters Laboratories Inc. (UL)
UL 467	Grounding and Bonding Equipment

1.03 QUALITY ASSURANCE

A. Components and installation shall comply with NFPA 70, "National Electric Code."

B. Provide products specified in this Section that are listed and labeled. The terms "listed" and "labeled" shall be defined as they are in NFPA 70 Article 100.

1.04 SUBMITTALS

See Appendix A for Submittal Requirements.

PART 2. PRODUCTS

2.01 GENERAL

Furnish grounding elements for switchgear, transformers, cabinets panelboards, starters, and miscellaneous electrical equipment, for all non-current-carrying metallic portions of the entire electrical system and for exposed non-electrical systems located in electrical substations or switchgear rooms as required by ANSI C 2, NFPA 70, and building codes which would be applicable, if the Authority were a private corporation.

2.02 MANUFACTURERS

Subject to compliance with the requirements of this Section, provide grounding products of manufacturers as shown on the Contract Drawings.

2.03 GROUND RODS

Ground rods shall be copper clad steel. Unless otherwise shown on the Contract Drawings, the rods shall be 3/4-inch diameter by 10 feet long.

2.04 GROUNDING CONDUCTORS

A. Provide grounding conductors in accordance with the requirements of NFPA 70, Sections entitled "WIRES, CABLES, SPLICES, TERMINATIONS (600 VOLTS OR LESS)," "WIRES, CABLES, SPLICES, TERMINATIONS (MEDIUM VOLTAGE)," and "TAXIWAY/RUNWAY WIRES AND CABLES," as applicable, and as specified on the Contract Drawings.

B. Equipment grounding conductors shall be green insulated.

C. Isolated grounding conductors shall be green insulated with yellow striping.

2.05 ABOVE GRADE CONNECTIONS

Connectors to piping, fencing, and conduit systems shall be listed and labeled as grounding connectors for the materials used.

2.06 BELOW GRADE CONNECTIONS

Buried Cable and ground rod connections shall be exothermic welds. Welded connections shall be provided in kit form and selected for the specific types, sizes, and combinations of conductors shown on the Contract Drawings.

2.07 GROUNDING BUSHINGS

Grounding Bushing shall be insulated type.

2.08 LIGHTNING PROTECTION COMPONENTS

Lightning protection components shall be provided as specified in Section entitled "LIGHTNING PROTECTION SYSTEM."

PART 3. EXECUTION

3.01 INSTALLATION

A. General

Install grounding elements for switchgear, transformers, cabinets, panelboards, starters, and miscellaneous electrical equipment, for all metallic non-current carrying portions of the entire electrical system and for exposed non-electrical systems located in electrical substations or switchgear rooms as required by ANSI C 2, NFPA 70 and building codes which would be applicable, if the Authority were a private corporation.

B. Install grounding as shown on the Contract Drawings.

C. Grounding and bonding equipment for use in connection with interior wiring systems shall conform to UL 467.

D. Install separate insulated equipment grounding conductors with circuit conductors to maintain grounding system at equipotential. Raceway system shall not be utilized as the equipment ground.

E. Connect exposed metallic piping or ductwork of any non-electrical system that is located in an electric substation or switchgear room, to ground in the room. Where the run through the room exceeds 15 feet in length, make ground connections at both the entering and leaving points of the piping or ductwork.

F. Ground all non-current-carrying metallic enclosures of electrical conductors, or exposed non-current-carrying metallic parts of electrical equipment, or of power apparatus.

G. Connections:

1. General

   Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

2. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.

3. Make connections with clean bare metal at points of contact.

4. Make all connections of grounding connector cables to ground rods by exothermic welding method. Welds that are puffed up, or that show convex surfaces indicating improper cleaning are not acceptable.

5. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically non-continuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.

6. Tighten grounding and bonding conductors and terminals, including screws and bolts, in accordance with manufacturer's published torque-tightening values for connectors and bolts.

7. Where insulated grounding conductors are connected to ground rods, or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.

H. All sensitive electronic equipment including computers and other components specified on the Contract Drawings, shall be connected to an isolated grounding system. The isolated grounding system shall be installed as specified on the Contract Drawings. The isolated grounding system and the electrical power equipment grounding system must be connected together at a single point, as shown on the Contract Drawings and in accordance with the requirements of NFPA 70, and all applicable local codes. Utilization of a grounding electrode separate from, and not connected to, the electrical power equipment grounding system is not acceptable

I. All ground rods in grounding loops shall have less than 5 ohms resistance to ground. All individual or isolated ground rods shall have a maximum of 25 ohms resistance to ground. The maximum overall grounding system resistance to ground shall be as shown on the Contract Drawings.

3.02 FIELD TESTS

Make ground resistance tests at all ground rods to verify that grounding system is at equipotential and to ensure compliance with the requirements specified in 3.01 I above, in the presence of the Engineer, and prepare all test results in tabulated form indicating location and time of each test and soil resistivity measured. If ground resistance on a grounding resistance test is higher than the value specified in 3.01 I, either increase the length of the rod or add more rods to the grounding system until the required ground resistance is achieved.

END OF SECTION

SECTION 16450

GROUNDING

APPENDIX "A"

SUBMITTAL REQUIREMENTS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

A. Catalog Cuts for ground rods, connectors and connection materials, and grounding fittings.

B. Ground Resistance Test Results.

END OF APPENDIX "A"

DIVISION 16

SECTION 16452

ELECTRICAL BONDING

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for furnishing, installing and testing an electrical bonding system for corrosion control/stray current mitigation on all underground structures.

1.02 REFERENCES

	American Society for Testing and Materials (ASTM)
ASTM B 3	Soft or Annealed Copper Wire
ASTM B 8	Concentric-Lay Stranded Copper Conductors, Hard, Medium-Hard, or Soft
	Military Specifications (MIL)
MIL A-18001	Anode, Corrosion Preventative Zinc, Slab, Disk and Rod Shapes
	National Association of Corrosion Engineers (NACE)
NACE RP 0169	Control of External Erosion on Underground or Submerged Metallic Pipe Systems

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

The Electrical Bonding System shall be designed, manufactured and installed in accordance with the latest revision of applicable standards ASTM, MIL and NACE. In case of conflict between various standards, the more stringent requirement shall apply.

1.04 QUALITY ASSURANCE

A. The Contractor shall provide the Electrical Bonding System design, certified by a NACE accredited Corrosion Engineer, licensed as a Professional Engineer in the state in which the work is to be performed, and experienced in corrosion control procedures. Submit the qualifications of the Corrosion Specialist, for review by the Engineer.

B. Electrical bonding devices, of type and sizes required, shall have been satisfactory used for the purposes similar to those herein, for not less than three years.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store materials in original packaging in a manner to prevent soiling, damage, wetting or corrosion prior to installation.

B. Handle in a manner to prevent damage to finished surfaces.

C. Where possible, maintain protective coverings until installation is complete and remove such covers as part of final cleanup.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements of this Section, provide electrical bonding materials and equipment of the manufacturers listed on the Contract Drawings.

2.02 MATERIALS

A. Electrical Bonding Devices

Unless otherwise shown on the Contract Drawings, furnish materials and products in accordance with the following requirements:

1. Cables shall be stranded copper, #8 AWG minimum, conforming to ASTM B 3 and B 8, insulated with 0.11 inches of high molecular weight polyethylene.

2. Zinc Reference Electrode shall conform to the requirements of MIL A-18001, 1-1/4 inches by 1-1/4 inches by 9 inches long, 5 pound, 1/4" dia. steel core package electrode, and in accordance with the following requirements:

a. Lead wire shall comply with 2.02.A.1, and shall be factory connected to the anode center with the connection sealed in cast epoxy resin encapsulation.

b. Electrode shall be packaged in a permeable package cloth sack, total weight as recommended by the manufacturer, containing compacted backfill of mixture with the following requirements:

Material	Percent
Hydrated Gypsum	50
Bentonite	50

c. Epoxy resin encapsulation shall be two-piece, snap-together molded bodies, sized for cable, with two-part low viscosity polyurethane insulating and sealing compound, rated for 600 volts.

B. Buried cable and ground rod connection shall be exothermic welded.

C. Junction boxes shall be in accordance with Section 16135, entitled "BOXES AND FITTINGS".

PART 3. EXECUTION

3.01 EXAMINATION

A. Verify that electrical installations, structural, mechanical and other related work satisfy the requirements for performance of the work for this Section in accordance with the Contract Documents.

B. Report immediately to the Engineer any electrical, structural or related construction defects in areas where bonding devices are to be installed, and do not attempt to rectify any defect unless specifically instructed to do so by the Engineer.

C. Provide control and inspection of all exothermic bonding connections before casting them in concrete and for proper electrical connections of all underground structural members.

3.02 PREPARATION

Before installation of electrical bonding devices, the Contractor shall investigate the site condition to determine, what preparatory work, if any, will be needed.

3.03 INSTALLATION

A. General

1. Install electrical bonding devices in accordance with approved printed manufacturer's installation procedures, and as specified.
2. Coordinate with other trades, to electrically bond all structural steel and reinforcing bars, embedded in the concrete below grade. Bonding shall be completed in closed circuit to minimize corrosion activity, and shall conform to the Corrosion Specialist design.

B. Bonding Connections

1. Bond bare or uncoated reinforcing steel using single insulated conductors or straps, exothermically welded to steel beams.
2. Cross bond all bare or reinforcing steel, using exothermic welds.
3. Make welds in accordance with manufacturer's requirements.

C. Conductors

1. Use continuous, insulated conductors, without splices, between welded connections.
2. At the end of line of bonded steel beams, connect the insulated header cable, using exothermic welds, and terminate this cable inside the test junction box as shown on Contract Drawings. Where structural beams or steel members are coated, clean and coat with coal tar epoxy after completion and cooling of welded area.

D. Test Electrode Wells and Junction Boxes

1. Bury electrodes of type and at locations shown on the Contract Drawings. Excavate and backfill holes in accordance with the manufacturer's written instructions and in accordance with the following requirements:

   a. Wet packaged electrode thoroughly before backfilling the hole.

   b. Use fine clay soil, free from stones and bricks, for backfilling.

2. Install header cables of size, and at location shown on the Contract Drawings.

3. Install test junction box of type, and at locations, shown on the Contract Drawings in accordance with Section 16135 entitled "BOXES AND FITTINGS".

4. Run electrode lead wires to test junction boxes as shown on the Contract Drawings.

5. Install size and type of conduit shown on the Contract Drawings, in accordance with the requirements of Section 16110 entitled "RACEWAYS".

6. Install cable, leaving slack in test junction boxes.

7. Use exothermic welds, sealed with cast epoxy resin encapsulation, for splices made in direct buried cable.

E. Identification

Identify all cables, in each test junction box, using fiber tags (1/16 inch thick and 3/4 inches wide) intended with letters and numbers 5/16 inch high, fastened to cables with #14 AWG weatherproof copper wire.

F. Field Tests

Test that materials are installed and connected as shown on the Contract Drawings, and as required by the Corrosion Specialist's certified design.

1. Test the complete Electrical Bonding System to ensure electrical continuity. The tests must show that the elements of the structure are electrically bonded and prepared for connection to the test box.

2. Testing shall be in accordance with NACE RP 0169 requirements.

3. All test data shall be included in a final report, prepared by the Corrosion Specialist, indicating the initial conditions, with a listing of further recommendations pertaining to the maintenance and periodic testing of the system(s).

4. The Contractor shall correct any deficiencies discovered during the tests.

END OF SECTION

SECTION 16452

ELECTRICAL BONDING

APPENDIX A

SUBMITTAL REQUIREMENTS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples", Division 1 - GENERAL PROVISIONS:

A. The Electrical Bonding System design, certified by a NACE accredited Corrosion Specialist, licensed as a Professional Engineer in the state in which the work to be performed.

B. Shop Drawings

1. Details of bonding of structural steel and reinforcing bars encased in concrete below grade.
2. Steel and concrete shop drawings, including all required welds, bonding connections and recoating or patching of protective coatings.
3. Layout drawings of test electrodes, cabling and test junction boxes.

C. Submit 12 copies of all test data, and the final report.

D. Submit qualifications of the Corrosion Specialist and a copy of NACE certificate.

END OF APPENDIX "A"

DIVISION 16

SECTION 16470

PANELBOARDS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for electrical panelboards and cabinets.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	National Electrical Manufacturers Association (NEMA)
NEMA PB 1	Panelboard
NEMA PB 1.1	General instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less
NEMA PB 250	Enclosures for Electrical Equipment (1000 Volts maximum)
NEMA AB 1	Molded Case Circuit Breakers and Molded Case Switches
NEMA AB 3	Molded case Circuit Breakers and Their Application
NEMA 280	Application Guide for Ground Fault Circuit Interrupters
NEMA AB 4	Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications
NEMA Z535.4	Product Safety Signs and Labels
	National Fire Protection Association (NFPA)
NFPA 70	National Electric Code
	Underwriters Laboratories Inc. (UL)
ANSI/UL 67	Panelboards
ANSI/ UL 50	Cabinets and Boxes
UL 1059	Electrical Terminal Blocks
ANSI/UL 65	Electric Wired Cabinets
ANSI/ UL 486E	Equipment Wiring Terminals for Use With Aluminum and/or Copper Conductors
ANSI/UL 486A	Wire Connectors and Soldering Lugs for Use With Copper Conductors

ANSI/UL 969	Marking and Labeling systems
ANSI/UL 467	Electrical Grounding and Bonding Equipment
ANSI/UL 437	Key Locks

Federal Specifications

Panelboards, W-P-115a,c

Type 1 - Circuit Breaker Equipped

Class 1- Panelboards

Class 2 - Load Centers

Molded Case Circuit Breakers, W-C-375a,b

Fusible Switches, W-S-865c

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Panelboards shall be designed in accordance with applicable standards of ANSI, NEMA, NFPA and UL. A list of acceptable manufacturers is shown on the Contract Drawings.

B. Unless otherwise shown on the Contract Drawings, Panelboard cabinets shall meet the following environmental requirements:

1. Cabinets located in heated areas shall be NEMA Type 1.
2. Cabinets located in unheated areas or in areas subject to dust or oil, shall be NEMA Type 12.
3. Cabinets located in exterior areas or locations subject to rain, dripping liquid, or hosing shall be NEMA Type 4X, stainless steel.

C. ANSI design test shall have been made on a prototype of each type of panelboard.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Panelboards shall be delivered to the construction site complete. All circuit breakers, other electrical devices, and accessories, shall be in place and wired.

B. Panelboards and accessories shall be packaged to prevent damage due to vibration, jarring and the like during transportation and handling.

C. If any electrical devices or accessories must be shipped loose they shall be delivered in the manufacturer's original unopened protective packaging and shall be identified with suitable non-corrosive tag.

D. Store components and devices in clean and dry space, protected from weather.

E. Where possible, maintain protective covering until installation is complete and remove such covering as part of final cleanup.

F. Touch up any damage to finishes to match adjacent surfaces.

1.05 SPARE PARTS AND TOOLS

A. One set of all special tools and wrenches required for assembly or disassembly of the panelboard and the installation of breakers shall be furnished.

B. Furnish a list of recommended spare parts for each panelboard. This list shall contain the prices and availability of the spare parts recommended.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 GENERAL

A. List of acceptable manufacturers is shown on contract drawings.

B. The size, rating, and number of circuit breaker in the panelboard shall be as shown on the Contract Drawings.

C. All panelboards, for which there are established UL standards, shall bear the UL label.

D. Location of panelboards and their approximate dimensions shall be as shown on the Contract Drawings.

E. Each panelboard shall be factory assembled, tested and shipped as a single complete unit, with all circuit breakers and buses installed, unless written permission is given by the Engineer to disassemble any parts for shipment.

2.02 CONSTRUCTION FEATURES

A. Panelboard interior

1. Panelboard interiors shall be designed and assembled so that individual breakers may be added, removed, or replaced without disturbing adjacent units and without removing main bus or brunch circuit connectors.

2. All parts shall be readily accessible and like parts shall be interchangeable insofar as possible.

3. Modifications and optional features such as silver plated copper bus, subfeed lugs, shunt trips, meters, etc., shall be as shown on the Contract Drawings.

B. Panelboard Enclosures (Cabinets)

1. The panelboard assembly shall be mounted in a galvanized steel or stainless steel enclosure (cabinets) as shown on the Contract Drawings. Cabinets and trims shall be surface-mounted or recessed installation as shown on the Contract Drawings.

2. Cabinets shall be arranged to provide side gutters 6 inches wide. Cabinets shall be provided with top and bottom gutters not less than 6 inches wide. For 400A or 600A mains, top and bottom gutters shall be 8 inches. Where feeder cables supplying the mains of a panelboard are carried through its box to other panelboards, the cabinet shall be provided with adequate additional side gutters space for the riser cable and taps.

3. The cabinet shall have a galvanized sheet-steel one-piece frame with a hinged door.

4. Recessed or flush-mounted cover frames shall extend 3/4 inch beyond each side of the cabinets and shall be set with their backs flush with the finished wall. Covers shall have adjustable trim clamps to compensate for misalignment and shall be completely concealed when door is closed.

5. Surface-mounted cover frames shall be sized to match the overall dimensions of the cabinet or flanged around to cover the edge of the cabinet.

6. Breakers and interior bus shall be covered by a removable framed trim, mounted inside the cabinet.

7. Doors shall close against a rabbet placed all around the inside edge of the frame, with a close-fitting joint between the door and frame

8. Doors shall be fitted with concealed, continuous, flush piano hinges.

9. Fastening screws on front panel shall be stainless steel and shall be of the captive, tamper proof type. Front panels shall not be removable with door in locked position.

10. Provide a metal frame with clear impact resistant plastic cover, mounted inside of each panelboard door to hold circuit directory.

C. Overcurrent protective devices and buses

1. Overcurrent protective devices shall be circuit breakers, fully rated, bolt on, thermal magnetic, inverse time delay, molded case. Breakers shall be 1, 2 or 3 pole with an integral crossbar or an internal common trip element, to assure simultaneous opening of all poles of a multi-pole circuit breaker. All circuit breakers shall meet requirements specified in the section of these Specifications entitled "OVERCURRENT PROTECTIVE DEVICES"

2. Connections of the branch circuits to the main bus shall be of the phase sequence type, that is, adjacent poles shall be of unlike polarity and rotated in sequence. This shall allow complete flexibility of circuit arrangement (1, 2 or 3 poles) to evenly balance the electrical load on each phase.

3. Main bus bars, including full capacity isolated neutral, shall have an ampere rating not less than that of the main breaker or lugs, and shall be braced for a momentary short circuit as specified on the Contract Drawings. The minimum short circuit rating shall be equal or be greater than the rating of the panelboard integrated equipment.

4. Buses shall be designed in such a manner that no machining, drilling, or tapping shall be required to change circuits or add new breakers.

5. All main and branch circuit bus shall be copper with a 1000 Amperes per square inch current density, and contact surfaces shall be silver plated and shall have no more than 200 Amperes per square inch current density.

6. A copper ground bus shall be furnished and installed by the panelboard manufacturer for equipment grounding. When shown on the Contract Drawings the Manufacturer shall install an isolated type grounding bus.

7. Main lugs shall be solderless, mechanical type and shall be secured in line with UL standards to prevent lugs from turning or loosening when incoming cables are installed.

8. Where circuit breakers with ground fault protection are shown on Contract Drawings, they shall be UL class A type and shall be identified on the panelboard.

9. Lighting fixture circuits controlled only by a circuit breaker shall each be identified by a 1 inch long by 3/4-inch high black laminated plastic nameplate with white letters.

10. Circuit breakers used for switching fluorescent lighting shall be rated and identified with a SWD tag.

2.03 ACCESSORIES

A. Nameplates

1. Provide approved nameplates on the front cover of each cabinet, indicating the panel name and number.

2. Unless otherwise shown on the Contract Drawings, fabricate nameplates from an approved type of lamacoid plastic with letters engraved on the plate in white on black background. Where letter sizes are not shown on the Contract drawings, use 1/2-inch high letters. Nomenclature shall comply with a schedule approved by the Engineer.

3. Secure nameplates on equipment with brass or stainless steel screws with locking hardware.

B. Panelboard cabinet locks

Each locked cabinet shall be furnished with a combination catch and flat lock with spring loaded type door pull. Locks shall be fitted to separate keying for each system. Furnish one key for each cabinet installed and a maximum of 20 keys per system.

C. Provide a typewritten directory identifying each brunch circuit as to the load which it serves, and install the directory in metal frame inside the panelboard door.

2.04 PAINTING

A. Surfaces to be painted shall be prepared by the removal of all grease, oil, rust, scale or other foreign material.

B. A prime coat of zinc chromate paint and two (2) finish coats of enamel paint conforming to ANSI Z 55.1 shall be applied. The gray prime and finish paints shall be a compatible finish system. In public areas the cabinets shall be painted as above, unless otherwise shown on Contract Drawings.

C. Furnish a can of touch-up paint for use after equipment is positioned.

D. Stainless steel panels shall not be painted. Galvanized panels shall be painted if shown on the Contract Drawings.

2.05 SHOP TESTS

A. Shop tests shall be in accordance with NEMA, ANSI and IEEE specifications.

B. During the period of shop drawing submission complete information outlining the test methods and procedures to be followed shall be submitted to the Engineer for approval. A copy of test forms and a set of sample computations to be used shall be furnished at the time.

C. The Engineer shall be permitted to inspect any equipment, material or work to be furnished under this specification and shall have the right to reject any parts considered defective, unsuitable for the purposes or not in accordance with these specifications.

D. The Engineer shall be notified at least two weeks before testing. This notification shall list type and number of units to be tested. The Engineer reserves the right to require additional testing or to waive factory inspection or witnessing of tests.

E. Five (5) certified copies of all test results shall be furnished to the Engineer. Certification shall be by a Professional Engineer licensed in the State in which the tests are performed, and stamped.

F. Circuit breakers shall be tested individually in the following sequence:

1. Calibration test
2. Overload performance test
3. Continuous current test
4. Endurance performance test
5. Calibration test (repeated)
6. Determination of interrupting rating
7. Dielectric test

Results of tests on prototype circuit breakers of each size and type will be acceptable.

G. Panelboards shall be marked with their maximum short circuit rating at the supply voltage. The short circuit rating of each panelboard shall be determined after complete assembly. The short circuit tests on the breakers and panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. The method of testing shall be in accordance with UL 67. The source shall be capable of supplying specified panelboard short circuit current or grater.

H. Release of equipment shall not relieve the Contractor of the responsibility of furnishing equipment conforming to all specification requirements.

PART 3. EXECUTION

3.01 EXAMINATION

A. Verify that electrical installations, structural, mechanical and other related Work satisfy the requirements for performance of the work of this Section in accordance with the Contract Documents.

B. Before delivering the equipment to the site, the Contractor shall investigate the site conditions to determine the best method of shipment, what preparatory work, if any, will be needed to bring the equipment onto the site, and what will be the best and quickest method of unloading the equipment and setting it in place.

C. Report immediately to the Engineer any electrical, structural or related construction defects in areas where control panels or cabinets are to be installed, and do not attempt to rectify any defect unless specifically instructed to do so by the Engineer.

D. Before unloading the equipment it shall be inspected for damage during shipment. Any damage shall immediately be brought to the attention of the Engineer for resolution.

3.02 PREPARATION

A. Install any channels, angles or other supports that are required to support or mount the panelboards.

B. Use supports and fasteners as specified in the Section of the Specifications entitled "SUPPORTING DEVICES" or as shown on the Contract Drawings.

3.03 INSTALLATION

A. Surface and flush mounted panelboards shall be installed with tops 6 feet-6 inches above the floor, unless otherwise shown on the Contract Drawings.

B. Panelboards shall be installed true and plumb on supporting struts and shall not be mounted directly on concrete, concrete block walls, or any other walls subject to moisture. Leave a minimum gap of 1/2 inch between the back of the enclosure/cabinet and the wall, using stainless steel hardware.

C. Where mounting directly on the wall is unavoidable the back of the enclosure shall be painted with two coats, minimum, of a bituminous paint.

D. Cables shall be neatly racked and bundled with nonflammable nylon ties, routed and supported within the enclosures/cabinets or gutters. Minimum bending radii as recommended by cable manufacturers shall not be reduced.

E. After conduits and cables are installed, the enclosures/cabinets shall be inspected for foreign materials and shall be vacuumed clean. Prior to energization the panels shall be tested as described below.

F. A typewritten directory shall be furnished and installed in the frame inside the panelboard.

3.04 FIELD TESTS

A. Visually inspect each breaker in the panelboard and operate manually.

B. Check all connections for tightness

C. Check current rating of all circuit breakers. To each pole of the circuit breakers apply current 3 times its rating, recording currents and breaker trip times. Apply rapidly increasing currents and record the value that consistently causes instantaneous tripping of the breaker. Compare these recorded times with manufacturer's time current curves.

D. Perform megger and hi-pot test on each pole.

E. All discrepancies found by the contractor shall be brought to the attention of the Engineer

F. All testing shall be performed in the presence of and as directed by the Engineer. The Contractor shall notify the Engineer when the equipment is installed and ready for testing.

END OF SECTION

SECTION 16470

PANELBOARDS

APPENDIX A

SUBMITTAL REQUIREMENTS

Submit for approval the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

A. Shop Drawings

Shop drawings for each enclosure/cabinet shall include:

1. Data sheet for each panelboard with the following information
   - a. Job name
   - b. Item number
   - c. Panelboard nameplate(s) in accordance with the design drawings
   - d. Quantity of this panelboard configuration
   - e. Phase, wire and voltage
   - f. Main and neutral Bus material, continuous current, current density, and momentary capacity.
   - g. Short- circuit rating
   - h. Main connection information:
     - (1) Circuit Breaker - rating, interrupting rating, number of poles, type, manufacturer, and catalog number
     - (2) Lugs per phase, Cables per phase, Cable size range
     - (3) Location (top, bottom)
   - i. Thru feed lugs, subfeed
   - j. Ground bar with main lug on frame
   - k. Branch connection information:
     - (1) Circuit breakers rating, number of poles, type, manufacturer, and catalog number
     - (2) Lugs and cables per phase, Cable size range
   - l. Panelboard circuits breaker's arrangement for left and right side-top to bottom.
   - m. Panelboard overall dimensions H x W x D
   - n. Panelboard NEMA rating
2. Panelboard dimensional drawing. Indicate conduit entrance space at the top and bottom, knockout diagram and mounting details
3. Panelboard directory

B. Catalog cuts

1. Panelboards and Cabinets
2. Circuit breakers
3. Family of time current characteristic curves for all types and sizes of circuit breakers

C. As-built Documentation acceptable to the Engineer, with typewritten copy of completed panelboard directories.

END OF APPENDIX "A"

DIVISION 16

SECTION 16475

OVERCURRENT PROTECTIVE DEVICES (600 VOLTS OR LESS)

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for overcurrent protective devices.

B. The types of overcurrent protective devices specified in this Section are:

1. Low Voltage Power Air Circuit Breakers
2. Molded Case Circuit Breakers
3. Safety Switches
4. Fuses

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American National Standards Institute (ANSI)
ANSI C 37.13	Low Voltage AC Power Circuit Breakers used in enclosures
ANSI C 37.16	Related Requirements and application recommendation for Low Voltage Power Circuit Breakers
ANSI C 37.50	Test Procedures for Low Voltage AC Power Circuit Breakers
ANSI C 97.1	Low Voltage Cartridge Fuses 600 Volts or Less
	National Electrical Manufacturers Association (NEMA)
NEMA AB-1	Molded Case Circuit Breakers and Molded Case Switches
NEMA KS-1	Enclosed Switches
	National Fire Protection Association (NFPA)
NFPA 70	National Electrical Code
	Underwriters Laboratories Inc. (UL)
UL 98	Enclosed and Dead Front Switches
UL 198	Safety Standard for Fuses
UL 489	Molded Case Circuit Breakers and Circuit Breaker Enclosures
UL 943	Standard for Ground Fault Circuit Interrupters

Federal Specifications (FS)

W-C-375B/Gen	Circuit Breakers, Molded Case; Branch Circuit and Service
FSW –S-865	Covers Surface-mounted, Air-break, Box or Enclosed Switches for Ratings through 500 Volts, 1200 Amperes and 50 Horsepower

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

The overcurrent protective devices and associated materials shall conform to all applicable standards, and shall also conform to the requirements specified herein and shown on the Contract Drawings.

1.04 QUALITY ASSURANCE

Overcurrent protective devices of types and ratings required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Overcurrent protective devices to be installed in an assembly, as shown on the Contract Drawings, shall be mounted in the assembly and delivered in accordance with the manufacturer's specifications for such assembly.

B. Overcurrent protective devices to be installed in their own enclosures, as shown on the Contract Drawings, shall conform to the following requirements:

1. Enclosures shall be packaged with material to prevent damage to components due to vibration, jarring and the like during transportation and handling.

2. Enclosures shall be delivered in the manufacturer's original, unopened, protective packaging and shall be identified with suitable non-corrosive tags.

C. Where possible, maintain protective coverings until installation is complete and remove such coverings as part of the final cleanup.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

1.07 SPARE PARTS

Furnish a minimum of three but not less than 10% spare fuses of each type and rating required and shown on the Contract Drawings.

PART 2. PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of this Section, provide low voltage power circuit breakers, molded case circuit breakers, safety switches and fuses of one of the manufacturers specified on the Contract Drawings.

2.02 MATERIALS

A. General

1. Location, types, sizes, ratings and enclosures for overcurrent protective devices are shown on the Contract Drawings.

2. Overcurrent protective devices mounted in their own enclosures as shown on the Contract Drawings shall conform to the requirements of NEMA, UL, and NFPA. Enclosures shall be as specified in the Section of these Specifications entitled "PANELBOARDS ".

3. Overcurrent protective devices, to be installed as part of an assembly unit, shall be installed in accordance with the manufacturer's requirements for the specified assembly or as shown on the Contract Drawings.

4. Overcurrent protective devices and enclosures for which there are established UL standards, shall bear the UL label.

B. Low Voltage Power Air Circuit Breakers

1. General

a. All circuit breakers shall be 3 pole, single throw, 600V AC class, 60 Hz, trip free, with stored energy closing. Controls shall be as shown on the Contract Drawings.

b. Circuit breakers shall be of the draw-out type with self-aligning fingers to engage the line and load primary terminals.

c. The draw-out mechanism shall firmly support the breaker from the fully connected to the fully disconnected positions and shall be so designed as to permit racking the breaker without opening the door in all three positions: connected, test, and disconnected.

d. Interlocks shall be provided to prevent racking the breaker from the connected position to the test or disconnected position, or moving the breaker into the connected position while the breaker is closed.

e. Required circuit breaker sizes and ratings shall be as shown on the Contract Drawings.

f. In addition to all contract requirements to achieve the operation indicated on the Contract Drawings and specifications, provide the following spare contacts rated 125 VDC, 20 amperes continuous.

(1) A minimum of two normally open and two normally closed contacts, which shall operate when the breaker is in the fully connected position.

(2) A minimum of one normally open and one normally closed contacts, which shall operate when the breaker is withdrawn from the fully connected position. Contacts shall be rated 125V DC, 20 amperes continuous.

g. Provide a position indicator visible from the front of the switchgear for each breaker to indicate whether the breaker is open, tripped or closed.

h. Tripping shall be through integrally mounted solid state overcurrent and short circuit trip units with adjustable settings for long time, short time and instantaneous trip unless otherwise shown on the Contract Drawings.

2. Manually Operated Breakers

a. Provide manually operated circuit breakers with a front mounted handle to manually charge the stored energy closing mechanism.

b. Breakers shall be mechanically trip free and shall be furnished with provisions for the future addition of a control solenoid for remote closing.

c. Provide a mechanical trip and close button on the front of each breaker.

d. Provide a maintenance handle for slow closing during contact adjustment.

3. Electrically Operated Breakers

a. Provide electrically operated breakers with a motor- operated, stored-energy, closing mechanism. Motor voltage shall be as shown on the Contract Drawings.

b. Breakers shall be electrically and mechanically trip-free and each shall be provided with an electrically operated spring release to close the breaker.

c. Provide a mechanical trip button on the front of each breaker.

d. Provided an electrical close button or control switch on the front of each breaker.

e. Provide a maintenance handle for slow closing during contact adjustment.

f. Provide breakers with a shunt trip device for remote operation, arranged for both local and remote control of the closing and tripping functions.

4. Fused Circuit Breakers

a. Where shown on the Contract Drawings, fused circuit breakers shall be provided.

b. The fuses shall be current limiting type and shall be integrally or separately mounted units coordinated with overcurrent trip devices so as to avoid unnecessary blowing of the fuses.

c. Fused breakers shall have a blown fuse indicator and lockout device. The lockout device shall trip all phases upon blowing and prevent the breaker from being closed with any fuse element blown. Operation of the breaker shall not be permitted by this device until the fuse is replaced and the lockout reset.

d. The blown fuse indicator shall be visible from the front of the breaker and shall indicate which fuse has blown.

e. When a Protective Device Coordination Study is performed, the fuse rating shall be in accordance with the requirements of the protective study.

C. Molded Case Circuit Breakers

1. General

a. Molded case circuit breakers for panel or individual mounting shall be molded-case type, quick-make and quick-break on manual or automatic operation. The handle mechanism shall be trip-free to prevent holding contacts closed on a fault. Tripping shall be indicated by the handle automatically assuming a position between the manual "off" and "on" positions.

b. Molded case circuit breaker contacts shall be of the high-pressure type and shall be made of a silver composition material. Arc shields shall be provided to confine, cool, and quench the arc drawn at interruption.

c. Continuous ampere ratings and number of poles shall be as shown on the Contract Drawings.

d. Molded case circuit breakers shall be bolt-on type. Unless otherwise shown on the Contract Drawings or as required by the system interrupting rating, all 120V or 208V circuit breakers shall have a minimum short circuit interrupting rating of not less than 10,000 amperes (RMS symmetrical) and all 277V or 480V breakers shall have a minimum short circuit interrupting rating of not less than 18,000 amperes (RMS symmetrical).

e. All molded case circuit breakers feeding 120V or 277V lighting circuits that are not controlled by local wall switches shall be UL approved type "SWD" circuit breakers.

f. Each molded case circuit breaker shall be suitable for the circuit on which it is applied and the load that it controls.

g. Accessories including, but not limited to, auxiliary switches, shunt trips, undervoltage trips, ground fault sensing and tripping shall be as shown on the Contract Drawings.

2. Thermal-Magnetic Circuit Breakers

a. Circuit breakers up to, but not including 400 amperes shall be thermal magnetic trip. Electronic trip circuit breakers rated 100 amperes or higher may be provided in lieu of thermal magnetic type.

b. Automatic operation of the molded case circuit breaker shall be obtained by means of calibrated thermal and magnetic tripping devices for each pole of the breaker. The thermal device shall provide time-delay tripping on overloads, and the magnetic device shall provide instantaneous tripping on short circuits. The instantaneous magnetic trip shall be adjustable and accessible from the front of the breaker on frame sizes above 100 amperes.

3. Electronic Trip Circuit Breakers

a. Circuit breakers rated 400 amperes and higher shall be electronic trip.

b. The integral trip system shall be independent of any external power source and shall contain industrial grade electronic components as a minimum.

c. Circuit breakers shall be equipped with back-up thermal magnetic trip system unless otherwise indicated on the Contract Drawings.

d. Circuit breaker trip system shall be a microprocessor based true rms sensing design.

e. The sensor size rating plug and adjustment positions shall be clearly marked on the face of the circuit breaker.

f. The following time/current adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.

Long time pick up
Long time delay
Short time pick up
Short time delay
Instantaneous pick up
Ground fault pick up
Ground fault delay

g. A means to seal the trip unit adjustments in accordance with NEC shall be provided.

h. Local visual trip indication for overload short circuit and ground fault trip occurrences shall be provided.

D. Safety Switches

1. Safety switches shall conform to NEMA KS-1, UL 98 and FSW-S-865.

2. Safety switches shall conform to the NEMA classification and shall be rated, as shown on the Contract Drawings.

3. Safety switches utilized for service entrance shall include a groundable insulated neutral.

4. Safety switches shall be of the quick-make, quick-break type with terminals suitable for copper conductors, shall be padlockable in the "off" position and shall be equipped with defeatable door interlocks.

E. Fuses

1. Fuses shall be of the class, size and ratings (current, voltage, interrupting capacity, type, NEMA class) as shown on the Contract Drawings.

2. Fuses shall conform to UL 198 and ANSI C97.1 for low voltage fuses.

3. Unless otherwise shown on the Contract Drawings, fuses used in conjunction with motor protection shall be current limiting, dual element, time-delay type.

PART 3. EXECUTION

3.01 INSTALLATION

A. General

Unless otherwise shown on the Contract Drawings, overcurrent protective devices shall be installed in conformance with NFPA 70, and UL 98, in accordance with the manufacturer's instructions and in accordance with the requirements of this Section.

B. Fuses

1. All fuses rendered inoperative during the Work shall be replaced before the issuance of the Certificate of Final Completion.

2. All replacement fuses shall be provided in addition to the spare fuses specified in 1.07 herein.

END OF SECTION

SECTION 16475

OVERCURRENT PROTECTIVE DEVICES (600 VOLTS OR LESS)

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

A. Shop Drawings

1. Fuses; time-current and current-limiting curves for both melting and clearing.
2. Circuit breakers; time-current curves.
3. Fused circuit breakers - time current curves.

B. Catalog Cuts

1. Low Voltage Power Air Circuit Breakers
2. Molded case circuit breakers
3. Safety Switches
4. Fuses

END OF APPENDIX "A"

SECTION 16475

OVERCURRENT PROTECTIVE DEVICES (600 VOLTS OR LESS)

INSTRUCTIONS TO SPECIFIER

A. General

Ensure that the Contract Drawings show the following items specified in this Section:

1.03	Design and performance requirements which are not included in
1.06	Each type and rating of spare fuses
2.01 A	A list of acceptable manufacturers must be added to the Contract Drawings. The following is a suggested list: <u>Circuit Breakers and Safety Switches</u> Square 'D' Company General Electric Company Siemens Energy Automation, Inc. Cutler – Hammer <u>Fuses</u> Commercial Enclosed Fuse Company (CEFCO) Cooper Industries Inc./Bussman Division Gould Incorporated/Circuit Protection Division
2.02 A.1	Location, types, sizes, rating and enclosures.
2.02 A.2	Indicate whether overcurrent protective devices are to be installed via assembly or enclosure
2.02 B.1.a	Controls for low voltage power air circuit breakers
2.02 B.1.e	Required sizes and ratings of circuit breakers
2.02 B.1.h	If electro-mechanical tripping is required
2.02 B.3.a	Motor voltage
2.02 B.4.a	Location of fused circuit breakers
2.02 C.1.c	Continuous ampere rating and number of poles for molded case circuit breakers
2.02 C.1.d	Minimum short circuit interrupting rating if other than that specified.
2.02 C.1.g	Accessories for molded case circuit breakers
2.02 D.2	Safety switch rating
2.02 E.1	Class, size and ratings of fuses, and type of enclosures
2.02 E.3	Fuses used in conjunction with motor protection if other than that specified
3.01 A	Installation if other than that specified in this Section and the manufacturer's instructions

B. Other

Ensure that the following Sections are included in the Contract booklet:

Section 16470	PANELBOARDS AND CABINETS"
Section 16477	"PROTECTIVE DEVICE COORDINATION STUDY"
Section 16450	"GROUNDING"

END OF INSTRUCTIONS

DIVISION 16

SECTION 16680

INDUCTIVE DETECTION CABLE AND DETECTOR SENSOR UNIT

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for inductive detection cable and detector sensor unit.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM D 1248	Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.
ASTM D 2308	Specification for Thermoplastic Polyethylene Jacket for Electrical Wire and Cable.

International Municipal Signal Association (IMSA)

IMSA Series 50/51	Loop Inductance Detection Cable and Wire Specification.

Institute of Transportation Engineers (ITE)

ITE ST-017B	Equipment and Material Standards of the Institute of Transportation Engineers.

National Electrical Manufacturers Association (NEMA)

NEMA TS 1	Traffic Control Systems.

National Fire Protection Association (NFPA)

NFPA 70	National Electrical Code (NEC).

Underwriters Laboratories, Inc. (UL)

UL 467	Grounding and Bonding Equipment.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. The inductive detection cable and equipment shall conform to requirements specified in this Section. Where specific requirements are not listed herein, such equipment shall, as a minimum, conform to the requirements of the standards and publications listed in 1.02.

B. The detector sensor units furnished under this Section shall be dual-channel detector units in the quantities shown on the Contract Drawings.

C. The detector sensor unit shall respond to changes in the inductance of the sensor loop/lead-in combination(s) connected to its loop input terminals. The unit shall develop a detection output when there is a sufficiently large change in the magnitude of the connected inductance.

1. The detector sensor unit shall detect all motor vehicle types that normally traverse the public roadways, including motorcycles. The detector sensor unit shall detect all vehicles that are stopped and shall detect all vehicles moving at speeds up to 80 miles per hour within the detection zone of the inductive loop.

1.04 ENVIRONMENTAL REQUIREMENTS

A. The detector sensor unit shall operate without degradation or damage under ambient shock (thermal and mechanical), vibration, lightning and electromagnetic/electrical interference at the construction site.

B. The detector sensor unit shall operate over an ambient temperature range from minus 40 degrees F to plus 165 degrees F (minus 40 degrees C to plus 74 degrees C). Operation of the detector sensor unit shall not be degraded by rain, snow, fog or normally encountered ambient humidity conditions.

1.05 QUALITY ASSURANCE

A. Wires and cables that have been manufactured more than two years prior to installation shall not be used.

B. Verify that sealer is within the manufacturer's established shelf life and has been dated by the sealer manufacturer to so indicate.

C. Sawcutting equipment shall be capable of sawcutting concrete and asphalt pavement to depths of two inches.

D. Air compressor shall be capable of providing the pressure and volume of air sufficient to clear loop sawcut slots of moisture and debris.

E. After installation, test the equipment in the presence of the Engineer to show compliance with the requirements of this Section. Continue testing until the results are satisfactory to the Engineer. Perform all repairs, construction and modifications required to comply with the Specifications at no additional cost to the Authority.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to the construction site in original unopened containers or bundles with labels that clearly identify the manufacturer and product name, including storage requirements and instructions.

B. Properly store and handle all materials delivered to prevent deterioration or damage due to moisture, temperature change, contaminants or other causes.

1.07 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 CONSTRUCTION FEATURES

A. General

1. All wiring shall be in accordance with the requirements of NFPA 70 National Electrical Code (NEC) as shown on the Contract Drawings. No wiring shall be exposed. Provide electrical connection by barrier type terminal blocks, as defined in NEMA TS 1. Identify all wire terminations and terminal block connections. Locate connections readily accessible for maintenance. Make wire and cable terminations with insulated spade terminals, as defined in NEMA TS 1. Soldering of terminal connections will not be permitted.

B. Detector Sensor Unit

1. Detector sensor units shall meet the requirements of NEMA TS 1 and in ITE ST-017B. Provide units of solid-state design that employ digital techniques, unless otherwise shown on the Contract Drawings. The units shall conform to requirements of 1.03.

2. Detector sensor units shall be as described below and as shown on the Contract Drawings. Provide each detector unit and/or circuit board with a unique serial number.

   a. Shelf-mounted, case-contained units shall include two detection channels and shall operate on an input voltage from 80 VAC RMS to 135 VAC RMS. Power supply shall be contained in the unit. Dual-channel units shall interface with two 10-pin mating connectors, MS311106A-18-1S or approved equal for relay output as described above. Provide varistors between power line leads to limit peak transient voltage to 270 VDC.

3. Provide each detector channel with an isolated output circuit such that detection is indicated by either of the following, based upon the application and the requirements of 1.03:

   a. An output relay, with a contact or resistive load rating of 2 milliamperes through 1 ampere at 18 to 28 volts, 0.5 amperes at 120 VAC and, 1 ohm maximum closed contact resistance; or

   b. An optically isolated solid-state transistor, with an output rating of 20 milliamperes minimum conductance with 1.4-volt drop across the output terminals in the conducting state or a maximum of 50 microamperes with any voltage between 0 and 26 VAC applied across the output terminals in the non-conductive state.

4. Inductive tuning of loops shall be automatic for all types of configurations. The units shall accommodate loop circuits in the range of 20 to 2,000 microhenries. Tuning controls of any kind for this function will not be acceptable. Each unit or detection channel shall be self-retuning on initial turn-on and self-retuning within 30 seconds of reactivation or restoration of electrical power. The sensor units shall automatically accommodate those after-tuning changes in the loop/lead-in electrical characteristics as might reasonably be expected to occur in undamaged, properly installed loops, without producing a false output or change in sensitivity.

5. Each unit or detection channel shall be capable of operation in one of the following two modes which shall be front panel switch selectable:

   a. Pulse mode: A vehicle passing over a loop shall cause a programmable output pulse of from 75 to 150 millisecond duration. In this mode, the detector shall rephase two seconds after initiation of the above described output pulse. The rephase sequence shall allow for detection of the smallest detectable vehicle within a maximum of 4 minutes subsequent to detection of a stopped vehicle in the loop field.

   b. Presence mode: Continuous output based on continuous occupancy of the loop field. Minimum hold time for the smallest detectable vehicle shall be four minutes and no more than 120 minutes with a 3-turn compact loop and minimum cable lead-in.

6. Each channel of the units shall have three modes of operation; delay, extension and normal that is neither delay nor extension.

   a. In the delay mode, delay the channel output for the time set. If a vehicle departs before the time set, an output shall not occur and the timer is reset. The delay time shall be settable in the range from 0 to 30 seconds. Settability shall be within one second in the 0-15 second range and within two seconds in the 16-30 second range.

   b. In the extension mode, extend the channel output after the vehicle departs the zone of detection for the time set. If a new vehicle arrives before the extension timer times out, the timer shall be reset, the output shall be maintained and the timer shall resume timing when the vehicle departs. The extension time shall be settable in the range from 0 to 7-1/2 seconds. Settability shall be within 1/2 second.

7. Should continuous detection exceed the presence time programmed, the sensor unit shall retune to the current environment. Operation of a detection channel shall not terminate if the loops are defective through either single point leakage to ground or short to ground. Circuitry in the detection channel shall be such that output response to an open loop is selectable as either a detection or no detection.

8. Provide means to ensure no detection channel adversely interacts with any other channel installed in the same cabinet.

9. Provide an overcurrent protection device on all sensor units. For shelf-mounted, case-contained units, the circuit breaker shall be accessible from the front or back of the unit. Other overcurrent protection devices may be mounted internally for shelf-mounted units. Lightning protection shall be as specified in ITE ST-017B.

10. Grounding of all sensor units and cables shall be as specified in the NFPA 70 and UL 467.

11. Equip each sensor unit with an indication light or meter for each output circuit to identify when the detector unit is sensing a vehicle. Provide a sensitivity control for each detection channel with a minimum of three sensitivity selections for each channel. All controls and indicators shall be readily accessible from the front panel.

C. Detector Loop Lead-in Cable

1. Induction loop lead-in cable shall consist of two NEC No. 14 AWG stranded tinned copper conductors insulated with 0.030-inch minimum high molecular weight, heat stabilized, color polyethylene insulation, conforming to both ASTM D 1248, Type I, Class B, Grade 4 and IMSA Standard 50-2.

2. Twist the conductors together at the rate of seven turns per foot. Use non-hygroscopic fillers to form a firm compact cylindrical core. Provide a non-hygroscopic core tape with aluminum or copper shield and a ground drain wire.

3. The outer jacket shall consist of an extruded, black, polyethylene jacket, conforming to both ASTM D 2308 and IMSA Standard 50-2**.**

D. Inductance Loop Wire

1. Inductance loop wire shall be single conductor No. 14 AWG; polyethylene insulated stranded copper with a 600-volt rating, and shall conform to the requirements of IMSA Standard 51-7. Mark the exterior jacket of the wire at regular intervals with the proper type letter or letters, the manufacturer's name or trademark, the AWG size and the maximum rated voltage.

   a. Protect the loop wire by a continuous flexible polyethylene tubing of 0.184-inch minimum inner diameter, 0.031-inch minimum wall thickness, and 0.26-inch maximum outer diameter, having a smooth bore. The tubing shall be highly abrasion resistant and shall remain flexible from minus 22 degrees F to plus 212 degrees F (minus 30 degrees C to plus 100 degrees C).

E. Loop Embedding Sealer

1. Provide detector loop sealer to encapsulate traffic signal loop wires embedded in roadway. The sealer shall be cold applied and may be a one- or two-component system, the viscosity of which shall be sufficient to allow the material to be either poured or placed under pressure and to fully encapsulate the loop wire. The sealer shall be curable at temperatures of 40 degrees F (4 degrees C) and above.

   a. When the sealer is bonded to common paving material, it shall have sufficient strength and resiliency to withstand stresses due to vibrations and differences in expansion and contraction as a result of temperature changes or traffic conditions and shall be compatible with the sheathing or covering of inductance loop wires.

   b. Cured sealer shall be resistant to most chemicals and solvents, including salts, acids and hydrocarbons. Packaged stability of the components in original unopened containers, stored in temperatures from 32 degrees F to 100 degrees F (0 degrees C to 38 degrees C) shall be a minimum of six months.

PART 3. EXECUTION

3.01 PREPARATION

A. Before manufacture or procurement of equipment, submit detailed specifications, Catalog Cuts and Shop Drawings outlining the construction and operation details of all equipment for prior Engineer approval as specified in 1.07. Do not procure equipment until the Engineer has given written approval.

3.02 INSTALLATION

A. Saw cut a rectangular shaped channel of the dimensions shown on the Contract Drawings with an access channel from each loop to the edge of the roadway. Cut the corners of the channels diagonally to assure a clean smooth radius.

B. Blow channel free of debris and moisture after the trench has been cut. If the loop is not immediately installed, install a backer rod filler to prevent the channel from collapsing. At curbs, if any, install a suitable conduit through the curb below the roadway level and terminate in the access channel.

C. Locate the sensor loop(s) connected to the detector unit input terminals at the zone(s) of detection as shown on the Contract Drawings. Connect the sensor loops to the detector sensor units by means of lead-in cable.

D. Install the loop detector wire in its polyethylene tubing continuous without splices, joints, kinks or curls, and no straining or stretching of the tubing around the corners of the channel or junction box. Use a wooden or plastic tool with rounded corners to seat the tubing in the bottom of the channel. After the wire is in place, recheck for slack, raised portions and tightness. If any of the foregoing is found, they shall be corrected. Twist the lead-in wires together with a minimum of seven turns per foot from the loop channel to the nearest junction box.

E. Extend the twisted loop wire from the channel to the nearest junction box. At this point connect to the detector lead-in cable. Install detector lead-in cables continuously without splices from the cabinet housing the sensor electronics to the junction box nearest the loop. Make connection of the lead-in cable to the loop wire with a compression solder-less connector secured mechanically and electrically with the proper tool as per ITE ST-017B. Clean the conductor with a minimum of insulation removed. Insulate all joints with a resin splicing kit.

F. Lead-in Detector Cable

1. Terminate the lead-in cable inside controller cabinet at a surge voltage protected terminal strip. Provide an excess of 18 inches of lead-in cable in each cabinet. Group and tag terminations with cable identification tags that show the loop designations shown on the Contract Drawings. Secure the conductors to the cable racks using nylon cable ties. Maximum lead-in cable length, unless otherwise shown on the Contract Drawings, shall be 850 feet from field junction box to controller cabinet.

2. Provide induction loop detector leads slack of five feet in rectangular junction boxes and three feet in circular junction boxes. Secure all slack cable at the bottom of the boxes with nylon cable ties. Form the slack cable and wires around the interior of the junction box.

G. After successful testing of the loop in accordance with 3.03 A.1, seal the channel with a joint sealant mixed and applied in accordance with manufacturer's instructions. Completely fill the channel with the joint sealant with no air bubbles below the surface. The loop sealer shall be flush with the roadway. Remove joint sealant that is accidentally applied to the roadway surface. Allow the joint sealant to sufficiently harden before allowing traffic to move over the area.

1. At sloping roadway apply the joint sealant in a manner that prevents the joint sealant from running out of the trench and onto the roadway.

3.03 FIELD TESTS

A. Perform initial installation test in accordance with 1.05 E.

1. Prior to installation of loop sealer, test each loop with a 500-volt megohmmeter. The tested resistance from each loop lead to ground shall be a minimum of 50 megohms. Test each loop for continunity with an ohmmeter. End-to-end resistance shall not exceed five ohms.

2. Perform an inductance test to determine the inductance of the loop. Submit in writing a tabulation of all test results for all loops. Provide a loop inductance meter to perform the inductance tests. If the loop inductance does not conform to the requirements shown on the Contract Drawings, adjust the number of turns of wire in the trench and retest the inductance of the loop.

END OF SECTION

SECTION 16680

INDUCTIVE DETECTION CABLE AND DETECTOR SENSOR UNIT

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:

~~1.~~A. Shop Drawings: A complete set of detailed drawings including reproducible Shop Drawings on Mylar, from which clear prints can be made. Included within this documentation shall be electrical wiring diagrams defining terminal identification number assignment.

~~2.~~B. Catalog Cuts and Data Sheets: Complete manufacturer's data including chemical resistance, material properties and test methods for loop embedding sealer and characteristics of detector sensor, loop and loop lead-in.

END OF APPENDIX "A"

SECTION 16680

INDUCTIVE DETECTION CABLE AND DETECTOR SENSOR UNIT

INSTRUCTIONS TO SPECIFIER

~~B.~~A. Contract Drawings

Ensure that the Contract Drawings show the following items specified in the text:

1.03 B	Specify number of dual-channel detector units, if required.
2.01 A	Specify wiring used in accordance with the requirements of the NFPA 70 National Electrical Code.
2.01 B.2	Specify either shelf- or rack-mounted detector sensor units.
3.02 A	Specify saw cut dimensions and shape.
3.02 C	Specify the sensor loop(s) that are connected to the detector unit input terminals.
3.02 F.1	Specify maximum lead-in cable length if greater than 850 feet from field junction box to controller cabinet.

END OF INSTRUCTIONS

18 Attachment 7 - Division 1 General Provisions

Table of Contents

1. CONSTRUCTION REQUIRED BY THE SPECIFICATIONS 104
2. AVAILABLE PROPERTY 105
3. CONSTRUCTION SITE SECURITY REQUIREMENTS 105
4. OPERATIONS OF OTHERS 107
5. LABOR ACTIONS 107
6. CONTRACTOR'S MEETINGS 107
7. CONTRACT DRAWINGS 108
8. SHOP DRAWINGS, CATALOG CUTS AND SAMPLES 108
9. SUBSTITUTION 112
10. WORKMANSHIP AND MATERIALS 113
11. INSPECTIONS AND REJECTIONS 115
12. MANUFACTURERS' CERTIFICATION 117
13. NO RELEASE OF CONTRACTOR 117
14. ERRORS AND DISCREPANCIES 117
15 DIFFERING SUBSURFACE CONDITIONS 117
16 ACCIDENTS AND FIRST AID PROVISIONS 118
17 SAFETY PROVISIONS 118
18 RECYCLING OF CONSTRUCTION DEBRIS MATERIAL 120
19 DIESEL-POWERED EQUIPMENT 121
20 DAILY PROGRESS, EQUIPMENT AND LABOR REPORTS 125
21 LAWS AND ORDINANCES 125
22 SIGNS 126
23 CONTRACTOR'S FIELD OFFICE AND REPRESENTATIVE 126
24 SURVEYS 126
25 TEMPORARY STRUCTURES 127

26 PERMIT AND REQUIREMENTS FOR WELDING 127

27 FINAL INSPECTION 128

28 WARRANTIES 128

29 REQUIREMENTS FOR CRANES AND DERRICKS - NEW YORK 128

30 REQUIREMENTS FOR CRANES AND DERRICKS - NEW JERSEY 135

31 TEMPORARY UTILITY SERVICES 137

32 TEMPORARY SANITARY FACILITIES 137

33 PROGRESS SCHEDULE 137

34 ANALYSIS OF BID – NOT APPLICABLE TO THIS CONTRACT 147

35 CONDITIONS AND PRECAUTIONS 147

36 HOURS OF WORK AND CONSTRUCTION STAGING 148

37 MAINTENANCE OF TRAFFIC AND WORK AREA PROTECTION 148

38 PERMIT AND REQUIREMENTS FOR CONFINED SPACE ENTRY 152

SPECIFICATIONS

DIVISION 1

GENERAL PROVISIONS

1. CONSTRUCTION REQUIRED BY THE SPECIFICATIONS

These Specifications relate generally to performing various modifications to tolling lanes at the following Plazas supporting the installation of replacement equipment under the Integrated Toll Collection System (ITCS) Strategic Investment (hereafter referred to as ITCS-SI):

1. GW Bridge Upper Level
2. GW Bridge PIP
3. GW Bridge Lower Level
4. Goethals Bridge
5. Holland Tunnel
6. Lincoln Tunnel
7. Outerbridge Crossing

These Specifications require the doing of all things necessary or proper for or incidental to the matter referred to in the immediately preceding paragraph, as defined by approved Detail Design and Shop Drawings

In addition, all things shown on approved Detail Design and Shop Drawings even though not expressly mentioned in these Specifications, all things mentioned in these Specifications even though not shown on the Detail Design and Shop Drawings, and all things not specified either on the Detail Design and Shop Drawings, or in the Specifications but involved in carrying out their intent and in the complete and proper execution of the matter referred to in the immediately preceding paragraph are required by these Specifications; and the Contractor shall perform the same as though they were specifically delineated, described and mentioned.

In case of a conflict between a requirement of the Detail Design and Shop Drawings and a requirement in Division 1 of the Specifications, the requirement of Division 1 shall control. In case of a conflict between a requirement contained in other Divisions of the Specifications and a requirement of the Detail Design and Shop Drawings, the requirement of the Detail Design and Shop Drawings shall control.

Some Sections of the Specifications make cross references to construction specified in other Sections of the Specifications, including cross references intended to avoid duplication by the bidders in quoting prices and to point out some of the necessity for coordination. Such cross references are not intended to be complete or all inclusive, and the Contractor shall ascertain for himself both the nature and the extent of all construction which may be related to that under each Section of the Specifications whether or not expressly referred to.

Some Sections of the Specifications contain a general description of the construction under such Sections. Such description is merely a very general one and is not intended to outline the construction required by the Technical Specifications and Detail Design and Shop Drawings. Accordingly, such description shall be construed as in aid of and supplemental to, but in no case limiting, impairing or decreasing, the requirements elsewhere set forth with respect to the construction to be performed.

The Contractor's compensation for all construction whatsoever referred to in the Specifications and Detail Design and Shop Drawings in their present form, even though the need for certain items of such construction may be contingent upon future occurrences or determinations or upon other circumstances, shall be deemed to be included in the price(s) quoted by the Contractor in the Change Order unless the Specifications or Detail Design and Shop Drawings expressly state that compensation in addition to such price shall be payable for such items of construction. The express statement in some cases to the effect that certain construction shall be without additional cost to the Authority shall not impair the application of this paragraph in other cases.

The distribution of various parts of the construction among the Divisions and Sections of the Specifications or among the Detail Design and Shop Drawings is not intended as a representation of the most effective or logical method of organizing, scheduling, or subcontracting the construction, and the Contractor shall ascertain for himself how to do so unless otherwise expressly prescribed in this Change Order.

In all cases, the provisions of the second paragraph of this numbered Section shall control.

2. AVAILABLE PROPERTY

Subject to the conditions elsewhere stated herein, those areas to be occupied by the permanent construction will be made available to the Contractor upon the commencement of his first operations at the construction site.

Any additional property that the Contractor desires for his operations shall be obtained by him at his own expense.

The Contractor will be permitted to use only so much of the aforesaid areas as is necessary for the performance of the Change Order, and he must at all times so conduct his operations as not to encroach upon or block the portions used by others. The Port Authority Engineer (hereafter referred to as "Engineer") may at any time make joint or exclusive assignments of particular portions thereof, either to the Contractor or to others, and may take over and use for other purposes any portions which, in the opinion of Engineer, are not required for the performance of the Change Order.

The Contractor shall daily clean up the areas made available to him so that they are free at all times of refuse, rubbish, scrap material or debris.

3. CONSTRUCTION SITE SECURITY REQUIREMENTS

The Port Authority of New York and New Jersey operates facilities and systems at which terrorism or other criminal acts may have a significant impact on life safety and key infrastructures. The Authority reserves the right to impose multiple layers of security requirements on the performance of the Work of the Change Order, including on the Contractor, subcontractors and materialmen, depending upon the level of security required, as determined by the Authority. The Contractor shall comply, and shall ensure that his subcontractors and materialmen comply, with the following security requirements:

A. Identity Checks, Background Screening and Issuance of Photo Identification Cards

No person will be permitted on or about the construction site without a Facility Photo ID issued by the Authority. Facility Photo IDs are required for employees of the Contractor, subcontractors and materialmen. All employees of the Contractor, subcontractors and materialmen shall wear Facility Photo IDs in a conspicuous and clearly visible position whenever they are working at the construction site.

As part of the requirement for the issuance of Facility Photo IDs, the Contractor shall perform background checks through the Secure Worker Access Consortium (SWAC) and obtain SWAC ID cards with a "HIGH" SWAC approval level for all workmen and materialmen on this Change Order. Information on the SWAC process, including office locations and hours of operation, is available on the following website: http://www.secureworker.com/ .

The Contractor shall coordinate with the Engineer at least five (5) business days in advance to obtain Facility Photo IDs. The SWAC ID card, a state issued driver's license and an additional form of identification shall be presented by each workman and materialman in order to be issued a Facility Photo ID by the Authority. Facility Photo IDs will be issued at no cost to the Contractor.

The Contractor shall ensure that all workmen and materialmen renew their SWAC ID and Facility Photo ID prior to the respective ID cards' expiration dates. Any workman or materialman with an expired SWAC ID or expired Facility Photo ID shall not be permitted access to the construction site.

B. Construction Site Access Control

1) The Authority may provide for construction site access control, inspection and monitoring by security guards retained by the Authority. However, this provision shall not relieve the Contractor of his responsibility to secure equipment and Work at the construction site at his own expense.

2) At the beginning of each work period or work shift, the Contractor shall furnish to the security guards, if any, or to the Engineer a memorandum showing for that work period or work shift:

   a) The name and company affiliation of each employee of the Contractor or of a subcontractor who is expected to enter the construction site and,

   b) The name of each firm expected to deliver materials, service equipment or perform other services and a description of such materials or services.

C. High Security Areas

1) If Work under this Change Order is required in high security areas, as may be designated as such by the Authority, the Contractor shall comply with certain security procedures while performing Work in such areas. The security procedures may require that the Contractor, subcontractors or materialmen performing Work in such areas be escorted to and from these areas by security personnel designated by the Authority. Further, the Contractor, subcontractors or materialmen may be required to be monitored by security personnel designated by the Authority while performing Work in certain high security areas.

2) Prior to the start of Work at the construction site, the Contractor will be provided with a description of the high security areas from the Authority, which will be in effect on the date that Work commences. The description of high security areas may be changed at any time by the Authority during the duration of this Change Order. The Contractor shall notify the Authority no less than twenty-four hours prior to the performance of any Work in a high security area. The Contractor shall conform to the security procedures as may be established by the Authority and the escorting and monitoring of workmen and materialmen hereunder.

The Authority may impose, increase, and/or upgrade security requirements for the Contractor, subcontractors and materialmen during the duration of this Change Order to address changing security conditions and/or new governmental regulations. The Contractor will be compensated for changes to the security requirements as directed by the Engineer at the Net Cost of such Work. "Net Cost" shall be computed in the same manner as is compensation for Extra Work, including any percentage addition to cost, as set forth in the clause of the Contract entitled "Compensation for Extra Work". Performance of such Net Cost Work shall be as directed by the Engineer and shall be subject to all provisions of the Contract relating to performance of Extra Work. Compensation for said Net Cost Work shall not be charged against the total amount of compensation authorized for Extra Work.

4. OPERATIONS OF OTHERS

During the time that the Contractor is performing the Change Order, other persons will be engaged in other operations on or about the construction site including facility operations and maintenance all of which shall remain uninterrupted.

The Contractor shall so plan and conduct his operations as to work in harmony with others engaged at the construction site and not to delay, endanger or interfere with the operations of others (whether or not specifically mentioned above), all to the best interests of the Authority and the public and as may be directed by the Engineer.

5. LABOR ACTIONS

Whenever any labor strike, slowdown, work stoppage, picketing or other labor action which might interfere with the performance of the Change Order, or of other Authority or PATH contracts or the operation of any Authority or PATH facility occurs at the construction site or at any other Authority or PATH facility as a result of the Contractor's (or its subcontractor's) utilization of particular means, methods or manpower to perform the Work required by the Change Order, the Contractor shall pursue all remedies which are appropriate and available to him to avoid such interference.

6. CONTRACTOR'S MEETINGS

The Contractor shall conduct job progress and coordination meetings with subcontractors in his field office every two weeks, or as frequently as job conditions require or the Engineer may request. The Engineer shall be notified and, at his option, may attend these meetings. The Contractor shall prepare and distribute minutes to the Engineer and the subcontractors within forty-eight (48) hours of the day following the meetings.

The Contractor shall attend separate job progress and coordination meetings with the Engineer every two weeks, or at times otherwise requested by the Engineer.

7. CONTRACT DRAWINGS

Contract Drawings for this Change Order are the As-built Drawings that represent the current ITCS infrastructure previously supplied by the Contractor.

The Contract Drawings do not show all of the details of the Work and are intended only to illustrate the character and extent of the Work to be performed. Accordingly, they shall be supplemented and modified by the Engineer or Record to the extent necessary to further illustrate the Work being performed under this Change Order and resubmitted as Detail Design Drawings.

An indication on the Drawings of the existence, nature or location of any utilities, structures, obstructions, conditions or materials does not constitute a representation as to the conclusions to be drawn therefrom nor a representation that no others exist in addition to those shown, even in the same location; nor does the absence of any indication on said drawings of the existence, nature or location of any utilities, structures, obstructions, conditions or materials constitute a representation that none exist.

8. DETAIL DESIGN DRAWINGS, SHOP DRAWINGS, CATALOG CUTS AND SAMPLES

The Contractor shall specifically prepare for this Change Order all Shop Drawings that may be required in addition to the Detail Design Shop Drawings or in addition to any other drawings that the Engineer may issue.

The specific requirements elsewhere set forth in the Specifications for furnishing Shop Drawings, Catalog Cuts and samples for any particular portion of the Change Order shall not limit the obligation of the Contractor to furnish Detail Design Drawings, Shop Drawings, Catalog Cuts and samples for any other portion when so required by the Engineer.

The Contractor shall submit a general “Submittal Schedule” for the Engineer’s review and approval listing the planned transmittal date and estimated number in each specification section category of Detail Design Drawings, Shop Drawings, Catalog Cuts, pages of calculations and samples within 30 days after receipt by the Contractor of the acceptance of the Change Order Proposal. A more detailed schedule shall be submitted no less than 30 calendar days prior to the actual date of any submittal.

After checking and verifying all field measurements and after complying with applicable procedures specified hereunder, the Contractor shall submit to the Engineer for review and approval, in accordance with the approved schedule of all Drawing submissions, or for other action if so indicated by the Engineer, six copies, unless otherwise requested, of all Drawings which will bear a specific written indication that the Contractor has reviewed the submission for conformance to the requirements of this section.

The Authority uses Oracle Primavera Contract Management (formerly known as Expedition) software to track the status of Submittals provided by the Contractor. In order to facilitate this electronic tracking, the Contractor shall use the transmittal form that is provided at the pre-construction meeting, and shall

forward it to the Engineer via a MAPI compliant e-mail system (e.g., Microsoft Outlook, CC mail, Lotus notes, etc.).

The Contractor's transmittals of Submittal data shall fully comply with the numbering and naming conventions and other procedures that will be provided by the Engineer to the Contractor at the pre-construction meeting.

All submissions shall contain specific reference to the contract drawing and technical specification section to which they apply, as indicated below or as otherwise identified, as the Engineer may require. In general, submissions shall specifically reference Drawing numbers or Specification section numbers for which the item pertains. The data shown on the Detail Design and/or Shop Drawings shall be complete with respect to quantities, dimensions, conformance to the specified performance and design criteria, materials, test results and similar information to enable the Engineer to review the submittal as required.

The Contractor shall also submit six copies to the Engineer for review and approval pursuant to the approved submittal schedule, of all Catalog Cuts and samples for conformance to the requirements of the Detail Design and Shop Drawings and Specifications. All Catalog Cuts and samples shall have been reviewed by the Contractor and shall be accompanied by a specific written indication that the Contractor has reviewed the submittal for conformance with the Detail Design and Shop Drawings and Specifications and shall be identified clearly as to material, supplier, manufacturer's procedures and pertinent data such as catalog numbers and the use for which intended.

Before submission of each Detail Design Drawing, Shop Drawing, Catalog Cut and sample, the Contractor shall have determined and verified all quantities, dimensions, conformance to the specified performance and design criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed and coordinated each Detail Design Drawing, Shop Drawing or Catalog Cut with other Detail Design Drawings, Shop Drawings and Catalog Cuts and with other requirements of the Work.

At the time of each submission, the Contractor shall give the Engineer specific written notice of each variation in any Detail Design Drawing, Shop Drawing, Catalog Cut and sample from the requirements of the Detail Design Drawing, Shop Drawings or Specifications and, in addition, shall cause a specific notation of each such variation to be made on each submittal to the Engineer, for review and approval of each such variation.

The Engineer's review and approval of Detail Design Drawings, Shop Drawings, Catalog Cuts or samples shall not relieve the Contractor from responsibility for any variation from the requirements of the Detail Design and Shop Drawings or Specifications unless the Contractor has in writing called the Engineer's attention to each such variation at the time of submission as required hereunder and the Chief Engineer has given written approval of each by an express specific written notation thereof incorporated in or accompanying the Detail Design Drawing, Shop Drawing, Catalog Cut or sample approval. Approval of Detail Design and Shop Drawings, Catalog Cuts and samples which are inconsistent with the requirements of the Detail Design and Shop Drawings and Specifications shall not be deemed to waive or change such requirements or to relieve the Contractor of his obligations to perform such requirements

unless the Chief Engineer shall expressly and specifically state that he is waiving or changing such requirements, as stated above.

Where a Detail Design Drawing, Shop Drawing, Catalog Cut or sample is required, no related Work shall be performed prior to the Engineer's review and approval of the submission.

The format for Detail Design and Shop Drawings prepared by the Contractor shall be as follows:

1) Standard "D" size drawings with outside cut line dimensions of 22 inches by 34 inches and showing in detail all dimensions and description of materials.
2) Two borders shall be drawn. The first shall be drawn one-half inch from the outside edges (top, bottom, left and right). The second shall be drawn inward to the drawing, one-half inch from the top, bottom and right borderlines and one and one-half inch from the left borderline. The inside borders on these drawings shall be 20 inches by 31 inches.
3) A title block shall be shown on the right side of the drawing adjacent to the inside border identifying the Contractor's Name, Change Order Title, Change Order Number, cross-referenced drawing number, Specification reference number and related paragraph and applicable signatures. These drawings shall be arranged in systematic order and numbered consecutively.

Upon receipt of the submittal, the Engineer will review the Detail Design Drawing, Shop Drawing, Catalog Cut or sample for conformance to the design information and materials shown on the Drawings and contained in the Specifications. Approval by the Engineer shall not constitute a complete review or approval of the means, methods, techniques, sequences or procedures of construction, except where a specific means, method, technique, sequence or procedure of construction is specifically delineated in or required by the Detail Design and Shop Drawings or Specifications, and the approval shall not constitute a review and approval in regard to safety precautions or programs incident thereto. The review and approval of a separate item will not in itself indicate approval of the assembly in which the item functions. Any design shown on the Detail Design and Shop Drawings and prepared by the Contractor, his subcontractors, their detailers, or their professional engineers is the complete responsibility of the Contractor.

Within the number of working days hereinafter specified after receipt of the Detail Design Drawing, Shop Drawing prints, the Engineer shall approve or not approve the same or require corrections or additions to be made thereon. When a Detail Design or Shop drawing is not approved or if additions or corrections are required, the Engineer shall return within this period one of the six copies submitted and the Contractor shall make the revisions, corrections or additions shown thereon to be made. The Contractor shall resubmit six prints showing the drawing corrected as required. The Contractor shall direct specific attention in writing to revisions other than the corrections called for by the Engineer on the previous submittal. Each drawing shall be corrected as required until the approval of the Engineer is obtained. After each resubmission, the Engineer shall have the number of working days hereinafter specified in which to approve revisions or corrections.

The number of working days within which the Engineer will advise the Contractor as to whether the Detail Design or Shop Drawings are approved, not approved, or require corrections or additions to be made thereto shall be as follows, except that 20 working days shall be required for the Engineer to review drawings submitted with design calculations.

No. of Dwgs. Submitted Within 5 Consecutive Working Days for Each Discipline(*)	No. of Working Days for Engineer to Review Detail Design and Shop Drawings
Up to 50	10
51 to 75	15
More than 75	20
* Disciplines shall be defined as follows: Structural, Architectural, Civil, Geotechnical, Mechanical, Electrical, Traffic and Environmental.	

Failure of the Contractor to provide 30 calendar days advance notice to the Engineer of any submittal shall result in a five (5) working day extension of the number of working days stated in the chart above. In no event shall an extension of the Engineer's review time provided for in this section relieve the Contractor from its duty to meet all contractual Milestone dates.

After approval has been given to any Detail Design and Shop Drawing or Catalog Cut, no change will be permitted thereon unless approved in writing by the Engineer.

Before final payment for the Work is made, the Contractor shall submit to the Engineer only those previously approved or approved as noted Detail Design and Shop Drawings, which have been revised by field changes.

The Contractor shall mark-up the approved and approved as noted Detail Design and Shop Drawings directing specific attention to revisions reflecting the permanent construction as actually made. In accordance with the requirements specified in this numbered Section, the Contractor shall submit one original print of these drawings, marked "FINAL DETAIL DESIGN DRAWING DRAWING – NOT FOR REVIEW" or "FINAL SHOP DRAWING – NOT FOR REVIEW", dated, and signed by the Contractor to the Engineer for verification. By signature, the Contractor is verifying that the drawing reflects the as-constructed condition.

All drawings, data, calculations and other papers of any type whatsoever, whether in the form of writing, figures or delineations, which are prepared in connection with this Change Order and submitted to the Authority shall become the property of the Authority. The Authority shall have the non-exclusive right to use or permit the use of all such drawings, data and other papers and any ideas or methods represented thereby for any purpose and at any time without additional compensation. No such papers shall be deemed to have been given in confidence. Any statement or legend to the contrary in connection with

such drawings, data or other papers and in conflict with the provisions of this paragraph shall be void and of no effect.

9. SUBSTITUTION

Where a proprietary item or make is specified or mentioned herein or called for or mentioned on the Detail Design or Shop Drawings and the phrases "similar and equal to" or "approved equal" are used in connection therewith, the utilization of any other item or make will be deemed a substitution. Substitution for the proprietary item or make specifically named may be made only in accordance with the Section hereof entitled "Workmanship and Materials" and in accordance with the following.

Whenever materials or equipment are specified or described in the Detail Design or Shop Drawings or Specifications by using the name of a proprietary item or the name of a particular supplier, the naming of the item is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of another supplier or manufacturer may be accepted by the Engineer if sufficient information and proof is submitted by the Contractor to permit the Engineer to determine that the material or equipment proposed is equivalent or equal to that named and the Engineer approves the substitution. The procedure for review by the Engineer will include the following. Requests for review of substitute items of material and equipment will not be accepted by the Engineer from anyone other than the Contractor. If the Contractor wishes to furnish or use a substitute item of material or equipment, the Contractor shall make a timely written application to the Engineer for approval thereof, certifying that the proposed substitution will perform at least the identical functions and achieve at least the identical results called for by the specified product and otherwise be equal to the specified product with regard to, but not limited to, durability, maintenance, strength, energy costs and record of proven performance. The application shall state that the evaluation and approval of the proposed substitution shall not delay the Contractor's completion of the Work as required by the Change Order, whether or not approval of the substitution will require a change in the construction and, in no event will the Contractor be granted an extension of time for completion of any portion of the Work for reasons related directly or indirectly to the evaluation of the proposed substitution or to the proposed substitution itself. Any variations of the proposed substitution from that specified shall be identified in the application, and maintenance, repair and replacement services for the substitution shall be indicated. The Engineer may require the Contractor to furnish at the Contractor's expense additional laboratory test data concerning the proposed substitution.

Such submission to the Engineer shall be made only by including the requested substitution in the list of materials required to be submitted to the Engineer in accordance with the Section hereof entitled "Inspections and Rejections" within forty-five calendar days after the receipt of the acceptance of the Contractor's Proposal. After the approval of said list, no substitutions will be permitted, except that a brand or make named in the Specifications may be submitted for approval in lieu of a brand or make on said list. Any such submission shall not imply, or impose on the Engineer, any obligation whatsoever to discuss, disclose or justify the reasons for his opinion, approval, acceptance or rejection.

The Engineer shall be the sole judge of as to whether a proposed substitution will be approved, and no substitution shall be ordered or utilized without the Engineer's prior written approval. The Engineer may require Contractor to furnish at Contractor's expense a special performance guarantee or other assurance

with respect to any approved substitution. Furthermore, the approval of any substitute proprietary item or make shall not in any way entitle the Contractor to additional compensation.

Notwithstanding such approval, however, the Contractor assumes the risk that such approved substitute item or make is not equal to that shown or specified and if at any time the substitution shall appear not to be so equal he shall replace the substitution with that originally shown on the Detail Design or Shop Drawings or called for in the Specifications at his own cost and reimburse the Authority for any loss occurring on account of the substitution failing to be equal, notwithstanding that it had been previously approved for use by the Engineer.

The construction called for by the Detail Design and Shop Drawings and Specifications may be adapted for a particular proprietary item or make of material or equipment. Therefore, if any construction not required by the Detail Design or Shop Drawings or Specifications in their present form is necessary or desirable because of the use of substitute item or make of material or equipment (even though such other item or make is approved by the Engineer), such construction shall be furnished or performed by the Contractor at his expense and subject to the approval of the Engineer.

10. WORKMANSHIP AND MATERIALS

Workmanship and materials shall in every respect be free from defects of any kind and shall be in accordance with the best modern practice and whenever the Detail Design or Shop Drawings, Specifications or directions of the Engineer admit of a doubt as to what is permissible or fail to note the quality of any construction the interpretation which calls for the best quality is to be followed. Workmanship shall conform to applicable Specifications, manufacturer's instructions and recommendations for installation of products for the applications shown on the Detail Design or Shop Drawings, all of which shall be subject to the provisions of the Section of Division 1 GENERAL PROVISIONS entitled "Inspections and Rejections".

Materials and Equipment incorporated into the Work shall be new except as may be otherwise herein specifically required, and shall comply with make, size, type and quality specified, or as specifically approved in writing by the Engineer in accordance with the Section of Division 1 GENERAL PROVISIONS entitled "Substitution".

Reference to standards of any society, institution, association, or governmental authority in the Specifications or on the Detail Design or Shop Drawings, whether specific or by implication, shall mean for such standards which are part of the building code in effect for Work of this Change Order, the edition date published in such code; and such references which are not part of the building code, shall mean the latest edition date in effect at the time of execution of this Change Order unless specifically stated otherwise.

In addition, various paragraphs of these Specifications may contain references to certain standard or tentative specifications or requirements of various organizations. Unless otherwise stated, these references are to be construed as referring to the specifications and requirements in effect on the date set for execution of this Change Order..

If required by the Engineer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment to be employed by the Contractor in performing the Work. All materials and

equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the approved instructions of the applicable supplier except as otherwise provided in the Detail Design and Shop Drawings or Specifications.

In case of a discrepancy between a description or requirement in the Detail Design and Shop Drawings and Specifications for any material or equipment and a catalog number or other designation for the same material or equipment (even though stated to be acceptable), the description or requirements shall control.

All inventions, ideas, designs and methods contained in the Specifications and Detail Design or Shop Drawings in which the Authority has or may acquire patent, copyright or other property rights are hereby expressly reserved for the exclusive use of the Authority. The Specifications and Detail Design and Shop Drawings contain confidential information which is disclosed only to enable this Change Order to be performed. Said Specifications and Drawings must not be used for any purpose detrimental to the interest of the Authority and must not be produced or copied in whole or in part or used for furnishing information to others without the written consent of the Authority, provided, however, that the Contractor may, when the performance of the Change Order so requires, furnish said information to others for the purpose of engaging or informing subcontractors and materialmen.

If, in accordance with this Change Order, the Contractor furnishes research, development or consultative services in connection with the performance of the Change Order and if in the course of such research, development or consultation patentable subject matter is produced by the Contractor, its officers, agents, employees, subcontractors or materialmen, the Authority shall have, without cost or expense to it, an irrevocable, non-exclusive, royalty-free license to make, have made, and use, either itself or by anyone on its behalf, such subject matter in connection with any activity now or hereafter engaged in or permitted by the Authority. Promptly upon request by the Authority, the Contractor shall furnish or obtain from the appropriate person a form of license satisfactory to the Authority, but as between the Contractor and the Authority the license herein provided for shall nevertheless arise for the benefit of the Authority immediately upon the production of said subject matter and shall not await formal exemplification in a written license agreement as provided for above. Such license may be transferred by the Authority to its successors, immediate or otherwise, in the operation or ownership of any real or personal property now or hereafter owned or operated by the Authority, but such license shall not be otherwise transferable.

The right to use all material, software, firmware, compositions of matter, manufactures, apparatus, appliances, processes of manufacture or types of construction required in connection with this Change Order and to which a patent, copyright or other intellectual property right applies or may apply shall be obtained by the Contractor without separate or additional compensation whether the same is patented, copyrighted or otherwise protected as an intellectual property right before, during or after the performance of the Change Order.

The Contractor shall indemnify the Authority against and save it harmless from all loss and expense incurred in the defense, settlement or satisfaction of any claims in the nature of patent, copyright or other intellectual property right infringement arising out of or in connection with the Authority use, in accordance with the preceding two paragraphs of this numbered Section, of such subject matter or material, software, firmware, compositions of matter, manufactures, apparatus, appliances, processes of manufacture or types of construction to which a patent, copyright or other intellectual property right applies or may apply. If requested by the Authority and if notified promptly in writing of any such claim, the Contractor shall conduct all negotiations with respect to and defend such claim without expense to the

Authority. If the Authority be enjoined from using any of the facilities which form the subject matter of this Change Order and as to which the Contractor is to indemnify the Authority against patent, copyright or other intellectual property right claims, the Authority may, at its option and without thereby limiting any other right it may have hereunder or at law or in equity, require the Contractor to supply, temporarily or permanently, facilities not subject to such injunction and not infringing any patent, copyright or other intellectual property right or to remove all such facilities and refund the cost thereof to the Authority or to take such steps as may be necessary to ensure compliance by the Authority with such injunction, all to the satisfaction of the Authority and all without cost or expense to the Authority.

11. INSPECTIONS AND REJECTIONS

All Work and all construction, processes of manufacture and methods of construction involved in or related to the performance of the Work shall be at all times and places subject to the inspection of the Engineer, acting personally or through his Inspectors, and the enumeration in these Specifications of particular portions of such Work, construction, processes of manufacture or methods of construction which will or may be inspected by the Engineer or such Inspectors shall not be deemed to imply that only such Work, construction, processes of manufacture and methods of construction will or may be so inspected. The Engineer shall be the judge of the quality and suitability of the Work, construction, processes of manufacture and methods of construction for the purposes for which they are used or to be used. Should they fail to meet his approval they shall be forthwith reconstructed, made good, replaced or corrected, as the case may be, by the Contractor at his own expense. Rejected material shall be removed immediately from the site. The fact that the Inspectors have approved the materials and workmanship shall not relieve the Contractor from his obligation to supply other material and workmanship when so ordered by the Engineer.

The Contractor, at his own expense, shall furnish such facilities and give such assistance for inspection as the Engineer may direct. In the case of materials required by the Specifications to be inspected in the factory or plant, and in the case of any other items which the Engineer may designate, the Contractor shall secure for the Engineer and his Inspectors free access to all parts of such factories or plants and shall furnish to the Engineer three copies of purchase orders, two copies of mill shipping statements and four copies of shipping statements. Moreover, in the case of such materials to be factory or plant inspected, the Contractor shall give at least ten days' notice to the Engineer of his intention to commence the manufacture or preparation of such materials.

Other than the materials and equipment specifically required to be inspected at the manufacturer's factory or plant, all materials will be inspected at the construction site and any portions thereof which are rejected by the Engineer shall be immediately removed from the construction site by the Contractor and shall be replaced with new materials by the Contractor at his own expense.

In the case of materials to be inspected at the construction site, the Contractor shall submit a list of all such materials in triplicate to the Engineer for his approval prior to ordering same. The list shall be submitted within forty-five calendar days after receipt of the notice of acceptance and shall contain the following information:

A. Classification of submittal in accordance with the following:

Class I - A submittal for record of an expressly specified item.
Class II - A submittal of an item which conforms to an express generic specification or a submittal which is deemed by the Contractor to be identical to an expressly specified item.

Class III - A submittal which is deemed by the Contractor to be functionally equivalent but not identical to a specified item.

B. In the case of Class II and Class III, the Contractor shall supply adequate information to the Engineer to enable the Engineer to compare the specified item and the proposed substitution. Information shall include, but need not be limited to, technical specifications, Catalog Cuts, drawings, references to existing installations and test data, or any other data required by the Engineer.

C. In the case of fabricated materials for which Detail Design or Shop Drawings are to be prepared, a brief description of the material and the statement "See Detail Design Drawings" or "See Shop Drawings".

D. In the case of materials or equipment listed in manufacturer's catalogs, the list shall contain the vendor's name, the manufacturer's name, brand name, style designation, catalog number and, where the Specifications require catalog cuts, the statement "see catalog cut".

E. In the case of materials or equipment for which Detail Design or Shop Drawings are not to be prepared, and which are not listed in any catalog, the list shall contain a complete description of the material or equipment, which shall be in sufficient detail to describe completely the materials or equipment and quality therefor.

The Engineer shall advise the Contractor whether said list is approved or requires corrections or additions within the number of working days indicated in the chart below:

Type of Submittal	No. of Working Days for Engineer to Approve/Disapprove Items
Class I Material submittals	10
Portland Cement mix designs that require confirmation of the 28-day properties	35
Changes in asphalt mix designs that need to be confirmed with a batch mix at the plant	35
Class II Material submittals	20
Class III Material submittals	30

Failure of the Contractor to provide 30 calendar days advance notice to the Engineer of any submittal shall result in a five (5) working day extension of the number of days stated in the chart above. In no event shall an extension of the Engineer's review time provided for in this section relieve the Contractor from its duty to meet all contractual Milestone dates.

Within ten working days after receipt of said list, the Engineer shall notify the Contractor of which items are approved and which disapproved. Within two working days thereafter, the Contractor shall resubmit a new list covering those items which were disapproved. After each such re-submission, the Engineer shall have a similar period of ten days in which to approve or disapprove.

Should materials or equipment be delivered to the construction site without having been placed on the aforementioned list and approved, it shall be immediately removed from the construction site by the Contractor at his own expense.

12. MANUFACTURERS' CERTIFICATION

Where materials and equipment are required by these Specifications to conform to certain standard or tentative specifications or requirements of any organizations, including American Society for Testing and Materials, American National Standards Institute, Association Rules for Grading Lumber, Federal Specifications, National Electrical Manufacturers Association, American Association of State Highway and Transportation Officials, American Water Works Association and the International Municipal Signal Association, the Contractor shall furnish to the Engineer the manufacturer's written certification that each of the materials or equipment conforms to the foregoing standard or tentative specifications. The certification shall be delivered to the Engineer prior to installation of the materials to which it refers. Such certifications shall not be binding or conclusive on the Authority and may be rejected at any time by the Engineer if incorrect, improper or otherwise unsatisfactory in his opinion.

13. NO RELEASE OF CONTRACTOR

Any provision of this Change Order for testing, inspection or approval, and any actual testing, inspection or approval, of any materials, workmanship, plant, equipment, drawings, program, methods of procedure, or of any other thing done or furnished or proposed by the Contractor to be done or furnished in connection with the Change Order is for the benefit of the Authority not the Contractor. Any approval of such things shall be construed merely to mean that at that time the Engineer knows of no good reason for objecting thereto. No such provision for testing or inspection, no omission of testing or inspection, and no such approval shall release the Contractor from his full responsibility for the accurate and complete performance of the Change Order in accordance with the Detail Design and Shop Drawings and Specifications or from any duty, obligation or liability imposed upon him by the Change Order or from responsibility for injuries to persons or damage to property.

14. ERRORS AND DISCREPANCIES

If, in the performance of the Change Order, the Contractor discovers any errors or omissions in the Detail Design and Shop Drawings or Specifications, or in the marks, lines and elevations furnished by the Authority in the construction undertaken and executed by him, he shall immediately notify the Engineer and the Engineer shall promptly verify the same.

If with the knowledge of such error or omission and prior to the correction thereof, the Contractor proceeds with any construction affected thereby, he shall do so at his own risk and the construction so done shall not be considered as construction done under and in performance of this Change Order unless and until approved and accepted.

15 DIFFERING SUBSURFACE CONDITIONS

If during the performance of Work, the Contractor becomes aware of any unanticipated subsurface conditions or has cause to suspect the presence of such condition, then the Contractor shall immediately notify the Engineer, or designee thereof verbally, to be followed immediately by written notification. The Contractor shall specify the nature, location, and impact on the Work of such conditions. The Contractor

shall immediately stop Work in and secure the area against injury to persons or damage to property pending further instructions from the Engineer.

The Contractor shall then conduct all necessary investigations and testing of the subsurface conditions as directed by the Engineer to identify the character and extent of the unanticipated subsurface conditions and/or to satisfy applicable Federal, State and local laws, codes and ordinances and regulations and shall notify the Engineer accordingly. The investigation program shall be submitted to the Engineer for review and approval.

In the event the Contractor discovers such subsurface conditions during the performance of the Work and (i) special handling of such condition is necessary and required for the performance of the Work as determined by the Engineer; (ii) such special handling cannot be avoided or mitigated by the exercise of reasonable measures by the Contractor; and (iii) the Contractor actually incurs increased costs caused by such condition that could not have been reasonably anticipated from the Detail Design Drawings, Shop Drawings, Reference Drawings and Specifications and inspection of the construction site; then in such event, as approved by the Engineer, the Contractor shall, notwithstanding any provision in this Change Order to the contrary, be compensated for such costs for special handling, including the necessary investigations and testing of subsurface conditions, in accordance with the provisions of the Contract clause entitled "Compensation For Extra Work".

16 ACCIDENTS AND FIRST AID PROVISIONS

The Contractor shall promptly report in writing to the Engineer and to the Authority Manager, Claims Administration, all accidents whatsoever arising out of or in connection with the performance of the Change Order, whether on or adjacent to the construction site, which result in death, injuries or property damage, giving full details and statements of witnesses. In addition, if death or serious injuries or serious damage is caused, the accident shall be reported immediately by telephone to both of the said representatives of the Authority.

The Contractor shall provide at the construction site such equipment and medical facilities as are necessary to supply first aid service, in case of accident, to any who may be injured in the progress of the Change Order. He shall have standing arrangements for the removal and hospital treatment of any person who may be injured while engaged in the performance of the Change Order.

If any claim is made by any third person against the Contractor or any subcontractor because of any accident, the Contractor shall promptly report the fact in writing to the aforementioned representatives of the Authority, giving full details of the claim.

17 SAFETY PROVISIONS

In the performance of the Change Order, the Contractor shall exercise every precaution to prevent injury to workers and the public or damage to property.

He shall, at his own expense, provide temporary structures, place such watchmen, design and erect such barricades, fences and railings, give such warnings, display such lights, signals and signs, exercise such

precaution against fire, adopt and enforce such rules and regulations, and take such other precautions as may be necessary, desirable or proper, or as may be directed.

The Contractor shall employ for Work of the Change Order, a competent person conforming to the requirements of the Code of Federal Regulations 29 CFR 1926.32(f) who shall be designated by the Contractor as authorized to perform the duties required by 29 CFR 1926 et seq. as applicable for Work of this Change Order.

Obtain and submit to the Engineer one copy of material safety data sheet (MSDS) conforming to the requirements of 29 CFR 1910.1200(g) for each hazardous chemical utilized for permanent and consumable materials employed for Work of this Change Order.

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss, including but not limited to:

A. All employees on the Work, the public, and other persons and entities who may be affected thereby;
B. All the Work, materials and equipment to be incorporated therein, whether in storage on or off the site; and
C. Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and underground facilities not designated for removal, relocation or replacement in the course of construction.

The Contractor's duties and responsibilities for the safety and protection of the Work shall continue until all the Work is completed and the Contractor has removed all workers, material and equipment from the construction site, or the issuance of the Certificate of Final Completion, whichever shall occur last.

Until fire protection needs are supplied by permanent facilities under this Change Order, install and maintain temporary fire protection facilities. Comply with requirements of National Fire Protection Association NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alteration and Demolition Operations".

The Contractor shall employ only such men as are physically fit and are free from contagious or communicable diseases.

The Contractor shall use only machinery and equipment adapted to operate with the least possible noise, and shall so conduct his operations that annoyance to occupants of nearby property and the public will be reduced to a minimum.

The bringing of intoxicating substances onto the construction site and the use or consumption of intoxicating substances at the construction site are prohibited. It shall be the responsibility of the Contractor to insure that all employees of the Contractor and of all subcontractors, materialmen and any other persons under contract to or under the control of the Contractor shall comply with the provisions of this paragraph.

The Contractor shall daily clean up all refuse, rubbish, scrap materials and debris caused by his operations, to the end that at all times the construction site shall present a neat, orderly and workmanlike appearance. Before the Certificate of Final Completion of Work will be issued, the Contractor shall remove all surplus materials, falsework, temporary fences and other temporary structures, including foundations thereof, plant of any description and debris of every nature resulting from his operations and shall put the construction site in a neat, orderly condition.

In the event the Contractor encounters at the construction site, material reasonably believed to be asbestos, polychlorinated biphenyl (PCB) or any other hazardous material not shown on the Detail Design or Shop Drawings or mentioned in the Specifications, the Contractor shall immediately stop Work in the area affected and report the condition in writing to the Engineer. Work in the affected area shall not thereafter be resumed by the Contractor except upon the issuance of a written order to that effect from the Engineer.

Within 15 days of the acceptance of his Proposal, the Contractor shall submit to the Engineer for review, the Contractor's Site Safety Program, which shall be specific for the construction site and include a description of the Work to be performed, a hazard assessment of the Work to be performed and the means by which such hazards shall be mitigated. The Contractor’s Site Safety Program shall comply with all applicable federal, state, municipal and local and departmental laws and shall include, among other things, the designation by the Contractor of a qualified individual to administer such Site Safety Program.

18 RECYCLING OF CONSTRUCTION DEBRIS MATERIAL

The Contractor shall remove from Authority property all construction debris, demolition debris and other debris material generated from the performance of the Work of this Change Order unless the material is deemed acceptable by the Engineer for on-site re-use or recycling in accordance with the technical requirements of this Change Order and remains at the Work site. The Contractor shall transport to recycling facilities or re-use and recycle on-site for this Change Order, as applicable, no less than 75% by weight of the following types of designated debris material, to the extent arising from the Work of this Change Order:

Asphalt Concrete

Portland Cement Concrete

Steel

Excess Unrestricted Soil

During the process of removal of all such designated debris material from Authority property, the Contractor shall submit to the Engineer on a monthly basis a Designated Debris Material Assessment Summary indicating the actual types and quantities by weight of the designated debris material removed for this Change Order up to that point in time. In addition, the Designated Debris Material Assessment Summary shall also include types and quantities by weight of designated debris material actually re-used or recycled on-site in this Change Order or, if shown on the Detail Design or Shop Drawings, are stockpiled for future use by the Authority. The Designated Debris Material Assessment Summary shall be accompanied by written verification from recycling and landfill destinations identifying the originating

Work site, quantity of material delivered and type of debris material for all designated debris material removed from the Work site.

Within 15 days of the acceptance of his Proposal, the Contractor shall submit to the Engineer for review the Contractor's Designated Debris Material Assessment Plan indicating the anticipated types and anticipated quantities by weight and the intended destinations for all such designated debris material to be removed from the Work site. The Designated Debris Material Assessment Plan shall also indicate anticipated types and anticipated quantities by weight of all such designated debris material to remain at the Work site for re-use or recycling in this Change Order as applicable.

All removals shall be completed promptly upon the completion of construction under this Change Order.

19 DIESEL-POWERED EQUIPMENT

A. The Contractor and its subcontractors shall minimize all air-borne pollutants generated by diesel-powered equipment and vehicles at all times during the performance of this Change Order in accordance with this numbered Section. The requirements herein apply to all land-based and barge-mounted diesel-powered construction equipment. Marine propulsion engines, marine auxiliary engines, and dredges used in construction activity are exempt from these requirements.

B. No diesel-powered equipment shall be brought on the construction site without meeting the following requirements unless a waiver has been granted as specified in D. below. In addition, all such equipment and engines shall comply with all Federal, state and local regulations applicable to exhaust emission controls and safety.

1) Ultra Low Sulfur Diesel (ULSD) Fuel

All diesel-powered equipment to be used in the performance of the Work of this Change Order shall use ULSD fuel with an average sulfur content of no more than 15 parts per million (ppm). This requirement applies to on-road and non-road diesel engines. The Engineer may collect samples of the ULSD fuel directly from the fuel tanks of the diesel-powered equipment used on the construction site in order to verify that sulfur concentrations do not exceed 15 ppm. Diesel-powered equipment not using ULSD shall be removed from the construction site or shall immediately comply with the ULSD fuel requirements in this Section as directed by the Engineer and at no additional cost to the Authority.

2) Emissions Control Devices – Best Available Technology (BAT)

All non-road diesel-powered equipment with a rated horsepower of 50 horse power (hp) or greater and active on the construction site for any portion of a 24-hour workday for more than 20 total consecutive and non-consecutive days shall be retrofitted with Emissions Control Devices (Devices) utilizing the best available technology (BAT). The Devices shall consist of Diesel Particulate Filters (DPFs) or other measures with equivalent particulate matter (PM) removal efficiency, wherever the implementation of such a Device is feasible in the opinion of the Engineer. For non-road diesel-powered equipment rated between 50 hp and 75 hp, Diesel Oxidation Catalysts (DOCs) may be used in place of DPFs.

Both active and passive filter regeneration mechanisms shall be considered for DPFs. In cases where DPFs are not feasible for safety considerations, mechanical reasons, or where the technology would not function properly, the Contractor shall submit a request for a waiver to the Engineer for review and approval prior to the use of such diesel-powered equipment. If the Engineer grants a waiver under these circumstances, then the Contractor shall retrofit the diesel-powered equipment with Flow Through Filters (FTF) if feasible in the opinion of the Engineer. DOCs shall be used in place of DPFs or FTFs unless it is proven to the Engineer by the Contractor that the application of this type of technology is also technically infeasible.

The use of diesel-powered engines greater than 50 hp without tailpipe reduction measures will be permitted pursuant to the Engineer's approval of a written request for a waiver submitted by the Contractor in accordance with D. below.

The use of Devices shall be targeted primarily toward the reduction of PM and secondarily to the reduction of nitrogen oxides (NOX), and shall in no event result in an increase in the emissions of either pollutant. The Devices of best available technology shall be defined as those that are contained in the U.S. Environmental Protection Agency (EPA) Verified Retrofit Technology List, the list of California Air Resources Board (CARB), Verifications, Europe's Verified Technology List (VERT), or as otherwise approved by the Engineer to provide the maximal level of pollutant reductions intended by this Section. For more information, refer to the following websites:

U.S. Environmental Protection Agency Verified Technology List:
http://www.epa.gov/otaq/retrofit/nonroad-list.htm

California Air Resources Board Verified Technology List:
http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm

Europe's Verified Technology List:
http://www.akpf.org/pub/vert_filterliste.pdf

3) Diesel Construction Equipment Age Requirements

To facilitate the application of verified Emission Control Devices, as well as provide lower baseline emissions, Tier 0 engines shall not be used in the performance of this Change Order unless they have been upgraded to Tier 1 and then retrofitted with best available technology devices. As determined by the Engineer, exceptions will be made only for specific engines that are not readily upgraded to Tier 1, and where the Work of this Change Order cannot reasonably be performed using alternative engines that comply with this Section. In such cases, the Contractor shall submit a written request for a waiver to the Engineer for review and approval prior to bringing such equipment onto the construction site.

4) Diesel Engine Idling Policy

The idling time of non-road and on-road vehicles shall be limited to three (3) consecutive minutes as determined by the Engineer with the following exceptions:

a. An on-road or non-road vehicle is forced to remain motionless because of traffic conditions or mechanical difficulties over which the operator has no control, or is in queue when engaged in an active operation with other equipment.

b. It is necessary to operate defrosting, heating, or cooling equipment to ensure the safety or health of the driver or passengers.

c. To ensure the safe and proper operation of auxiliary equipment that is located in or on the vehicle, to accomplish the intended use of the vehicle or equipment, but only to the extent so necessary (for example - cranes and concrete mixers).

d. To bring the vehicle to the manufacturer's recommended operating temperature, but only to the extent so necessary.

e. The outdoor ambient temperature is below twenty (20) degrees Fahrenheit.

f. A vehicle is being actively worked on for repairs or maintenance and engine idling is necessary to make such repairs or maintenance.

5) Electrification

Where electric power is distributed to and available throughout a construction site, electrically powered equipment shall be preferred over diesel-powered versions of that equipment.

C. Submittals:

The Contractor shall submit to the Engineer for review and approval an inventory list for all non-road diesel equipment and engines, and verified Emissions Control Devices. No Work shall commence utilizing diesel-powered non-road equipment rated at 50 hp or greater until the Contractor submits a comprehensive and complete inventory list inclusive of all such equipment, including the specifics of each as detailed below, and same is approved by the Engineer.

1) The inventory list shall be provided in an electronic format (e.g., Microsoft Word, Access or Excel), and shall include the following:

a. Change Order number and title.

b. Owner of equipment's name, address, telephone number and contact person familiar with the operation and maintenance of the equipment and the emission control technologies; whether owner is the Contractor, subcontractor or rental firm.

c. Dates that equipment is anticipated to arrive at and depart from the site.

d. Number, type, make, year of manufacture, manufacturer and serial number.

e. Engine type, tier level, make, horsepower rating, year of manufacture, and serial number.

f. Approximate fuel consumption rate per shift.

g. Anticipated function, duration of use, and days and hours of operation.

h. Retrofit type, make, model, manufacturer, installation date, EPA, VERT or CARB verification number or supporting documentation related to emission control devices.

i. Previous acceptance or waivers granted by the Authority, or the City of New York, or the Metropolitan Transportation Authority, or another public agency that issued a waiver under the same or substantially the same standards.

2) On-Going Equipment Updates:

Whenever a new or additional piece of diesel-powered non-road equipment is required to complete the Work of this Change Order, the Contractor shall submit to the Engineer an update of the equipment inventory list. These updates shall include the actual dates the equipment arrives and departs from the site.

D. Waivers:

The Contractor shall submit a written request for a waiver to the Engineer for review and approval prior to bringing equipment that does not conform to the above requirements onto the construction site. The Contractor shall demonstrate due diligence by providing written documentation of efforts to comply with this Section. For waivers based upon the unavailability of retrofit devices for certain equipment, the Contractor will generally be required to provide written documentation from more than one vendor or supplier of retrofit devices to satisfy this requirement. Waiver requests related to the use of DPFs shall take into consideration actively regenerating filters for equipment with low temperature profiles that typically preclude the application of passively regenerating filtration systems.

Equipment retrofitted with an approved device in connection with another construction contract of the Authority, or the City of New York, or the Metropolitan Transportation Authority is exempt from further retrofitting for three (3) years from the date the retrofit was approved, even if new BAT retrofit devices are available. The Contractor shall submit to the Engineer documentation of approval of a retrofit device by the Authority, or the City of New York, or the Metropolitan Transportation Authority, or another public agency that issued a waiver under the same or substantially the same standards for the equipment in question. In addition, if the Authority, or the City of New York, or the Metropolitan Transportation Authority, another public agency that issued a waiver under the same or substantially the same standards previously waived a requirement contained in this Section for a particular piece of equipment, that equipment shall be exempt from the requirement for three (3) years from the date the initial waiver was granted.

1) In responding to waiver requests, the following conditions will be taken into consideration with applicable documentation:
   a. A BAT retrofit device would pose a safety hazard or impair operator visibility; or
   b. A BAT retrofit device would void the engine warranty; or
   c. A BAT retrofit device cannot be used for mechanical reasons; or
   d. A BAT retrofit device or the engine would not function properly if the BAT retrofit device were installed; or
   e. A Tier 0 engine is not readily upgraded to Tier 1, and where the task cannot be reasonably accomplished using alternative engines that do comply with this Section; or
   f. The furnishing and installation of a BAT retrofit is more than 30 percent of the fair market value of the construction equipment; or
   g. The Authority, or the City of New York, or the Metropolitan Transportation Authority, or another public agency that issued a waiver under the same or substantially the same standards previously approved a BAT retrofit device for the equipment in question. Such approval is valid for three years from the date it was issued; or
   h. The Authority, or the City of New York, or the Metropolitan Transportation Authority, or another public agency that issued a waiver under the same or substantially the same standards previously granted a waiver for the equipment in question. Such waiver is valid for three years from the date it was issued.

   In addition, the Engineer may, in his or her discretion, grant a waiver based upon excessive costs to satisfy the requirements of this Section, undue burden on the Contractor, marginal benefits, or other relevant factors, provided adequate supporting documentation is submitted by the Contractor.

2) Waiver requests shall include the following:
   a. Name of contractor applying for the waiver.
   b. Change Order number and title.
   c. Owner of equipment's name, address, telephone number and contact person familiar with the operation and maintenance of the equipment and the emission control technologies, whether owner is the Contractor, subcontractor or rental firm.
   d. Number, type, make, year of manufacture, manufacturer and serial number.
   e. Engine type, make, horsepower rating, year of manufacture, and serial number.
   f. Approximate fuel consumption rate per shift.
   g. Anticipated function, duration of use, and days and hours of operation.
   h. Technical explanation of safety hazard, mechanical constraint, warranty, limited availability, or functionality issues cited as basis for waiver.
   i. Written documentation from retrofit device manufacturers, engine manufacturers, or rental companies, as appropriate, supporting the stated reasons for the waiver; for waivers based upon the unavailability of a retrofit device for specified equipment, the Contractor shall provide documents from more than one supplier.
   j. If applicable, documentation of previous BAT retrofit approvals granted by the Authority, or the City of New York, or the Metropolitan Transportation Authority, or another public agency that issued a waiver under the same or substantially the same standards for the equipment in question.
   k. If applicable, documentation of previous waivers granted by the Authority, or the City of New York, or the Metropolitan Transportation Authority, or another public agency that issued a waiver under the same or substantially the same standards for the equipment in question.

3.) Review of Waiver Application

The Engineer will make a determination whether to approve the Waiver Request no later than 10 days after its receipt.

20 DAILY PROGRESS, EQUIPMENT AND LABOR REPORTS

The Contractor shall furnish to the Engineer at the end of each day Work is performed at the construction site, a memorandum showing for that day (a) the construction performed, (b) the type of equipment used identifying each piece of equipment as owned by the Contractor or rented from others; (c) a statement of any unusual happening that occurred, and (d) the names and number of workers in each trade classification that were employed. Such memorandum shall not be deemed a substitute for the notices, time slips, memoranda or other data required under the clauses of the Contract relating to compensation for Extra Work.

21 LAWS AND ORDINANCES

In order to effectuate the policy of the Authority, the Contractor shall comply with all provisions of federal, state, municipal, local and departmental laws, ordinances, rules, regulations and orders which would affect the Change Order and the performance thereof and those engaged therein if said Change Order were being performed for a private corporation, except where stricter requirements are contained in the Specifications or Detail Design or Shop Drawings, in which event the latter requirements shall apply.

However, the Contractor shall not apply for any permits, licenses or variances in the name of or on behalf of the Authority, but shall do so in his own name where required by law, regulation or order or by the immediately preceding sentence. Nor shall the Contractor apply for any variance in his own name without first obtaining the approval of the Authority.

The Contractor shall verify that employees performing Work under this Change Order in the United States are legally present in the United States and authorized to work by means of the federally required I-9 program.

22 SIGNS

No advertisement or sign, other than the name and address of the Contractor, will be permitted on any fences, temporary structures or elsewhere on the construction site and such advertisement will be permitted only upon the condition that it is first approved by the Engineer. In any event, the advertisement shall not exceed six feet by eight feet in overall dimensions.

23 CONTRACTOR'S FIELD OFFICE AND REPRESENTATIVE

At a readily accessible point on or near the construction site, the Contractor shall maintain a field office provided with a telephone.

During the performance of any Work at the construction site, the Contractor shall have a representative thereat who shall be authorized by the Contractor to receive and put into effect promptly all orders, directions and instructions from the Engineer. The Contractor's representative shall be provided, at all times, with a conformed copy of this Change Order and a set of the Detail Design and Shop Drawings.

Orders and directions may be given orally by the Engineer and shall be received and promptly obeyed by the Contractor or his representative or any superintendent, foreman or other employee of the Contractor who may have charge of the particular part of the Work in relation to which the orders or directions are given. A confirmation in writing of such orders or directions will be given by the Engineer when so requested by the Contractor.

24 SURVEYS

The Engineer will establish a bench mark and a base line at or adjacent to the location of the Contractor's operations. The Contractor shall perform all surveys which may be required for the performance of the Change Order. He shall carefully preserve any base line and bench mark which may be established by the Engineer.

The Contractor shall, in addition, furnish to the Engineer, without additional compensation therefor, any or all information and data regarding points, lines, grades, elevations and other survey information established by the Contractor during the performance of the Change Order.

Surveys and measurements of quantities for purposes of computing Contractor's compensation shall be made by the Contractor as directed by and in the presence of, or jointly with, the Engineer, at the

Engineer's option. Computations of quantities for payment shall be made by the Contractor and shall be subject to the approval of the Engineer.

25 TEMPORARY STRUCTURES

Unless otherwise provided in this Change Order, the Contractor shall determine the need for and shall design, furnish and construct all barricades, fences, staging, falsework, formwork, shoring, scaffolding and other temporary structures required in the performance of the Change Order, whether or not of the type enumerated in the Specifications or on the Detail Design or Shop Drawings, including those which would be required by law or regulation if this Change Order were being performed for a private corporation. All such temporary structures shall be of adequate strength for the purposes for which they are constructed and shall be provided with graphics, warning signs and warning lights as required to inform personnel and the public of the hazards being protected against, and the Contractor shall maintain them in satisfactory condition. The design and drawings for such structures shall be prepared by the Contractor utilizing a professional engineer licensed in the state where the structure will be constructed, and when requested by the Engineer they shall be submitted for his review before being used.

The Contractor shall ensure that each temporary structure is inspected by the professional engineer who designed the temporary structure prior to initial use and submit a schedule of periodic inspections to be performed by such professional engineer to the Engineer for review. The number of periodic inspections of temporary structures to be performed by the professional engineer shall be the minimum required by law or regulation if this Change Order were being performed for a private corporation. The Contractor shall also submit a signed and sealed statement of inspection from the professional engineer performing the inspection of the temporary structure, including a statement of fitness for use for the intended purpose of the temporary structure, to the Engineer for review.

Neither such approval, however, nor any requirements of the Engineer, the Specifications or the Drawings shall relieve the Contractor of his responsibility for the design, construction and use of the temporary structures or from any obligations and risks imposed on him under this Change Order, and any such approval or requirements shall be deemed merely to relate to minimum standards and not to indicate that the temporary structures are adequate or that they meet the Contractor's obligations under this Change Order.

Temporary structures shall be painted with approved dark color paint and shall be repainted whenever necessary during the period that the Change Order is being performed. Upon completion of all Work under this Change Order, the temporary structures shall be removed from the construction site.

26 PERMIT AND REQUIREMENTS FOR WELDING

Prior to the commencement of any cutting or welding operations at the construction site, the Contractor shall notify the Engineer and obtain an Authority cutting and welding permit. The Authority will issue this permit without payment of a fee, and application forms may be obtained from any Resident Engineer of the Authority, at his office at the facility. Unless otherwise approved by the Engineer, all cutting and welding operations shall be performed in accordance with the conditions which form a part of said permit.

The permit application must be filled out and submitted in duplicate to the Engineer at least forty-eight hours prior to commencing welding or cutting operations at the construction site.

27 FINAL INSPECTION

When, in the opinion of the Contractor, the construction is completed and ready for final inspection, he shall so notify the Engineer in writing and the Engineer will give said construction (including any portions with respect to which Certificates of Partial Completion have been issued) a minute and thorough inspection. Before any Certificate of Final Completion will be issued, any defects or omissions noted on this inspection must be corrected by the Contractor.

28 WARRANTIES

The Specifications may provide for certain warranties of portions of the permanent construction. These warranties are intended for the greater assurance of the Authority and not as a substitute for rights which the Authority might otherwise have. Although such warranties shall be enforceable as provided, neither any requirement of this Change Order with respect to warranties by the Contractor nor any guarantee or warranty given to the Contractor or the Authority by any manufacturer shall be deemed to be a limitation upon any rights which the Authority would have, either expressed or implied, in the absence of such guarantees or warranties.

29 REQUIREMENTS FOR CRANES AND DERRICKS - NEW YORK

With respect to the performance of Work in the State of New York:

During the performance of Work at the construction site, the use by the Contractor or his subcontractors of power operated cranes and derricks for hoisting and/or rigging purposes; or for construction, alteration, demolition, excavation and maintenance purposes, including highways or sewers; or for the installation of piles; or for the hoisting or lowering of any article on the outside of any building or structure shall be subject to the approval of the Engineer in accordance with this Section.

A. Determinations will be made in writing by the Engineer on whether cranes and other such equipment meeting certain criteria shall be exempt from all or part of the requirements herein. Such determinations shall in no way relieve the Contractor from conformance with all applicable requirements of this Section and governing codes including the possession of a valid operator's license subject to verification by the Engineer.

    1) The following equipment will be considered for full exemption, which means exempt from B., C., D., E., F., G., H. and I. below:

        a. Excavating or earth-moving equipment, except cranes used with clamshells.

        b. Augurs, churn-drills, and other drilling equipment not used for the hoisting of any objects.

        c. Mobile cranes, including jibs and any other extensions to the boom, exceeding 50 feet but not exceeding 135 feet in length, and with a manufacturer's rated capacity of 3 tons or less used exclusively as a man-basket.

d. Hoisting machines permanently mounted on the bed of material delivery trucks that are used exclusively for the loading and unloading of such trucks, provided that the length of boom does not exceed the length of the truck bed by more than 5 feet, and any material transported thereon shall not be raised more than 2 feet in the unloading process.

e. Cranes and derricks with a manufacturer's rated capacity of less than 1 ton.

f. Mechanics trucks with a hoisting device used in activities associated with the maintenance and repair of construction related equipment.

g. Articulating boom cranes that do not have an integral hoisting mechanism and that are used exclusively for the loading and unloading of trucks or trailers, provided that the length of boom does not exceed 135 feet, and that any material transported thereon shall not be raised more than 100 feet in the unloading process.

2) The following equipment will be considered for Partial Exemption – I, which means exempt from B.4.), C.2.), C.4.) and D. below:

a. Cranes with less than 160 feet combined boom/jib length to be used for a period not exceeding 24 hours, operated entirely within Authority property and at a location at least one boom/jib length away from all Authority property.

b. Service cranes and clamshells with a boom length of 110 feet or less, to be operated entirely within Authority property and at a location that does not require the moving of any load over a roadway or sidewalk.

c. Pile drivers or clamshells operated entirely within Authority property with a soil bearing pressure not exceeding 500 pounds per square foot.

d. Mobile cranes, including jibs and any other extensions to the boom, not exceeding 50 feet in length and with a manufacturer's rated capacity of 3 tons or less.

3) The following equipment will be considered for Partial Exemption – II, which means exempt from B., C. 2.), C. 3.), C. 4.), D., F., G. and I. below:

a. Articulating/knuckle boom cranes used to hold, support or stabilize material to facilitate construction activity.

b. Cranes with a manufacturer's rated capacity of 1 ton or more.

B. For each crane or derrick not considered fully exempt by the Engineer, submit the following forms to the Engineer prior to delivery of the crane or derrick to the construction site: (See F. below for all forms)

1) A copy of a current and valid Form CD-2, entitled "Crane/Derrick/Mobile Work Platform – Approval and Operation Application/Certificate", Revised 08/15/05, as issued by the New York City Department of Buildings - Cranes & Derricks Division, hereinafter called "NYCDOB-C&D". Form CD-2 shall bear the approval stamp of NYCDOB-C&D as a "Temporary Certificate of Approval/Temporary Certificate of Operation," and shall include an expiration date, a legible CD Number, and an authorized signature from a representative of NYCDOB-C&D. In the event that such approved Form CD-2 is not available, the Contractor shall ensure that the owner of the crane or derrick files a Form CD-2 directly with NYCDOB-C&D. Submit to the Engineer proof of the filing, a copy of the completed Form CD-2, and an "acceptable to operate" inspection report issued by NYCDOB-C&D.

2) A fully executed Form CD-11, entitled "Equipment Owner Identification Form", Revised 12/03, as issued by NYCDOB-C&D.

3) A fully executed Form CD-16, Statement of Notification to Community Boards.

4) A fully executed Form CD-4, entitled "Crane/Derrick/Mobile Work Platform – On- Site Inspection Application/Certificate", Revised 12/03, as issued by NYCDOB-C&D. Form CD-4 shall be accompanied by drawings and calculations, all signed and sealed by a Professional Engineer licensed in the state of New York. The drawings and calculations shall clearly indicate the following:

   a. Location of each crane or derrick.

   b. All pertinent features of the site.

   c. Supporting platforms and structures.

   d. Swing and reach of each crane or derrick.

5) If the crane or derrick location is within two hundred feet (200') of an NYC subway line or facility, approval from New York City Transit ("NYCTA") is required prior to the placement, assembly, or erection of the crane or derrick. In such cases, a Certificate of On-Site Inspection cannot be issued without NYCTA written approval.

   Upon the review and acceptance in writing by the Engineer of all of the above submissions, the crane or derrick will be permitted to enter the construction site. Coordinate all such deliveries with the Engineer.

C. Upon delivery to the construction site for cranes or derricks considered for Full Exemption or Partial Exemption – I or Partial Exemption – II by the Engineer, submit the following to the Engineer in accordance with A. above. For all other cranes or derricks, submit all of the following to the Engineer:

1) Names, classifications, and license numbers of each crane or derrick operator and the master, tower, or climber crane rigger.

2) For cranes or derricks to be operated solely on Authority property, file Form CD-8, entitled "Technical Report – Statement of Responsibility", Revised 12/03, as issued by the NYCDOB-C&D. Form CD-8 shall be completed in its entirety with the exception of Box #5B, and signed and sealed by a Professional Engineer licensed in the state of New York in Box #5A.

Upon review and acceptance by the Engineer of all submitted drawings and associated documentation specified above, the Contractor will be permitted to place and/or assemble the crane or derrick at the construction site, with the exception of tower or climber cranes. For tower or climber cranes, additional submittals and inspections shall be required as specified in 4.) below.

3) For cranes or derricks to be operated on other than Authority property, file all forms, drawings and associated documentation directly with NYCDOB-C&D. Upon the submission to the Engineer of a current and valid "Certificate of On-Site Inspection" as issued by NYCDOB-C&D, will the Contractor be permitted to assemble or erect the crane or derrick at the construction site.

4) For tower or climber cranes, in addition to the documentation in B. and C. above, submit the following to the Engineer:

   a. A fully executed Form CD-7, entitled "Notification of Erecting or Dismantling of Climber or Tower Crane", Revised 07/07. Form CD-7 shall be accompanied by a copy of the license of each master or tower rigger designated to supervise the erection of the crane and all associated documentation required to ensure compliance with the manufacturer's recommendations. Form CD-7 shall also be accompanied by signed and sealed drawings by a Professional Engineer licensed in the state of New York for the erection, jumping, climbing and dismantling of the tower or climber crane. Documentation and drawings shall include the following:

      i. Serial number identification of equipment to be used for all rigging and lifting operations including all machines to be used for erection or dismantling.

      ii. Detailed listing of assemblies and components required for erection and dismantling of rigging and lifting equipment, including but not limited to lifting frame, climbing hydraulic cylinders, upper basket, lower basket, outriggers, communication system, tie-downs, dogs, horn, lights and weathervane.

      iii. Location of rigging and lifting equipment, assist cranes, sidewalk sheds, surrounding buildings, protection for their roofs and pick-up points, loads, and radius of swing of all loads. In addition, submit to the Engineer the safe load from the crane manufacturer's approved load radius chart for lift radius.

      iv. Weight list certified by the crane manufacturer listing all assemblies and components to be lifted. All components shall be clearly marked with their weight painted on the assembly, or stamped on metal tags attached to the assembly. In lieu of an equipment manufacturer's certification, submit documentation signed and sealed by a Professional Engineer licensed in the state of New York certifying the weight list and indicating how such weights were determined.

      v. Locations of the centers of gravity for all asymmetrical components.

      vi. Sequence of operation detailing erection, jumping, climbing and dismantling, along with the rigging materials to be used in such operations.

vii. Written certification by a Professional Engineer licensed in the state of New York that all safety devices on each crane to be used in the erection, jumping, climbing and dismantling operations have been calibrated in accordance with the crane manufacturer's recommendations.

viii. Names, license numbers (as applicable) and contact information for each licensed rigger, rigger foreman, site safety manager, crane safety coordinator and entity performing the erection, jumping, climbing, and/or dismantling Work.

ix. Load test procedure signed and sealed by a Professional Engineer licensed in the state of New York identifying the weights to be used and the load moment and line pull testing to be conducted in accordance with b. below.

b. A load test shall be conducted on each tower or climbing crane by a Professional Engineer licensed in the state of New York in accordance with the load test procedure submitted under (ix) above. Upon completion of the load test and determination that the results are satisfactory, submit to the Engineer the signed and sealed report certifying acceptance of the results by the Professional Engineer licensed in the state of New York.

c. A fully executed Form CD-12, entitled "Designation of Safety Coordinator" Revised 12/03, as issued by NYCDOB-C&D.

d. A signed and sealed report documenting the results of the field inspection of the crane in the "unassembled state (for cranes delivered in the unassembled state)" performed by a Professional Engineer licensed in the state of New York and certifying that all crane parts are in satisfactory condition, and acceptable for assembly and erection.

e. A copy of the Safety Coordination Meeting Log as stipulated in Section BC 3319 entitled "Cranes and Derricks" of the Building Code for the City of New York (BCCNY) (3319.8.2 through 3319.8.8, and 3319.10.2). Conduct the safety coordination meeting within the week prior to the erection, jumping, climbing, or dismantling of a tower or climber crane in accordance with BCCNY and notify the Engineer one week prior to the meeting.

Upon review and acceptance by the Engineer of all documentation in B. and C. above, the Contractor will be permitted to erect the tower or climber crane at the construction site.

D. Prior to the use and/or operation of each crane or derrick, including tower or climber cranes, at the construction site when the crane or derrick will be operated solely on Authority property, complete the following:

1) Performance of a field inspection of the crane or derrick in the "assembled state" by a Professional Engineer licensed in the state of New York in accordance with BCCNY Reference Standard RS 19-2 including the verification, inspection, and certification of the following:

a. That the crane or derrick has a current and valid Form CD-2 as issued by NYCDOB-C&D for the configuration to be used at the construction site.

b. That the support, dunnage, configuration and location of the crane or derrick have been constructed and positioned in accordance with the drawings and calculations submitted to the Engineer with Form CD-4.

c. That the crane or derrick is in working order and there is no visible damage including, but not limited to, the following items:

i. Bent or missing lacings

ii. Pins are properly installed and have no visible fatigue

iii. Maladjustment of control mechanisms interfering with proper operation

iv. Excessive wear of control mechanisms components and contamination by lubricants or other foreign matter

v. Malfunction of operational aids

vi. Hydraulic hoses

vii. Deformation, chemical damage, cracks and wear of hooks and latches

viii. Rope reeving for compliance with crane manufacturer's specifications

ix. Malfunction and excessive deterioration of electrical apparatus and accumulation of dirt and moisture

x. Hydraulic system for proper oil level

xi. Tires for recommended inflation pressure

Upon the completion of the field inspection and the determination that the crane or derrick is sound and has been assembled and positioned in accordance with the drawings and calculations submitted to the Engineer with Forms CD-4 and CD-7, submit to the Engineer both a signed and sealed inspection report certifying conformance by the Professional Engineer licensed in the state of New York and a fully executed Form CD-8, signed and sealed in Box #5B.

2) For tower or climber cranes, in addition to the above, procure the services of a New York State Licensed Surveyor to perform a plumbness survey, a licensed testing laboratory to perform anchor bolt pull-out testing, and a licensed rigger to certify compliance with the manufacturers bolt torque values connecting sections. Submit to the Engineer a fully executed Form CD-6, entitled "Crane / Derrick and Work Platform – Plumbness And Torque Notification/Anchor Bolt Pull Out Test" Revised 12/03, as issued by NYCDOB-C&D.

Upon the review and acceptance by the Engineer of a signed and sealed inspection report and Final Form CD-8 (and Form CD-6 for tower and climber cranes), the Contractor will be permitted to use and operate the crane or derrick. Form CD-4 and Final Form CD-8 (and Form CD-6 for tower and climber cranes), as accepted by the Engineer will constitute the "Certificate of On-Site Inspection."

E. Requirements for inspection and operation of cranes at the construction site:

1) Monthly inspections and reports shall be performed, prepared and signed by a competent person as defined in Federal Register Part II, Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1926 Cranes and Derricks in Construction; Final Rule (OSHA), and a copy of each inspection report shall be store in the crane cab for three months.

2) Pre-lift meetings shall be held as outlined in Federal Register Part II, Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1926 Cranes and Derricks in Construction; Final Rule (OSHA). Submit pre-lift meeting minutes to the Engineer.

3) No crane or derrick operator shall start an operation when the wind speed exceeds 30 miles per hour or the wind speed is forecast to reach 30 miles per hour before the operation can be completed. Tower cranes shall not be raised to new operating levels when the wind speed exceeds 20 miles per hour.

4) Operating and jumping procedures shall comply with the requirements of Chapter 33/Section BC 3319 and Reference Standard RS 19-2 of the BCCNY.

F. The forms issued by the NYCDOB-C&D listed below can be found on the following website:

www.nyc.gov/html/dob/downloads/pdf/cd

CD-2 - Crane/Derrick/Mobile Work Platform – Approval and Operation Application/ Certificate, Revised 08/15/05

CD-4- Crane/Derrick/Mobile Work Platform – On-Site Inspection Application/ Certificate, Revised 12/03

CD-6- Crane/Derrick and Work Platform – Plumbness And Torque Notification/Anchor Bolt Pull Out Test, Revised 12/03

CD-7- Notification of Erecting or Dismantling of Climber or Tower Crane, Revised 07/07

CD-8- Technical Report – Statement of Responsibility, Revised 12/03

CD-11- Equipment Owner Identification Form, Revised 12/03

CD-12- Designation of Safety Coordinator, Revised 12/03

CD-16- Statement of Notification to Community Boards

CD-22- Inspection Request for Assembled/Unassembled Crane, Derricks, and Mobile Work Platforms revised 10/05

G. If Form CD-2 issued by the NYCDOB-C&D expires while the crane or derrick is in use at the construction site on Authority property, the Contractor shall ensure that the owner of the crane or derrick files all renewals and/or extensions directly with NYCDOB-C&D. Submit proof of the filing along with a copy of the completed Form CD-2 to the Engineer. Upon receipt of any such renewals or extensions issued by NYCDOB-C&D, submit copies to the Engineer.

H. The estimated review time for all crane and derrick submissions to the Engineer is five (5) business days. If the Contractor has not received any reply by the fourth day of the review, contact the Engineer.

I. The NYCDOB-C&D issues a letter of deficiency to the Authority or stop work order to the Contractor while the crane or derrick is on Authority property, the Contractor shall cooperate fully

with the NYCDOB-C&D to ensure that all acceptable corrective actions will be taken immediately. Keep the Engineer advised during the performance of all remedial Work.

30 REQUIREMENTS FOR CRANES AND DERRICKS - NEW JERSEY

With respect to the performance of Work in the State of New Jersey:

During the performance of Work at the construction site, the use by the Contractor or his subcontractors of power-operated equipment that can hoist, lower and horizontally move a suspended load as specified in Federal Register Part II, Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1926 Cranes and Derricks in Construction; Final Rule (OSHA), shall be subject to the approval of the Engineer in accordance with this Section.

A. General Requirements:

1) Cranes shall be operated by certified and licensed crane operators. A certified and licensed crane operator shall receive and maintain the following:
   a. Certificate from the National Commission for the Certification of Crane Operators (NCCCO), or other crane operator certification program found by the New Jersey Department of Labor Crane Operators License Advisory Board to offer an equivalent testing and certification program.
   b. Crane license issued by the Office of Safety Compliance, certified in one of the following:
      i. "Lattice boom truck crane" or "LBT" shall mean a crane consisting of a superstructure mounted on an automotive truck as a base and a means of travel.
      ii. "Lattice boom crawler crane" or "LBC" shall mean a crane consisting of a superstructure mounted on a base with crawler treads as a means of travel.
      iii. "Small telescoping boom crane" or "TSS" shall mean a crane with extendable and retractable boom mounted on an automotive truck as a base and a means of travel and with a manufacturer's load rating of less than 17.5 tons.
      iv. "Large telescoping boom crane" or "TLL" shall mean a crane with extendable and retractable boom mounted on an automotive truck as a base and a means of travel and with a manufacturer's load rating of 17.5 tons or more.
   c. Medical certificate that meets the requirements of the American Society of Mechanical Engineers Safety Standard B30.5-2007.
2) Determinations will be made in writing by the Engineer on whether cranes and other such equipment meeting OSHA 1926.1400 Scope section (c) entitled “Exclusions” shall be exempt from the requirements herein. Such determinations shall in no way relieve the Contractor from conformance with all applicable requirements of this Section and governing codes.

B. For each crane, submit the following to the Engineer prior to delivery of the crane to the construction site:

1) Equipment Owner Identification and Equipment User Identification.

2) Drawings clearly indicating location of each crane or derrick, all pertinent features of the site, and supporting platforms and structures.

3) Name of competent person as outlined in Federal Register Part II, Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1926 Cranes and Derricks in Construction: Final Rule (OSHA).

4) Monthly and annual crane inspection reports. Attached to such records of inspection shall be a written designation naming the competent person identified in B. 3.) above, signed by the owner or lessee of the crane.

5) High wind (50 MPH and over) emergency plan.

6) Name of qualified person as defined in Federal Register Part II, Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1926 Cranes and Derricks in Construction; Final Rule (OSHA). Any OSHA requirement requesting certification by a Professional Engineer shall be fulfilled by a Professional Engineer licensed to practice in the State of New Jersey.

Upon the review and acceptance in writing by the Engineer of all of the above submissions, the Contractor will be permitted to deliver, place and/or assemble the crane at the construction site. Coordinate all such deliveries, placements and/or assemblies with the Engineer.

C. Requirements for cranes upon delivery to the construction site:

1) Submit a valid certificate of competence to operate a crane and classifications for the operator to the Engineer.

2) Submit rigger's qualifications to the Engineer.

D. Requirements for inspection and operation of cranes at the construction site:

1) Crane ropes shall be inspected on a daily and monthly basis and copies of the monthly inspection reports shall be stored in the crane cab.

2) Should the monthly or yearly inspection expire while the crane or derrick is located at the construction site, the Contractor shall ensure that the owner of the crane or derrick performs the monthly and /or annual inspection. Submit proof of the inspection to the Engineer.

3) Pre-lift meetings shall be held in accordance with Federal Register Part II, Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1926 Cranes and Derricks in Construction; Final Rule (OSHA). Submit pre-lift meeting minutes to the Engineer.

E. The estimated review time for all crane and derrick submissions to the Engineer is five (5) business days. If the Contractor has not received any reply by the fourth day of the review, contact the Engineer.
F. If any governing agency issues a letter of deficiency to the Authority or stop work order to the Contractor while the crane or derrick is located at the construction site, the Contractor shall cooperate fully with the governing agency to ensure that all acceptable corrective actions will be taken immediately. Keep the Engineer advised during the performance of all remedial Work.
G. Cranes or derricks performing an emergency use pursuant to an order or direction issued by the Engineer shall be exempt from the submission requirements herein except for the requirements specified in B. 4.) and C. 1.) above.

31 TEMPORARY UTILITY SERVICES

Operate and maintain temporary services and facilities in a safe and efficient manner. Modify as required throughout progress of the Change Order, and remove from Authority property when no longer required, or replaced by the use of completed permanent facilities as approved by the Engineer.

Make arrangements to secure, and pay all costs for heat, light, power, water, and other services which may be required for the performance of the Change Order.

32 TEMPORARY SANITARY FACILITIES

Make arrangements for securing and pay all costs for temporary toilets, wash facilities and drinking water including toilet tissue, paper towels, paper cups and similar disposable materials for use by the Contractor, subcontractors, materialmen or other persons over whom the Contractor has control. Comply with regulations and health codes, which would be applicable if the Authority were a private corporation, for the type, number, location, operation and maintenance of fixtures and facilities. Install facilities where directed by the Engineer, and remove from Authority property when no longer required.

33 PROGRESS SCHEDULE

A. Schedule Requirements

1) The Contractor shall, at his own expense, prepare, maintain and update detailed electronic progress schedules for the Engineer’s review and approval. All submittals required herein shall be in the form and content stipulated in this Section. Each progress schedule shall bear the signature of the Contractor's authorized representative. The progress schedules/graphics required by this Change Order shall be produced using the latest version of Oracle – Primavera P6 scheduling software.

2) The schedule shall be prepared by a scheduler who is an employee of the Contractor with 3 (three) years minimum experience in the development and updating of Critical Path Method schedule networks for projects of a complexity comparable to this Change Order, or by an outside entity with similar experience specializing in project controls. The Contractor's senior management personnel shall actively participate in the development and updating of the schedule.

3) Progress schedules shall be sufficiently detailed to accurately depict all the Work and milestones (including acquisition of any required permits, design progress, procurement of subcontractors, key submittals and approvals, materials procurement and construction activities performed by the Contractor and his subcontractors) and shall graphically represent the logical sequence and duration of activities, all in accordance with the requirements of the Change Order. The information provided in progress schedules shall also include, but not be limited to, the interdependencies between the Contractors' Activities and all other Activities required for the successful completion of the Change Order, e.g., those to be performed by utility companies or by other entities. All Milestone dates specified in the Change Order shall be represented in the schedule by Milestone activities that are logically interrelated to the Work that must be accomplished in order to achieve the Milestone.

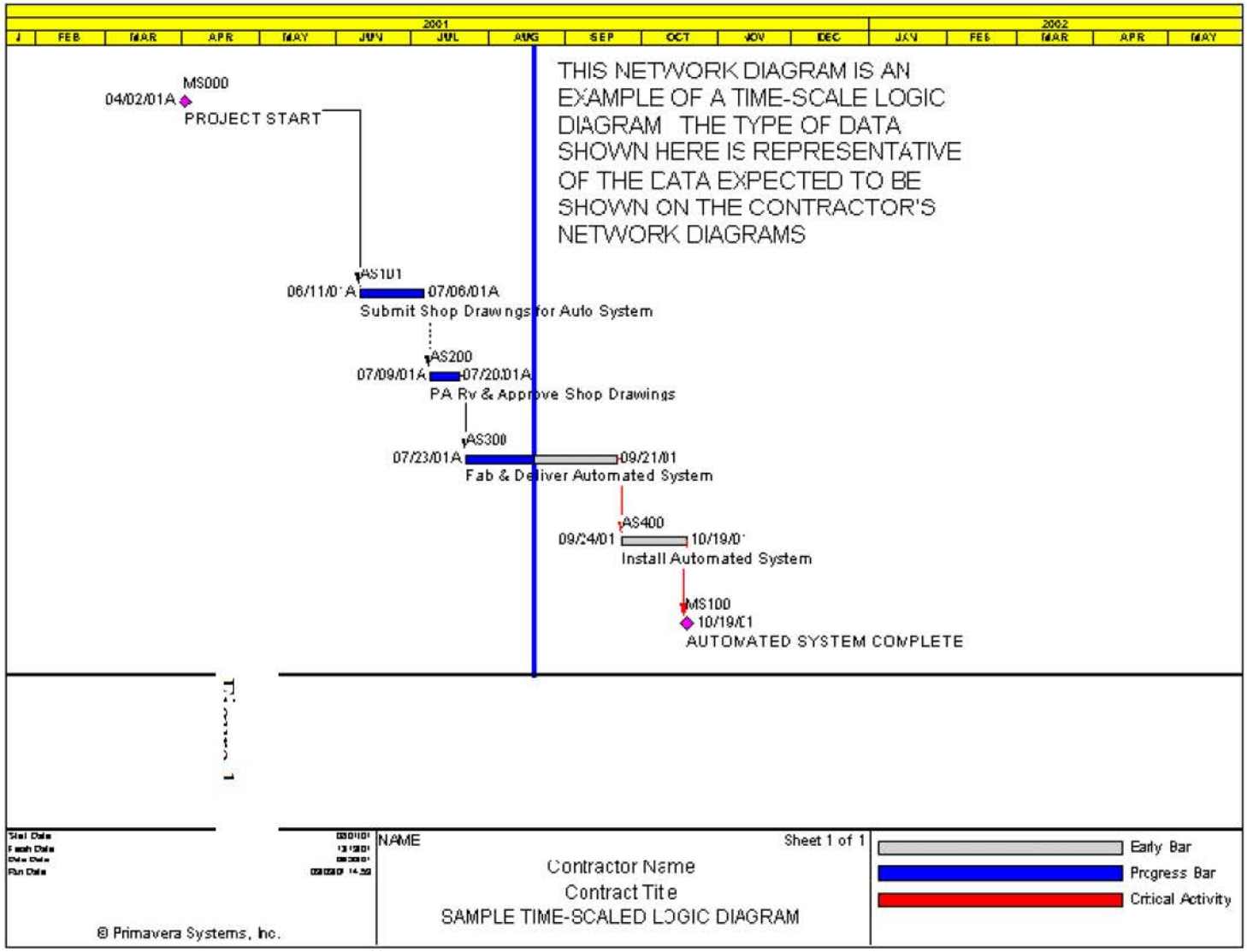
4) All activities, except the Change Order Start Milestone and Change Order Completion Milestone shall be linked to predecessor(s) and successor(s).

5) The Contractor’s schedule shall incorporate the Activity Code Structure shown in Attachment A, and such other coding as may be required by the Engineer.

6) The Contractor shall load construction activities with budget information and shall identify the cost to perform Work for each construction and management activity. The sum of the costs assigned to all activities shall be equal to the Change Order value. No activity costs shall be assigned to the preparation and review of submittals and materials fabrication or procurement.

7) To assist the Contractor in preparing its progress schedule, a sample Network Diagram is shown in Figure 1. The sample is intended merely as an example of a format for the Contractor's guidance. The types of data shown are the types of data expected to be shown on the Contractor's Network Diagram. However, the information presented in the sample Network Diagram shall not be misinterpreted as either representing a plan for the Contractor's Network Diagram or a depiction of the level of detail which will be required in such diagram.

8) The submittal of Progress Schedules under this Section shall not be deemed to be a substitute for the reporting requirements of the Section of Division 1 entitled "Daily Progress, Equipment and Labor Reports".


2001
2002
J FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY
THIS NETWORK DIAGRAM IS AN EXAMPLE OF A TIME-SCALE LOGIC DIAGRAM THE TYPE OF DATA SHOWN HERE IS REPRESENTATIVE OF THE DATA EXPECTED TO BE SHOWN ON THE CONTRACTOR'S NETWORK DIAGRAMS
MS000
04/02/01A
PROJECT START
AS101
06/11/01A
07/06/01A
Submit Shop Drawings for Auto System
AS200
07/09/01A
07/20/01A
PA Rv & Approve Shop Drawings
AS300
07/23/01A
09/21/01
Fab & Deliver Automated System
AS400
09/24/01
10/19/01
Install Automated System
MS100
10/19/01
AUTOMATED SYSTEM COMPLETE
NAME
Sheet 1 of 1
Contractor Name
Contract Tite
SAMPLE TIME-SCALED LOGIC DIAGRAM
Early Bar
Progress Bar
Critical Activity
© Primavera Systems, Inc.

B. Schedule Terminology

Schedule terminology used in this Change Order shall have the meaning described below:

1) Activity: A discrete item of Work with a Duration that can be clearly defined; a synonym for task. Unless otherwise permitted in writing by the Engineer, an activity's duration shall be not more than 14 calendar days or 10 working days except for non-construction activities, such as procurement cycles, material delivery, soil consolidation, etc. Each activity (task) description shall clearly identify the Work to be performed. No two or more activities in the schedule shall have exactly the same description.

2) Activity Codes: Activity Codes allow each activity to be grouped into specific classifications such as area, responsibility, phase, system, or location. The codes consist of specific values and descriptive titles that are entered into the data dictionary of the scheduling software. Activities shall be assigned specific Activity Codes as appropriate.

3) Alternative Solutions: Analyses of various options for dealing with encountered or anticipated problems. Alternative solutions shall be developed to assist in determining the best method(s) of preventing or correcting any impediments to the progress of the Work. Alternative Solutions analysis shall indicate impacts on scheduling and resources.

4) Analysis Report: A report that displays the impacts of all variances reported in the Current Progress Schedule. The Analysis Report focuses attention on the impacts of variances between planned and actual performance, so as to support an assessment of such impacts. The Analysis Report shall include Alternative Solutions.

5) Bar Chart: A schedule display designed to complement the Network Diagram. The Bar Chart is a traditional Gantt chart to which the Early Start Dates, Early Finish Dates, Late Start Dates, Late Finish Dates and Critical Path have been added.

6) Calendar: A calendar defines when Work on an activity can occur (i.e. Mon – Fri for a standard Work week). Activities shall be assigned to a calendar that represents the planned Work days. The calendar shall incorporate the Authority holidays listed below. The use of multiple calendars will be permitted.

New Year's Day	Columbus Day
Martin Luther King, Jr. Day	Veterans Day
Presidents' Day	Thanksgiving Day
Memorial Day	Day After Thanksgiving
Independence Day	Christmas Day
Labor Day	

7) Constraint: A constraint is a restriction imposed on the start or finish of an activity or the Change Order. An example of the use of constraints is the imposition of a "finish no later than" constraint[2] on the Completion Milestone that is equal to the Change Order completion date. This constraint facilitates the identification of activities that control or do not support the completion date. Constraints shall be limited to start and finish constraints on milestone activities that represent critical Change Order dates, unless otherwise approved by the Engineer in writing.

8) Critical Path: The longest path through the network in estimated total elapsed time from the start of the first Activity through the completion of the last Activity. The Critical Path consists of a series of Activities which must be completed on their scheduled completion dates in order for the Change Order to be completed on schedule.

9) Current Progress Schedule: The most recent progress schedule which has been approved by the Engineer. The Original Baseline Schedule shall be referred to as "Revision 0". Each time a different Current Progress Schedule is accepted by the Engineer, the revision number shall be increased by 1 and the old schedule shall be electronically archived so as to permit an audit trail.

10) Duration: The estimated and/or actual length of time required to fully perform a specific Activity. The Duration for construction activities shall be expressed in Work days.

11) Early Finish Date: The date upon which an Activity can be completed if it is begun on the Early Start Date.

12) Early Start Date: The earliest date upon which an Activity can begin.

13) Hammock: A hammock activity summarizing the early and late dates of a set of activities is used for reporting durations of groups of important activities. An activity shall be designated as a hammock by selecting Hammock as the activity type in the Primavera activity form.

14) Lag: The interval between the completion of a Predecessor Activity and the start of a Successor Activity. For example, ten days of positive Lag will cause the Successor Activity to begin ten days after the Predecessor Activity has been completed. Negative Lag will cause the Activities to overlap. The amount of Lag between each Activity shall be clearly represented on the Network Diagram.

15) Late Finish Date: The latest date by which an Activity shall be completed if the succeeding Activity is to be started on schedule.

16) Late Start Date: The latest date by which an Activity shall be started to allow completion by the Late Finish Date.

17) Milestone: A significant point in the performance of the Work. A milestone has no Duration, and represents the start of a portion of the Work or the completion of a portion of the Work. A milestone may also represent either the beginning or the completion of a task or action being performed by entities other than the Contractor (e.g., obtaining a permit, notification to proceed with certain Work, etc.).

---

[2] A late finish or "finish no later than" constraint limits the latest time an activity can complete

18) Negative Float: The amount of time that the planned completion date of an Activity is later than its required (Late Finish) date. An Activity with Negative Float must be completed ahead of schedule if the Work is to be completed on time. Negative Float usually indicates the need for corrective and/or preventive action to complete the Work on schedule.

19) Network Diagram: A logic diagram prepared according to the Precedence Diagram Method, which displays each Activity required for the performance of the Change Order in the sequence in which it is to be performed with appropriate logic ties between activities displayed.

20) Original Baseline Schedule: The detailed progress schedule first approved by the Engineer as specified herein. All performance of Work will be measured against the Original Baseline Schedule.

21) Precedence Diagram Method (PDM): A particular type of graphic representation of all Activities and Constraints. The Activities are represented by nodes; the Constraints are represented by lines between nodes. A sample PDM Network Diagram is shown in Figure 1 of this Section.

22) Predecessor Activity: The partial or full completion of an Activity which is a prerequisite to commencement of another Activity.

23) Relationship: A logic tie between two activities representing restrictions on the start or completion of the subsequent activity. Relationships may cause either positive or negative lag. The four basic types of relationships are finish to start, start to start, finish to finish and start to finish.

24) Successor Activity: An Activity which cannot be started or completed without the prior partial or full completion of a Predecessor Activity.

25) Total Float: The amount of time by which an Activity or series of Activities may be delayed without affecting the date of completion of the Work. Total Float is not for exclusive use or benefit of either the Contractor or the Authority but shall be used for the benefit of the Work in such manner as the Engineer may in his discretion decide. Use of float suppression and manipulation techniques, such as preferential sequencing, lag logic restraints, inflated activity duration and/or constrained dates, other than as may be required by the Change Order, shall be cause for rejection of the Original Baseline Schedule and any subsequent schedule revisions and updates.

C. Schedule Submittal, Review & Approval Process

1) Baseline Schedule

a. Within thirty (30) calendar days of the execution of the Change Order, the Contractor shall submit a proposed Baseline Schedule containing the Contractor's projected plan and schedule to complete all Work required by the Change Order within the time(s) for completion required by the Change Order. A schedule showing time(s) for completion later than those required by the Change Order will not be accepted.

b. The Engineer will review the Baseline Schedule and return it to the Contractor with comments, or accept it as the Original Baseline Schedule, within fifteen (15) calendar days. The Contractor shall participate in any meetings called to resolve issues with the schedule.

c. If it is not accepted, the Contractor shall revise the Baseline Schedule in accordance with the Engineer's comments and resubmit it for the Engineer's approval within fifteen (15) calendar days of the receipt by the Contractor of the Engineer's comments. Until such time as acceptance of the Baseline Schedule by the Engineer, the Contractor shall continue to resubmit the Baseline Schedule as directed by the Engineer within the same time frame and in the same format as the initial resubmission.

d. After the approval of the Original Baseline Schedule, no changes shall be made therein without the written approval of the Engineer. No other act or omission on the part of the Engineer shall be deemed to constitute such approval. The Contractor shall not be entitled to any damages by reason of the failure of the Engineer to give timely approval or comments on any progress schedule submitted hereunder.

2) Progress Schedule Updates

a. The Contractor shall submit to the Engineer not less frequently than once a month, on a date specified by the Engineer, an updated Current Progress Schedule. The Engineer may require that the Contractor also include scheduling updates with his monthly payment request. Schedule updates shall status the actual performance and progress of the Work and depict any changes. Schedule updates where early start or early finish of any activity is positioned on the data line but not actualized will not be approved.

b. If directed by the Engineer, within seven (7) calendar days after receipt by the Engineer of an updated progress schedule, the Contractor shall meet with the Engineer for the purpose of reviewing and obtaining the Engineer's approval of it.

c. The Engineer may require the Contractor to furnish a revised update which shall include any other information he may request to assist him in evaluating the Contractor's progress, including but not limited to manpower loading charts and equipment schedules; “what-if” analysis performed in a copy of the current progress schedule, etc.

d. In the event that the Engineer requests the Contractor to revise the updated schedule submitted, and/or to submit such additional information, the Contractor shall make the requested revisions and/or submit the updated schedule to the Engineer for approval along with the additional information requested within seven (7) calendar days of the Engineer's request.

D. Schedule Reporting Requirements

1) The Original Baseline Schedule submittal shall include the following:

a. One PDF printout file and one Primavera file submitted electronically.

b. Six copies of the following output reports:

i. A Schedule narrative in writing that provides a general description of the Contractor’s approach to meeting the Change Order goals and the Critical Path.

ii. Explanation for any constrained dates.

iii. A time-scale logic diagram in PDM format containing all activities displaying Activity ID, Activity Description, Calendar, original and remaining durations, percent complete, Early Dates and Total Float, and sorted by:

1. Early Start, Total Float
2. Total Float, Early Start (Critical Path report)

c. Supporting data showing all activities with their associated cost, budgets or estimates.

d. The Contractor shall electronically archive all accepted schedules.

2) In addition to the reports required for the Baseline Schedule submittal, all Progress Schedule Update Reports shall include the following:

a. A narrative comparing the current Dates to the respective Milestone Dates, describing the physical progress during the current report period, explaining plans for continuing the Work during the next report period and describing and explaining changes in crewing and construction equipment. The narrative shall also explain changes in Activity durations, logic ties and Activity Values and the reason why the changes were made.

b. Whenever there is any delay or negative float prediction in the schedule, the Contractor shall submit an alternative solutions report that describes the delay, explains when it started and finished or is expected to finish and the basis for those dates and lists the affected schedule activities by activity ID, and he shall present reasons for the delay. Any revisions to durations or the logical sequence of Activities made to reflect these delays shall be explained. The report shall include proposed schedule recovery efforts such as multiple shifts or overtime to mitigate any potential delay to the overall Change Order completion date, or request an extension of time, as appropriate.

c. Critical Path Analysis.

d. An Analysis Report indicating Activities and/or Milestones which are behind schedule by at least 30 calendar days (commonly evidenced by Negative Float).

e. A report that compares the Current Progress Schedule update with the Original Baseline Schedule and prior month's accepted schedule update and lists all changes made to the schedule.

E. General Schedule Provisions

1) Should the Contractor fail to comply with any provision of this Section, The Engineer shall have the right in his discretion to withhold out of any payment (final or otherwise and even though such payment has already been certified as due) such sums as he deems necessary or desirable, all as more fully provided in the clause of the Contract entitled "Withholding of Payments".

2) Neither the acceptance, review or approval of any progress schedule or other data submitted by the Contractor pursuant to this Section, nor any other action on the part of the Engineer under this Section shall in any way be deemed to be a representation by the Engineer that the Contractor may or will be permitted to follow a particular schedule or sequence of operations or that by following any such schedule or sequence he may or will complete the Work by the time(s) required by the Change Order or by any other time(s). Nor shall the approval of any progress schedule or other such data relieve the Contractor of his obligation to complete the Change Order by the time(s) required in the Change Order, even though the schedule may be inconsistent with such completion.

3) Any approval under this Section shall be construed merely to mean that the Engineer knew of no good reason at that time to object thereto. No acceptance, review or approval or any other action under this Section shall limit, affect or impair the Contractor's obligation to perform all Work by time(s) required by the Change Order and in accordance with all other provisions of the Change Order.

4) The performance of the Work by the time(s) required in the Contract, after taking into account extensions to which the Contractor may be entitled under the clause of the Change Order entitled "Extensions of Time", may require the Contractor to perform the Work using overtime labor, additional shifts or additional plant and equipment and/or other measures at no additional cost to the Authority. The Contractor shall anticipate, avoid and mitigate the effects of all delays.

5) The Engineer shall have the right at any time when in his judgment the Work is not proceeding in accordance with the approved progress schedule or at any time when it is likely that the Work might not be completed by the time(s) required in the Change Order even though the Contractor is proceeding in accordance with the approved progress schedule, to order the Contractor without additional compensation to employ additional shifts to increase the number of men employed, to use additional plant or equipment, or to take such other steps as may be necessary or required to assure the completion within the time(s) shown in the accepted schedule.

6) No action on the part of the Contractor pursuant to this Section shall be construed as a request by him for an extension of the time(s) for completion required by the Change Order. A request for an extension of time shall be deemed made only if it complies with the requirements of the clause of the Change Order entitled "Extensions of Time". No extension of the time(s) for completion shall be inferred because of any action, omission to act, or statement on behalf of the Engineer pursuant to this Section. Extension of time, if any, shall be granted only pursuant to the clause of the Contract entitled "Extensions of Time".

7) The Contractor acknowledges and agrees that he is not entitled to an extension of time for impacts that do not extend the contractual end date of the Change Order.

ATTACHMENT A

MANDATORY ACTIVITY CODE STRUCTURE

1) Responsibility (Authority, Contractor)
8) Area (building, floor or area)
9) Trade/CSI code (concrete, steel, etc as required)
10) Location (3rd Fl, etc)
11) Phase of Work, if applicable
12) Change Order work, if applicable
13) Other, as required by the Engineer

```
--------------------------------------------------------------------------------
                           PRIMAVERA PROJECT PLANNER

Date 01/02/0          -----ACTIVITY CODES DICTIONARY-----              Page   1

NAME - Project Title
--------------------------------------------------------------------------------
   CODE    VALUE                        TITLE                           SEQUENCE
--------------------------------------------------------------------------------

Activity Codes:

  RESP  Responsibility
                       Architect/Engineer
                       Contractor
           0           Port Authority

  AREA  Area/Department
           G           General Area                                        1
           CTL         Air Traffic Control Tower                           2

  MILE  Milestone

  CSI   Trade/CSI Code
           03000       Concrete
           04000       Masonry
           07000       Thermal & Moisture Protection
           15000       Mechanical
           16000       Electrical

  LOCN  Location

  PHAS  Phase
           D           Design                                              1
           P           Procurement                                         2
           C           Construction                                        3

  CO    Change Order Wor

  OTH   As Req'd by Engr
```

34 ANALYSIS OF BID – NOT APPLICABLE TO THIS CHANGE ORDER

35 CONDITIONS AND PRECAUTIONS

A. Construction Site Conditions:

1) Notwithstanding restrictions specified elsewhere herein, during the time the Contractor is performing the Work, it shall at times be necessary, because of emergency conditions, to suspend the Contractor's operations or to postpone the time at which a work area becomes available for performance of Work. Should the Contractor be specifically directed to suspend operations in a work area specified herein to be available for operations of the Contractor, or should such work area not be available by the times specified elsewhere in the Change Order, and if solely because of such suspension of operations or late availability of the work area, the Contractor is necessarily kept idle at the construction site, the Contractor will be compensated as stipulated in the provisions of the Contract concerning "Compensation for Emergency Delays".

2) At least 7 days but not more than 10 days prior to performing excavation, call 1-800-272-4480 and provide the information required for excavation(s) in New York and call 1-800-272-1000 and provide the information required for excavation(s) in New Jersey.

3) No vehicles of the Contractor, employees of the Contractor, subcontractors, materialmen or others over whom the Contractor has control shall be permitted to park in or on Authority property, except for construction vehicles which will be permitted to park at the area of Work during the times when the Work is being performed.

   All vehicles, including construction vehicles and company vehicles shall be required to pay the appropriate tolls for each passage or crossing of Authority facilities, or parking at Authority lots.

4) Securely fasten material or construction which must be left in place between working periods in a manner approved by the Engineer so as not to be a hazard.

5) Take all precautions necessary for protection of persons, traffic and property during dust or fragment generating operations, concrete mixing or placing, or other operations which shall stain, soil or damage property or injure persons. Provide and erect waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less, or other protective enclosures as approved by the Engineer.

6) Restrict smoking to areas designated by the Engineer for this purpose.

7) Do not burn or bury debris of any type on Authority property, or wash waste materials down sewers or into waterways.

8) Provide sound suppression devices on gasoline and diesel powered construction equipment and pneumatic tools as required to maintain noise exposures below the limits specified in the Code of Federal Regulations (CFR) 29 CFR 1926 Occupational Safety and Health Regulations for Construction (OSHA). Maintain such sound suppression devices in proper operating condition throughout the time of their use, and adjust and repair as required to maintain noise within exposure levels stipulated in 29 CFR 1926.52, Table D-2.

9) Work requiring tunnel lane closures shall be coordinated with the Facility's daily tunnel lane closures for maintenance. Tunnel coning will be provided by the HT Facility during construction, Contractor shall furnish and install maintenance and protection of traffic for the work area.

10) Contractor shall submit to the Engineer a construction schedule two weeks prior to start of work requiring tunnel lane closures.

11) Barricades, warning/danger devices, signs, flags, and lights shall be provided and maintained by the Contractor as required by OSHA for public safety. The Contractor is responsible for maintaining the adequacy of the safety devices throughout the duration of the Work. The Authority shall have the right to order the Contractor to vary, and/or increase the safety devices installed on the work site.

12) Work shall be performed in such manner that the stability of the existing and adjacent areas are not disturbed. Adjacent Authority areas or appurtenances shall be the responsibility of the Contractor insofar as any damage caused by the Contractor's operations.

13) The Contractor shall replace and/or restore all damaged or destroyed property, including but not limited to planted areas, trees, shrubs and other existing structures or substructures, tiles, utility lines, roads, walks and/or curbs during the performance of this Work and arising from the activities or installations hereunder, and such replacement and/or restoration during the performance of this Work shall be in accordance with standards for new work and meet with the approval of the Engineer. Contractor shall restore all surfaces disturbed by his work to match existing materials. Regardless of the prior existing conditions, all restoration work shall be performed at a level consistent with new work. All structures, equipment and material of the Contractor not required for incorporation in the work shall be removed from the site at the completion of the work. Contractor shall take a complete and thorough set of photographs showing the existing condition of the site and access area and submit them to the Engineer, prior to the start of operation. Photographs will be used as an aid in the establishment of restoration requirements.

No requirement of or omission to require any precautions under this Change Order shall be deemed to limit or impair any responsibility or obligation assumed by the Contractor under or in connection with this Change Order and the Contractor shall at all times maintain adequate protection to safeguard the public and all persons engaged in the Work and shall take such precautions as will accomplish such end, without undue interference with the public or the operations of the Authority.

36 HOURS OF WORK AND CONSTRUCTION STAGING

Refer to ITCS Change Order Statement of Work Section 11 Hours of Work and Section 12 Staging, respectively.

37 MAINTENANCE OF TRAFFIC AND WORK AREA PROTECTION

A. Definitions

As used in this numbered Section, and this Section only, the terms used herein shall have the following meaning:

1) The terms "Traffic Lane", "Lane", "Active Roadway", "Street", and "Roadway" shall mean, in addition to the normally traveled pavement areas, other areas including but not limited to ramp terminal gore areas, roadway shoulders and all other areas that may foreseeably be occupied by moving vehicles.

2) "Flashing Arrow Sign Unit" (FASU) shall mean an engine/generator-, solar- or battery-powered flashing light sign with lights displayed in the shape of an arrow.

3) "Nighttime" shall mean the local time period from 1/2 hour after sunset to 1/2 hour before sunrise.

4) "Slow-Moving Vehicles" shall mean vehicles or equipment that travel at or under a speed corresponding to 15 mph less than the posted speed limit.

5) "Work Area" shall mean the area immediately surrounding the Work in progress, typically, where workers are afoot, and/or the space within a Roadway where the Contractor is doing Work on the roadway.

B. General Requirements

Conform to requirements of this numbered Section, the Detail Design and Shop Drawings and the following:

1) Portions of the latest editions, including all amendments thereto, of the Federal Highway Administration (FHWA): "Manual on Uniform Traffic Control Devices" (MUTCD) Part VI as hereinafter specified and applicable portions of the companion "Traffic Control Devices Handbook" (TCDH); "Standard Highway Signs"; "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects"; and the "Standard Color Tolerance Charts".

2) American Association of State Highway and Transportation Officials (AASHTO): "Roadside Design Guide", Chapter 9: Safety Appurtenances for Work Zones, and "Standard Specifications for Highway Bridges", as hereinafter specified.

3) The requirements of the Americans with Disabilities Act (ADA) laws in all respects as specified in the "ADA Accessibility Guidelines for Buildings and Facilities" (ADAAG).

4) American Traffic Safety Service Associations (ATSSA): "Guidelines for the Use of Portable Changeable Message Signs".

5) Maintenance of traffic and Work Area protection features specified herein and as shown on Maintenance of Traffic Drawings furnished by the Engineer of Record.

6) In the event of a technical conflict between a requirement in the publications referenced herein and the Specifications and Shop Drawings, the requirements of the Specifications and Shop Drawings shall control.

7) There may be more than one Work Area within the confines of a closed Roadway or Traffic Lane. Each Work Area shall be individually protected as specified herein.

C. Contractor-Furnished Materials and Equipment

1) Provide and maintain in good working order all materials, equipment, temporary construction signs and facilities required for proper maintenance of traffic and Work Area protection, as specified herein and/or shown on the Maintenance of Traffic (MOT) drawings. All said equipment/devices shall remain the property of the Contractor, unless otherwise shown on the MOT Drawings.

2) All items provided under paragraph C.1 shall be new or undamaged previously used materials in serviceable condition conforming to requirements specified herein.

3) Provide and maintain in serviceable condition the following, as shown on the MOT Drawings:

   a. Portable Changeable Message Signs: Trailer mounted FASU

   b. Traffic Cones.

c. Temporary Signs: Conform to requirements of Specification Section 02850 "Plywood Sign Panels and Wood Sign Posts" and/or Specification Section 02851 "Aluminum Sign Panels" hereof. Plywood signs shall be Type 1, unless otherwise shown on the MOT Drawings.

i. Temporary Sign Supports: Wood conforming to requirements of Specification Section 02850Portable Sign Supports: "Windmaster" as manufactured by Marketing Displays, Inc., Farmington Hills, MI.; or approved equal;

d. Back-Up Trucks: Nominal actual weight of 15,000 lbs. with nominal 24,000 lbs. gross vehicle weight registration and rear-most wheels situated close to rear of truck body. Standard "ICC" type rear bumpers are not an acceptable substitute for the required rear wheel location. Actual vehicle weight may vary depending on recommendations of the manufacturer of the vehicle-mounted impact attenuator selected. In addition, equip truck(s) with:

i. Standard 4-lamp flashing hazard signal lights (parking and tail lights);

ii. Four-lamp sealed beam rotating yellow warning light providing 35,000 candle power per lamp with an apparent flash rate of 120 flashes per minute. Truck mount such lights 7 to 10 feet above the Roadway and located so as to be visually unobstructed by any part of truck body, load or equipment.

iii. Vehicle-Mounted Impact Attenuator: "TMA" units as manufactured by Energy Absorption Systems, Inc., Chicago, IL; or approved equal;

4) Submit the following to the Engineer in accordance with Division 1 - GENERAL PROVISIONS entitled "Detail Design Drawings, Shop Drawings, Catalog Cuts and Samples":

a. Catalog Cuts and Data Sheets: Complete manufacturer's data for all equipment and materials.

D. Spare Materials and Equipment

1) Initially furnish and subsequently maintain the quantities of spare materials and equipment, as scheduled on the MOT Drawings, at the construction site or at another nearby location approved by the Engineer.

2) Totally relamp Flashing Arrow Sign Unit after each single bulb failure.

E. General Work Area Protection

1) Contractor shall establish a Traffic Maintenance Crew, properly trained, supplied, staffed and equipped to deploy and remove the maintenance of traffic and Work Area protection elements required for each of the Contractor's construction activities, as described on the MOT Drawings and/or paragraph E.3 herein. The Contractor shall identify and maintain one individual, per work period, as the central or key contact for the Traffic Maintenance Crew and their associated activities.

2) Contractor's Traffic Maintenance training shall be specifically developed from this Section. The contents of Contractor's Training programs shall specifically include the MOT Drawings Traffic Standard Details and all other requirements included on the MOT Drawings.

3) Prior to commencement of each day's Work, furnish and install, and periodically inspect, maintain, relocate, replace, cover, remove or reconstruct the traffic control delineations, guiding devices, signals, signs and pedestrian protection, Roadway plates, barricades, and barriers, if any, as required throughout the progress of construction operations. Maintain safe control of traffic flow and demarcate areas of Work at all times.

a. Ensure that construction material and equipment not removed from areas of Work during non-working periods are protected in such a manner that they shall not constitute a traffic hazard.

b. Do not park any vehicles other than construction vehicles required for construction operations within the demarcated protected areas of Work.

c. Promptly remove traffic control delineations, guiding devices, signals, signs, pedestrian protection, Roadway plates, barricades and barriers and whenever operations under this Change Order no longer require said Work Area protection.

d. Prior to the end of each work period and not less than twice a day on non-work days, the Contractor's Traffic Maintenance crew shall visually inspect and maintain all elements of the maintenance of traffic and Work Area protection installations.

4) Throughout Progress of Work of This Numbered Section

a. Maintain visual and physical accessibility to fire hydrants. Provide 24-hour advance notice to the Engineer in the event of hydrant obstruction.

b. Conduct Work Area protection operations so that Traffic Lane ingress and egress to intersecting Roadways, adjacent structures or property, and bus and taxi stops, if any, can be maintained. Obtain the approval of the Engineer and provide 24-hour advance notice to the Engineer in the event that Work Area protection operations obstruct access to Work Areas.

5) Placement and Removal of Temporary Signs and Traffic Control Devices

a. Do not locate signs or other traffic delineations, guiding devices and signs in a manner that would: obstruct or interfere with motorists' view of approaching, merging or intersecting traffic; obstruct other permanent signs or route markers; or mislead or misdirect the motorist.

b. Do not place traffic control signs under an overpass or elevated building, or within overpass or building shadow areas, unless otherwise shown on the MOT Drawings.

c. On Roadways passing below an overpass or elevated building, do not begin or end traffic cone or other delineation and guiding devices under or less than 100 feet from an overpass or building. Extend delineation and guiding devices as required to comply with this requirement.

d. Unless otherwise shown on the approved MOT Drawings, the Work of installing and removing temporary signs, traffic control devices and pavement marking shall be protected, as a minimum, in accordance with the MUTCD Part 6, as applicable.

6) Each Work Area not protected by Vehicle-strong Barriers shall be protected by a back-up truck when workers are present, unless otherwise shown on the MOT Drawings.

7) Vehicles used by the Contractor during performance of Work shall be considered as equipment vehicles and when not protected by a Vehicle-strong Barrier, said vehicle shall be protected by a back-up truck, unless otherwise shown on the MOT Drawings.

8) Slow-Moving Vehicles traveling on a Roadway outside of demarcated protected Work Areas shall be followed (approximately 50 feet behind) by a vehicle displaying the same flashing hazard signal lights and sealed beam rotating yellow warning light as required for back-up trucks.

F. Notwithstanding provisions herein requiring or permitting the Authority to approve or disapprove of any traffic control or delineation and guiding device provided by the Contractor, the Contractor shall ensure the suitability and performance of all such traffic control devices such that inconvenience to the traveling public is held to an absolute minimum.

38 PERMIT AND REQUIREMENTS FOR CONFINED SPACE ENTRY

Notify the Engineer one week prior to commencement of operations within locations designated as Permit Required Confined Spaces on the Detail Design and Shop Drawings and/or Specifications and obtain from the Engineer Form PA 3745C entitled “The Port Authority of NY & NJ - Contractor Permit Required Confined Space Notification”. Execute such form and submit it to the Engineer along with two copies of the Contractor's Confined Space Entry Program, at least forty-eight hours prior to commencing operations within the Permit Required Confined Spaces.

Unless otherwise approved by the Engineer, all operations shall be performed in accordance with the conditions forming a part of said permit. The Authority will issue this permit to the Contractor without payment of a fee. Each such permit shall be valid for the duration stated in the permit and shall be returned to the Engineer upon completion of operations or at the expiration of permit validity. A copy of Form PA 3745C is appended to this numbered Section.

PA 3745C / 7-02

THE PORT AUTHORITY OF NY & NJ

FACILITY: _____

CONTRACTOR PERMIT REQUIRED CONFINED SPACE NOTIFICATION

Hand print in ink. (See instructions)

Requested By: Print Name Signature	Company Name/Telephone Number:
Exact Location of Confined Space:	Change Order Number
Purpose of Entry:	
Prepared By: Chief Maintenance Supervisor/Designee (CMS/D) Print Name Signature	Date:

In accordance with 29 CFR 1910.146 (c) (8) (i) the issuance of this form explicitly states that the ensuing work involves entry into a Permit-Required Confined Space. Entry into this space is allowed only through compliance with the OSHA standard Permit-Required Confined Spaces, 29 CFR 1910.146.

A copy of this form shall be given or faxed (with verification of receipt) to the Police desk and/or Communications desk, and the local PAPD Tour Commander to alert personnel of work being performed in a PRCS.

PRE-ENTRY CHECKLIST

	YES	N/A		YES	N/A

Contractor informed of the elements, including the hazards identified that make the space permit required	☐	☐	Contractor personnel and Port Authority personnel will be working in or near permit spaces requiring joint entry operations	☐	☐
Contractor informed of precautions or procedures implemented for the protection of employees.	☐	☐	Contractor has obtained available information regarding permit space hazards and entry operations	☐	☐

IN THE EVENT OF AN EMERGENCY CONTACT: _____

(COMPLETED BY CHIEF MAINTENANCE SUPERVISOR/DESIGNEE)

1. Your name and company name.
2. Location, including cross streets.
3. Phone number from which you are calling.
4. This is a confined space operations. You need a rescue service.
5. Number of victims; conditions of victims if known.
6. Type of entry (manhole, door, etc.).
7. Any known conditions in the space (gas readings, flooding)

I UNDERSTAND THE ABOVE INFORMATION AND WILL ADHERE TO ALL RULES AND REGULATIONS MANDATED BY THE OSHA STANDARD FOR PERMIT REQUIRED CONFINED SPACES.

Print Full Name/Title Contractor Representative	Signature/Change Order Number	Date

THE CONTRACTOR IS OBLIGED TO INFORM THE PORT AUTHORITY OF ANY HAZARD CONFRONTED OR CREATED IN THE PERMIT SPACE BY USING THE SPACE BELOW.

Distribution: Copy 1. Completed PA 3745C and completed Contractor's Permit to Risk Management, PATC 43.
Copy 2. Retained by Facility CSM/D.

THE PORT AUTHORITY OF NY & NJ

PERMIT REQUIRED CONFINED SPACE RULES

1. No work shall be performed in any designated Permit Required Confined Space (PRCS) without acknowledgement by the Chief Maintenance Supervisor or his/her designee.
2. Contractors must complete the reverse side of this notification document and ensure that all personnel or subcontractor personnel are equipped and trained in accordance with OSHA 29 CFR 1910.146
3. Contractors will ensure monitoring is performed prior to entry into a PRCS. A copy of the contractors confined space entry permit shall be prominently posted outside or above the work site for the duration of the job.
4. Contractors are reminded that should the nature of the work being performed in the permit required confined space change or if all the employees working change during the performance of the task described on the contractor's permit, a new revised notification document and contractor's permit is necessary.

CONTRACTORS SAFETY PRECAUTIONS AND REQUIREMENTS

1. The contractor must provide a copy of its Confined Space Entry Program that meets or exceeds OSHA confined space entry requirements to the Facility Manager or the Chief Maintenance Supervisor and/or the Resident Engineer Office Construction Inspectors prior to the commencement of work. The contractor is responsible for furnishing all necessary equipment including monitoring devices, and the required Confined Space Entry Permit required under 29 CFR 1910.146. The contractor's Permit Required Confined Space Entry Permit is to be posted in a conspicuous manner prior to entering the Port Authority Permit Required Confined Space (PRCS).
2. The contractor must assure that all safety precautions and requirements are implemented prior to the commencement of work inside the PRCS. Examples of these safety precautions and requirements are appropriate site protection, air monitoring prior to and while inside the permit space, appropriate ventilation equipment is utilized, electrical and mechanical systems have been de-energized and locked/tagged out and all other appropriate personal protective equipment (PPE) is furnished and utilized by personnel.
3. The contractor is responsible for making notifications to the Port Authority High Tension System Operator to coordinate activities if necessary.
4. Neither this notification document nor any act or omission of the Port Authority shall be construed to impair the obligations of any person under or in connection with any agreement or contract with the Port Authority or in connection with the work done.

5. The contractor shall not do or permit to be done any act or thing which will invalidate or conflict with any insurance policy covering any area which the Contractor enters upon, and the Contractor shall promptly observe, comply with and execute the provisions of any and all present and future rules, regulations, orders, and directions of the New York Board of Fire Underwriters, New York Fire Insurance Exchange, or if the work area is located in New Jersey, the National Board of Fire Underwriters, the Fire Insurance Rating Organization of New Jersey, or of any other board or organization exercising or which may exercise, similar functions which may pertain or apply to the operations of the Contractor hereunder.
6. The contractor fully understands that certain areas owned or leased to the Port Authority are in turn leased or licensed to third parties. In the event that the contractor's work requires access to any of these areas arrangements must be made with the Port Authority property representative at the facility.
7. The contractor shall observe and obey (and compel its officers, members, employees, agents subcontractors, and other persons doing business with it to observe and obey the present and future "Rules and Regulations" of the Port Authority, and all Federal, State, County and Municipal rules, regulations and guidelines and laws.
8. Work being performed in PRCS is subject to immediate suspension by the Port Authority upon oral or written notice if, in the opinion of the Port Authority Resident Engineer's Office staff or Safety Inspectors/Engineers, such action is deemed justifiable to protect life or property.
9. Upon completion of work or when shift ends, the contractor shall return their cancelled entry permit to a Port Authority Representative.

(END OF SECTION)

19 Attachment 8 – Technology Services Department (TSD) Standards & Guidelines for Port Authority Technology

-THIS PAGE INTENTIONALLY LEFT BLANK-

Consolidated Edits to TSD Standards and Guidelines for ITCS-SI Technology

---

1) Introduction (page 6): Note that the edits provided below are intended to provide focused guidance and clarification related to the specific scope of work for the ITCS Strategic Investment.

2) Section 1.9 (page 9): Certain ITCS functions are tied to specific workstations. As such, these specific ITCS workstations are to be given fixed IP addresses.

3) Section 2.2.1 (page10): ITCS operating systems, databases and all other software will be provided and installed by the ITCS vendor.

4) Section 2.2.2.1 (page 10): ITCS workstations will not be mapped to any external drives.

5) Section 2.2.2.2 (page 12): The ITCS vendor will be installing and interconnecting all the equipment they provide. The ITCS vendor will also install and terminate the necessary fiber optic cables that will interconnect the ITCS switches to the PAWANET switches, however, it is expected that TSD will make the final connections at the PAWANET switches.

6) Section 2.2.3.2 (page 12): ITCS workstations do not require AD authentication. The ITCS application will employ its own single sign-on security.

7) Section 2.2.3.2 (page 12): The ITCS vendor shall be responsible for ITCS server logical security, configuration control and remote access in accordance with PA standards.

8) Section 2.2.3.2 (page 13): Password standards are documented in 2.2.4.5 below.

9) Section 2.2.4.1 (page 13): User accounts for dedicated ITCS workstations are created and controlled by the ITCS System Administrator on a Windows Active Directory Service server application native to the ITCS system. Toll Collector user access on lane controllers is controlled at the ITCS application level.

10) Section 2.2.4.5 (page 13): Bullet #4 - touch screens used by Toll Collectors will not provide grace logins

11) Section 2.2.4.5 (page 14): Bullet #18 – does not apply to the Plaza Supervisor workstation.

12) Section 2.4 (page 16): Will not apply to ITCS workstations.

13) Section 2.5 (page 16): The ITCS vendor will be responsible for providing their own stand-alone backup solution.

14) Section 2.6 (page 17): The ITCS vendor shall update the existing ITCS Business Resumption Plan to reflect the changes introduced by the new system.

15) Section 3.3 (page 19): The ITCS vendor will provide and maintain ITCS workstations including maintenance and update of virus protection software as applicable.

16) Section 5.0 (page 21): This section in its entirety is not relevant to the ITCS procurement.

17) Section 6.3.2 (page 24): ITCS workstations will not employ this method. The ITCS vendor will be responsible for software updates and distribution to ITCS servers and workstations.

18) Section 6.3.3 (page 24): ITCS workstations will not run Novell software.

19) Section 6.3.6.1 (page 25): ITCS workstations will have their own image that will be established and maintained by the ITCS vendor.

20) Section 6.4.2 (page 27): The ITCS vendor will be responsible for providing logical security for ITCS workstations.

21) Section 7.2.1 (page 27): The ITCS vendor will provide all ITCS server software.

22) Section 7.3.1 (page 27): The ITCS vendor shall comply with TSD standards for operating system logical security on UNIX and Linux servers.

23) Section 7.3.2 (page 27): The ITCS vendor will be responsible for providing their own backup solution.

24) Section 7.5 (page 28): The ITCS vendor will update existing System Administration and Detail Design documents to incorporate any applicable changes to application security practices.

25) Section 8.0 (page 28): The ITCS is a Vendor Provided Dedicated System. As such, special focus should be placed on the standards defined in Section 8.3, Communications Infrastructure Standards and Section 8.4, Server Infrastructure Standard since they are directly applicable to this procurement along with the additional clarifying details provided in the ITCS change order scope of work.

26) Section 8.2 (page 29): This section in its entirety does not apply to the ITCS procurement.

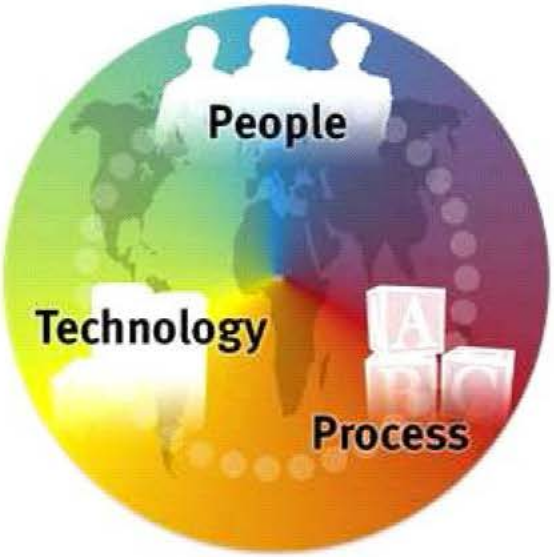
27) Appendix 1 (page 39): The existing ITCS Business Resumption Plan shall be modified to comply with the required TSD contents and format as necessary.

28) Appendix 9 (page 45): Fiber optic terminations should match the respective Cisco switch connectors which, in many cases, will be LC.

THE PORT AUTHORITY OF NY & NJ

STANDARDS AND GUIDELINES FOR PORT AUTHORITY TECHNOLOGY

(Non-Confidential Sections for use in preparation/distribution with RFP's)



Technology Services Department

Version 7.4
4/22/2013

(PREPARED FOR RFP: PLACE TITLE OF RFP HERE)

Table of Contents

Introduction 6
1.0 The Port Authority Wide Area Network (PAWANET) 6
1.1 PAWANET Overview 6
1.2 VOIP Circuit Diagram 7
1.3 Inter-site Services Providers 8
1.4 PAWANET Functions 8
1.5 Features of PAWANET 8
1.6 Supported Protocols 8
1.7 PAWANET Switches and Routers 8
1.8 Approved Servers 9
1.9 Enterprise Addressing Scheme (including IP addressing) 9
1.10 Enterprise Network Monitoring Software 9
2.0 Network Resources 9
2.1 Network Overview 9
2.2 Enterprise Network Architecture 10
2.2.1 Server Operating System and Software 10
2.2.2 Configuration 10
2.2.3 Server Network Resources Security 12
2.2.4 Network Access and User Account Security 13
2.2.5 Remote Access System 14
2.2.6 Hardware Standards 15
2.3 Network Naming Conventions 15
2.3.1 Server Names 15
2.4 Directory Services and Structure 15
2.5 System Backup and Recovery 16
2.5.1 Backup Logs 16
2.5.2 Backup Scheduling 16
2.6 Business Resumption Plan 17
2.7 Telecommunications Standards for Enterprise Network Resources 17
2.7.1 Closet and Telecommunications Room Access 17
2.7.2 Telecommunications Installation Contractor's Responsibilities 17
2.7.3 Electrical Requirements 18

FOR USE IN RFPS

2.7.4 Telephone Company Interface ... 18
2.8 Documentation ... 18
3.0 Virus Scanning & Management ... 18
3.1 Overview ... 18
3.2 Standards ... 19
3.3 Acquisition and Installation ... 19
3.4 Virus Detection and Response ... 19
4.0 Electronic Mail ... 19
4.1 E-Mail Overview ... 19
4.2 E-Mail System Architecture ... 20
4.3 E-Mail Environment: Design Considerations and Infrastructure ... 20
4.4 Integrating Applications Server with Port Authority Email System ... 21
4.4.1 Requesting SMTP Services ... 21
4.4.2 Email Restrictions ... 21
5.0 Intranet ... 21
5.1 Intranet Overview ... 21
5.2 Direction of eNet Development ... 21
5.3 eNet Software Infrastructure Standards & Guidelines ... 22
5.3.1 Design Guidelines ... 23
5.3.2 Accessibility Guidelines ... 23
6.0 Workstation Hardware and Operating System Software ... 23
6.1 Overview ... 23
6.2 Workstation Operating System Standard ... 23
6.3 Workstation Configuration ... 24
6.3.1 Workstation Naming Conventions ... 24
6.3.2 Automated Software Distribution for Computers ... 24
6.3.3 Remote Workstation Management ... 24
6.3.4 Drive Mappings ... 24
6.3.5 Standard Workstation Hardware Configurations ... 25
6.3.6 Standard Workstation Software ... 25
6.3.7 Enterprise Software ... 25
6.3.8 Other Business Applications ... 26
6.4 Workstation Security ... 26
6.4.1 Physical Security ... 26
6.4.2 Logical Security ... 27
7.0 Distributed Systems Environment ... 27

FOR USE IN RFPS

7.1 Overview 27
7.2 Microsoft Windows Servers 27
7.2.1 Virtual Environment 27
7.2.2 Windows Data Encryption 27
7.3 Unix 27
7.3.1 Unix Security 27
7.3.2 Backup 27
7.3.3 Download Scripts in the Unix/Linux Environment 27
7.4 z/OS 28
7.4.1 Databases 28
7.4.2 Geospatial Databases 28
7.5 Application Security 28
7.6 Server Physical Security 28
7.7 Load Balancing – Failover Architecture 28
8.0 Vendor Provided Dedicated Systems 28
8.1 Overview 28
8.2 Physical Security Technology Standards 29
8.2.1 Agency Standard for Digital Video Recording, Access Control and Alarm Monitoring 29
8.2.2 Situational Awareness Platform Software 31
8.3 Communications Infrastructure Standards 31
8.4 Server Infrastructure Standard 31
9.0 Wireless Technologies 31
9.1 Wireless Guidelines 31
9.1.1 Purpose and Scope 31
9.1.2 General Policy 32
9.1.3 Personal Area Networks - PAN 32
9.1.4 Wireless Local Area Networks – WLANs 32
9.2 Scope 32
9.3 Principles 33
9.4 Compliance Requirements 33
9.5 Device Specifications 33
9.5.1 Access Point (AP) Standard 33
9.1.5 Portable Electronic Devices (PEDs) – Cell Phones, PDAs, messaging devices, laptops and tablets 34
9.1.6 Cellular and Wireless Email 34

FOR USE IN RFPS

9.1.7 Synchronization 34
9.1.8 Responsibilities of Technology Services Department 35
9.1.9 Responsibilities of Technology Services Voice Networks Group 35
9.1.10 Responsibilities of Wireless and Handheld Device Users 35
9.2 Paging Device Policy 36
9.2.1 Policy 36
9.3 Cellular Phone & Wireless Modem Policy and Procedures 36
9.3.1 Policy 36
9.4 Technology Services Mobile Device (Windows Mobile and Apple) Policy 36
9.4.1 Introduction 36
9.4.2 Hardware – Hyper Link 36
9.4.3 Software 36
9.4.4 Support 36
9.4.5 Training 36
9.4.6 Acquisition 37
9.4.7 Personal Acquisition 37
9.4.8 Data Security Considerations 37
9.4.9 Data Backup 37
9.5 BlackBerry Device Policy & Procedure 37
9.6 BlackBerry Guidelines 37
9.6.1 Introduction 37
9.6.2 Support 37
9.6.3 Breakage and Loss 37
9.6.4 Data Security Considerations 38
9.6.5 Data Backup 38
Appendices 39
Appendix 1 -- Business Resumption Plan Document Format 39
Appendix 2 -- Communication Rooms/Closets Standards 41
Appendix 3 – Standard Cabling Schemes 41
Appendix 4 -- Unified Wiring Plan 42
Appendix 5 -- Telephone Closet / IDF Termination Blocks 44
Appendix 6 -- Workstation Jacks 44
Appendix 7 -- Standard Switches Inside the Department 44
Appendix 8 -- Workstation and Lateral Cable Identification Management 44
Appendix 9 – Fiber Optic Specification for Network Services - PAWANET 45
Appendix 10 -- Public Telephone Ordering Guidelines 46

FOR USE IN RFPS

Introduction

The purpose of this document is to communicate the standards established by the Technology Services Department (TSD) and provide guidance in proposing Information Technology (IT) solutions for the Port Authority of New York & New Jersey (PANYNJ), the Agency.
To that end, these guidelines intend to help RFP Submitters do the following:

- Implement computing and networking solutions that ensure the utmost reliability, availability and security.
- Procure hardware and software that advances business needs in a manner that is compatible in an ever-changing IT environment that enables departments to work with each other more effectively.
- Easily and efficiently communicate and exchange information throughout the agency.
- Achieve greater systems integration so that the application will be interoperable resulting in cost effectiveness and quality control.
- Adherence to these standards ensures that IT investments achieve Enterprise connectivity, interoperability, consistency, and will enhance performance in a cost-effective way.

1.0 The Port Authority Wide Area Network (PAWANET)

1.1 PAWANET Overview

The Port Authority has a modern distributed computing network, called the Port Authority Wide Area Network (PAWANET), which is managed as an enterprise resource. It connects all the various Port Authority facilities and transportation systems using high-speed voice, data, and video lines or links.

This network is crucial to all Port Authority businesses because it provides the connections for applications such as e-Mail, Internet and Intranet access, SAP, PeopleSoft, Electronic Toll Collection, Computer Aided Design and Drafting (CADD), Lease Image, Closed Circuit Television (CCTV) surveillance systems, and in the future, videoconferencing, and more.

PAWANET consist of a Managed Fiber Optic Dense Wave Division Multiplexed (DWDM) Network, provided by Verizon Select Services, as an Integrated Optical Service (IOS) network. This network consists of eleven separate and distinct (1) Gbps lightwave networks, each interconnecting with the data centers at Telecenter and the Port Authority Technical Center (PATC). Site-to-Site interconnectivity is achieved via the "hub and spoke" topology through the data centers. Additional high-speed Ethernet Private Lines (EPL) have been deployed to support key Port Authority off-ring facilities. Remote locations are linked using redundant high-speed dedicated point-to-point leased communication lines.

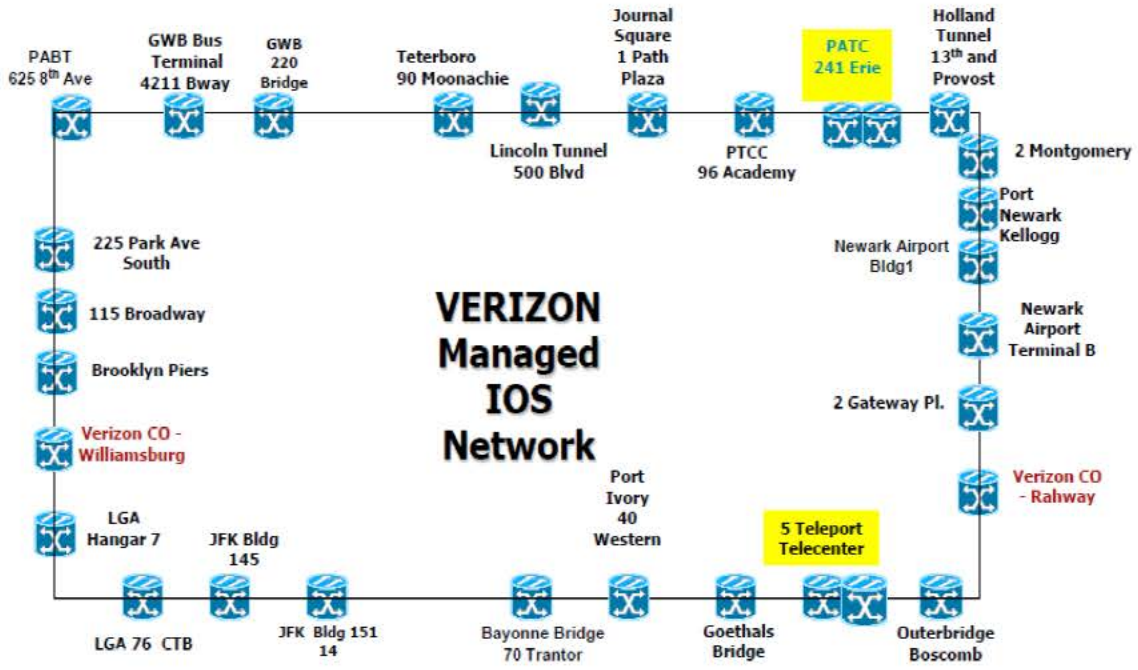
Remote locations are linked using redundant high-speed dedicated point-to-point leased communication lines. Wireless connectivity also supported when hardwired connections are not practical.

The network consists of state-of-the-art Cisco Systems equipment and services, such as, high performance Cisco Catalyst switches and routers. The Port Authority uses Bluewater Network Monitoring Services to monitor PAWANET, and Cisco Systems SMARTnet hardware/software maintenance services, and Cisco's Technical Assistance Center (TAC)

FOR USE IN RFPs

to support and maintain the network.

1.2 VOIP Circuit Diagram



FOR

1.3 Inter-site Services Providers

The Technology Services Department (TSD) has contracted with a variety of companies to provide inter-site services Companies providing communications services for the Wide Area Network are listed below.

- AT&T Local Services
- Verizon

1.4 PAWANET Functions

Currently PAWANET is used to transport the following:

Data	Supports the low and high volume transfer of data used for applications, such as SAP and PeopleSoft, and for network communications, such as e-Mail. Provides a data path for off-site, mainframe data backup of file, print and application servers. Enables the use of Storage Area Network (SAN) for network storage of user files and routing jobs to shared network printers.
Video	The transfer of Closed Circuit TV (CCTV) data is supported across the entire network to provide security for the Port Authority's key facilities.
Voice	The network provides the hardware capabilities for voice and VoIP transmission.
Videoconferencing	The network switches and transmission lines are used for videoconferencing to enable diversely located staff participate in meetings across large geographic area.
VOIP	Voice Over Internet Protocol (VOIP) is in the process of being implemented for the agency to replace the legacy Nortel system, which currently serves the majority of Port Authority users. VOIP will be another data stream utilizing the PAWANET infrastructure.

1.5 Features of PAWANET

PAWANET provides a high performance and reliable fail-safe communications network. These are its key features:

- Alternate paths of communication
- Support of high volume traffic such as CADD, CCTV and others
- Catalyst 3000, 4000 and 6500 switches at all the major sites, and at the Teleport
- Cisco high performance 2000, 3000 and 7200 router family products with redundant power supplies

1.6 Supported Protocols

The network supports the following network protocols, allowing dissimilar platforms to communicate within PAWANET:

TCP/IP:	TCP/IP is the universal protocol that allows communications between all systems within the Port Authority's network, as well as other networks.
IPX/SPX:	This protocol allows communications between all Novell platforms.
SNA/SDLC:	This protocol allows communications between all IBM systems and other systems that support System Network Architecture (SNA).

1.7 PAWANET Switches and Routers

The current standard switches and routers used on PAWANET are:

- Tellabs Reconfigurable Optical Add Drop Multiplexers (ROADMS) are the DWDM nodes on the Verizon Managed IOS Network.

FOR USE IN RFPS

- Cisco High performance 3000, 4000, and 6000 series switches
- Cisco High performance 2000, 3000 series routers for intermediate connectivity.
- Cisco 7200 high performance routers
  Provide high-speed connectivity and routing capabilities across the network in support of TCP/IP, IPX/SPX and bridging functions, and provides routing capabilities for Port Authority Internet access.
- A pair of fault tolerant 10 Gbps links on IOS are established on IOS to provide the required band with between the data centers at Telecenter and PATC.

1.8 Approved Servers

Only IBM File & Print and Application servers may be connected to PAWANET.

This includes turnkey and distributed systems where File & Print or Application servers are used. Any replacement File & Print or Application servers must be IBM servers. Deviation from this policy will not be allowed, without prior approval of the Chief Technology Officer or their designee.

1.9 Enterprise Addressing Scheme (including IP addressing)

The Port Authority's enterprise network is a TCP/IP Class B network allowing for a maximum of 255 subnet assignments. Subnets assigned on a geographical basis according to the number of resources required. Workstations are configured for dynamic assignment of IP addresses via Dynamic Host Configuration Protocol (DHCP).

TSD will assign static IP addresses for servers, printers and faxes that are to be connected to PAWANET.

1.10 Enterprise Network Monitoring Software

The Port Authority has selected Bluewater Network Monitoring Services to continually provide real time monitoring of PAWANET, and its data and voice link availability. To provide for real time network monitoring, the following software utilities are used by Bluewater and the Port Authority, respectively:

- Remedy Network Management software used by Bluewater
- Cisco Works for Switched Internetworks used by Port Authority

2.0 Network Resources

2.1 Network Overview

The Port Authority has a modern distributed computing network, which is managed as an Enterprise resource. The network connects all individual PCs, servers, printers, and other devices in a unified computing infrastructure that makes it possible for the Port Authority to conduct its business.
The Enterprise Network consists of the PAWANET (see Section 1.1) and connected Local Area Networks (LAN's). The line of demarcation between the cable and wiring is the responsibility of the carrier and the Port Authority's area of responsibility is usually a wiring closet. The Port Authority's Enterprise Network consists of the following components on the Port Authority side of demarcation:

Enterprise Devices

- Cabling
- Routers
- Switches
- Wiring Closets
- Communications Equipment Racks
- Server Racks
- File and Print Servers
- Application Servers

FOR USE IN RFPs

- Storage Area Networks (SAN)
- Network Printers
- Security Devices (Video Encoders, IP Cameras, ACS Panels)

LAN Devices

- Desktop PCs
- Workstations
- Voice Over IP Phones
- Laptops
- Video Conference Units
- Local Printers
- Scanners
- Copiers
- PC Peripherals

2.2 Enterprise Network Architecture

The Port Authority operates an extensive network of Enterprise file, print and application servers. These devices are linked to an Enterprise Wide Area Network. The flexibility provided by the use of multiple servers, server clusters and Storage Area Networks (SAN) offers users improved network response, greater reliability, increased data security and reduced operating cost. Adherence to the standards outlined in this section allows the Port Authority to manage their systems, applications and data in a way that best meets our business needs while maintaining interoperability and safeguarding Port Authority's information assets.

2.2.1 Server Operating System and Software

All Enterprise File & Print services in the Port Authority are currently, based on the Windows Operating System. Microsoft Windows, Linux and Sun Solaris are supported as application servers when required for functionality.

In addition to the base operating system, all servers must include the following components:

- Virus Protection (minimum: McAfee Engine 8.5.0i, with current DAT files)
- Network Security
- Remote Monitoring and Management
- Intrusion Detection
- Mainframe Systems Backup (minimum: Upstream 3.5.0c)
- Uninterrupted Power Supply (If central UPS is not installed at the location)
- Current Service Packs and security patches (minimum: SP1)

Note: All operating system and server software shall be provided and configured by the Technology Services Department prior to connection to PAWANET.

2.2.2 Configuration

All network devices--including servers, workstations, network printers, and network faxes--must use IP addresses which conform to the standards outlined in sections, 1.9 Enterprise Addressing Scheme, and 2.3.1, Server Names. System Administrators may refer to the Guide to System Administration for specific instructions on how to install and configure the Windows operating systems.

2.2.2.1 Drive Mapping Conventions and Organization

Mapping of workstation drive pointers to SAN or server disk volumes or folders is accomplished through a Windows Active Directory Login Script or the Microsoft equivalent. The following drive letters are reserved for Windows Active Directory installations:

FOR USE IN RFPS

Pointer	Volume or Folder
M:	Reserved
P:	Public Applications
Q:	Installation and Upgrade Utilities
S:	Departmental shared directories and files
T:	Reserved
U:	Users Private Home Directory

- Public (Shared) application software installed on a file and print server cluster must reside on a separate volume named "APPS".
  Example: P:\APPS
- Each software application installed on the file and print server, or server cluster, must have its own sub-folder.
  Examples: P:\APPS\EXCEL
  P:\APPS\WORD
- Shared Data stored on a file and print server cluster, shall reside in a volume named Data, and shall be mapped to the "S:\" drive pointer.
  Example <Cluster_name>:\DATA\<Department_NAME>\SHARE on a server cluster
- Each Department's SHARE folder will contain at least three sub-folders titled Org, Everyone and Projects.
- Under the Projects folder will be two additional folders, one called "Active" and one called "Completed". Active projects reside in the "Active" folder.
- When staff identifies a project as being completed, the project folder will be moved to the "Completed" folder and all rights, except for "Browse" will be removed from the folder. This will ensure that the final project documents remain unchanged, while still allowing authorized staff to review the old documents and use them as templates for new documents if desired. The "Completed" folder will be set to archive its data.
- Under the "ORG" folder will be subfolders with names corresponding to the various divisions within the department. By default, only staff within a division will have access to a division's folder. These folders are intended to hold data for a specific division that would not normally be shared departmentally. Staff from other divisions would not have access to these folders unless the division manager of the owning division gives their approval. Having folders setup by divisions will simplify the process of identifying who is responsible for the contents of a folder.
- The "S" and "U" drives should only be used to store business related files.
- The Systems Administrator, at the direction of the Director, may from time to time remove any data deemed to be non-business related.
- A folder called "Everyone" will be created in the Share folder. All staff in the department will have full access to this folder to store and retrieve files that are not related to a project or a division's day-to-day operations.
- Additional shared folders, with access restricted to only specific users, if required, will be created in the Share folder. Access will be restricted through the use of Inherited Rights Filters and access will be granted through the use of groups. These groups will be named using the same name as the folder name.
- In general, rights to any folder will be granted through the use of a group having the same name as the folder. The group would have trustee rights to the folder, and users would be added to or

FOR USE IN RFPs

removed from the group as needed. All rights would be granted or revoked through the use of form PA-3624A. Designated staffs in each department are required to approve these requests.

- A user "U" drive will be assigned to each standard Windows Active Directory account for use by each individual user to store business related data on the network. Access to the "U" drive is restricted to the account owner only. Users receive all rights to this folder". Users cannot share data on their "U" drive. Files should be shared only by using the Share, ("S") drive.
- Access to a user's home directory, by anyone other than the owning user is prohibited and will be removed after notifying the end-user.
- Installation files used in the installation of desktop software must reside in a sub-folder under the "APPS" volume

  Example P:\APPS\Psoft

2.2.2.2 Connecting LAN Devices to the Enterprise Network

The Technology Services Department (TSD) is responsible for connecting all LAN devices to the Enterprise Network (PAWANET) provided they meet the Port Authority's standards. The following system components must meet the standards in order to connect department devices:

Type of Device or Software

- Primary Network Operating System (NOS)
- Application Server Operating System
- Network Interface Card (NIC)

2.2.3 Server Network Resources Security

2.2.3.1 Server Physical Security

All servers and communication equipment must be located in locked rooms or secured with a cable and lock with the keyboard secured to prevent tampering and unauthorized usage.

2.2.3.2 Server Logical Security

To safeguard the Port Authority's Information Technology (IT) systems and data, TSD has implemented a number of processes and procedures, including the requirement that all users accessing the Port Authority's networks authenticate to the Microsoft (MS) Windows Active Directory (Active Directory). The Active Directory Service is a database containing descriptions of all network devices including servers, workstations and user accounts.

In plain English, this means that by executing a login when you first power on your PC you are telling the network who you are. This is accomplished by providing your Windows Username and password. Just as you are issued an ID card for access to certain facilities, buildings or rooms you need to visit to perform your job, your Windows authentication grants you access to network resources, such as shared data volumes, software applications and network printers you use in performing your assigned tasks.

TSD, or its contracted vendor, is responsible for providing all enterprise servers with the following protection of their logical resources:

- Guard against unauthorized access.
- Perform daily incremental backups of servers and authorized workstations and full backups weekly.
- Store all monthly backups off site at a secure location and secure daily and weekly backups on-site in a locked area.
- Test recovery procedures annually.

FOR USE IN RFPS

- Use system and application passwords that conform to the Technology Services Department standards.
- Configurations must conform to security parameters identified by NetVision and Quest Intrust Suite software.
- Control all remote access using the Port Authority's Remote Access System.
- Maintain current patch levels and critical security updates.

2.2.4 Network Access and User Account Security

2.2.4.1 Account Creation

User accounts are created and managed in MS Windows Active Directory Services for the Windows network resources. Documentation for the creation of user accounts and authority for access is maintained by the Customer Service Desk Manager.

2.2.4.2 Time Restrictions

Due to the fact that The Port Authority serves its clients 24 hours a day, we do not have Login Time Restrictions on our File & Print servers. All staff may access their account 24 X 7.

2.2.4.3 Concurrent Logins

Login sessions will be limited to one connection per user. User accounts should not have the ability to login to multiple workstations after establishing one active connection to the network.

2.2.4.4 Intruder Detection

These system-monitoring features must be active:

- Restrict the count of incorrect login attempts to three before the account is locked out.
- The time for which unsuccessful login attempts are retained to determine a possible intruder attack should be a minimum of 30 minutes before the counter is reset to zero.
- The time for which a user account remains disabled before the account can be used again should be a minimum of 30 minutes.

2.2.4.5 Passwords

All user accounts must have passwords conforming to the following standards:

- Minimum length is six (6) characters.
- The password should not be easily guessed. It should not be related to one's job and should not be a word in the dictionary or a proper name.
- Should be set to expire at least every 90 days and 30 days for accounts with system or application administrator access
- Grace Logins should be activated and limited to three
- Users should be notified several days in advance of password expiration.
- Users should be forced to change their password on initial login and once it expires.
- Unique passwords should be required when changed. Users should be prevented from reusing a previous password for a minimum of one-year.
- Users should not be permitted to change their passwords more than once a day.
- Passwords should be encrypted in storage.
- Passwords must be entered in a non-display field with a re-enter verify function for new passwords.
- Passwords must not be available on hard copy.
- Passwords used in system startup files and login scripts must be encrypted.
- If an application uses a default password, change it on installation.
- Do not use cyclical passwords, such as the word, February, during the month of February.

FOR USE IN RFPS

- Do not reveal your password to anyone except authorized persons.
- Use both upper and lower case characters and special characters where possible.
- Change password if it has been disclosed or compromised.
- Protect by using a screen saver password with a recommended 15-minute time-out period.
- Passwords should not be the same as the user ID

Passwords are considered confidential data. They protect the Port Authority's network resources and grant system privileges and access. Disclosure may result in unauthorized access to data, system files and transactions. Passwords are also your signature and identify you as the individual who is responsible for the system activity.

2.2.4.6 Modems and Switches

Staff is prohibited from connecting dial-up modems and switches including wireless switches (e.g. Linksys wireless switches) to workstations that are simultaneously connected to PAWANET or another internal communication network unless approved by the Technology Services Department (TSD).

Where modems have been approved, users must not leave modems and/or switches connected to personal computers in auto answer mode, such that they are able to receive in-coming dial-up calls.

2.2.5 Remote Access System

The use of local modems to establish direct dial connections to devices on the Port Authority's network is prohibited. Exceptions to this policy require the approval of the Technology Services Department's Director.

The approved mechanism for remote access to the Port Authority network is through the Remote Access System (RAS). The Remote Access System utilizes an Internet-based Virtual Private Network (VPN) tunnel established over the Internet linking remote users to the Port Authority Wide Area Network (PAWANET) (remote client to PA site). It is designed to provide authorized Port Authority users with secure access to corporate applications and to files available on their departmental file servers. This access to applications and resources is delivered through a thin-client environment consisting of a farm of Citrix MetaFrame/Microsoft Terminal Services servers capable of supporting 200 or more simultaneous users each. There is no provided access to the user's office PC desktop. Port Authority offices without direct connection to the Port Authority Wide Area Network (PAWANET) can use this system to establish remote access to corporate applications located on PAWANET.

RAS provides multiple security mechanisms to ensure that only authorized users gain access to the Port Authority's computing resources and systems. Through multiple security steps, the user must respond to security challenges. After successful authentication verification, authorized users are provided with access to corporate applications and their departmental network resources through the thin-client environment.

The Port Authority also supports corporate site-to-site VPN connections and utilizes Cisco equipment for these connections.

Remote access is authorized on a case-by-case basis by the Chief Technology Officer.

NOT USE IN RFPS

2.2.6 Hardware Standards

The TSD Enterprise Architecture team is responsible for setting the agency hardware standards. As of October 2012, the hardware standards are as follows:

- Desktop, Laptop, CAD* — Lenovo
- High End Multimedia Workstation* — Apple
- Mobile Devices — BlackBerry
- Printers* — Hewlett Packard
- Routers and Switches — Cisco
- Servers* — IBM and NEC
- Smart Devices — iPhone/iPad
- Storage Area Network (SAN) — IBM (Entry Level and Mid-Range)

* Note: To maintain optimal operating efficiency of the computing environment a standard "refresh" age has been adopted. The agency standard refresh age is greater than 5 years. TSD is responsible for the automatic replacement/upgrade of hardware that has exceeded the agency standard age limit.

2.2.6.1 Standard Servers

A representative sample of standard servers is as follows:

Server Description	IBM Model
WEB Server, Small applications server	xSeries 3550M4
Medium applications server	xSeries 3650M4
Database Server, Multiple and Large application server	xSeries 3850M4
Virtual Clusters	NEC Express 5800 series or IBM as stated above

Each server shall have at least three (3) network interface ports to support a production, management and backup network, and redundant power supplies.

The Port Authority manages servers models via a lifecycle process with a minimum 'in service' life of three (3) years.

2.3 Network Naming Conventions

2.3.1 Server Names

The Port Authority employs a naming convention for all servers within PAWANET. That convention will be discussed during a solution implementation phase.

2.4 Directory Services and Structure

The Port Authority uses Windows Active directory to manage network resources and user access. Port Authority departments are designated as organizational units (OU) and servers are network objects contained within the OU.

FOR USE IN RFPS

All network printers should be created using Printer Properties Pro utility.

Applications are distributed using Microsoft System Center Configuration Manager (SCCM).

Applications are distributed based on the type of workstation and user definitions.

Scheduling of distributions is performed in conjunction with client departments.

2.5 System Backup and Recovery

There are two Port Authority approved standard software products, used to perform scheduled server backups:

- **Upstream Reservoir** is a centralized backup tool used to create data backups for all distributed systems.

- **FDR Upstream** is a Mainframe based tool used to backup all Mainframe data.

Backup data is stored on disk storage for prompt backup and restore. Encrypted tape backup is stored remotely at a secure facility, and is required to assure off-site disaster recovery data storage. All backup media and records must be treated with the same level of security and confidentiality as the original data.

The System Administrator is responsible for verifying that system backups, both local and remote backups, can be used to restore the data. Tests of the ability to successfully restore from both backup systems should be performed annually. It is recommended that:

- Tests of the ability to restore system and application files will be performed on a non-production server.
- When incremental or differential backups are routinely used, the test restore procedure should incorporate both.
- Immediately prior to performing the test restore procedure, do a special full backup on the directories being tested.

2.5.1 Backup Logs

The System Administrator will maintain the following logs for a period of two years:

- Back-up activity
- Rotation of back-ups
- Usage/rotation of back-up media
- Off-site data storage

2.5.2 Backup Scheduling

The System Administrator is responsible for performing back-ups of data, application and system files. This must be as follows:

- Weekly full back up of each server. A full back-up is a back up of <u>all</u> files on the server.
- Daily differential, incremental or full back up of each server or server cluster. The type of back-up performed is dependent on time constraints and the amount of data to be backed up. Incremental back ups are back-ups of all files changed since the last back up. Differential back ups are back-ups of all files changed since the last full back-up.
- A Grandfather, Father, Son (GFS) scheme based on a 33 tape rotation should be used to ensure complete back-up and recovery.

FOR USE IN RFPs

2.6 Business Resumption Plan

The vendors, providing IT services to the PA, shall work with the Technology Services Department (TSD) to develop a disaster recovery and contingency plan. The System Administrator will participate in the planning, design, implementation, testing, updating and documentation of the plan. Appendix 1 shows a recommended outline for such a plan. The Business Resumption Plan will be reviewed quarterly and tested at least annually.

2.7 Telecommunications Standards for Enterprise Network Resources

To see the standards and guidelines for the following telecommunications components, please see the Appendix.

Appendix 2 - Communication Rooms/Closets Standards

Appendix 3 - Standard Cabling Schemes

Appendix 4 - Unified Wiring Specifications

Appendix 5 - Telephone Closet / IDF Termination Blocks

Appendix 6 - Workstation Jacks

Appendix 7 - Standard Switches

Appendix 8 - Workstation and Lateral Cable Identification Management

Appendix 9 - Fiber Optics Specifications for Network Services - PAWANET

2.7.1 Closet and Telecommunications Room Access

The following standards must be followed regarding access to closets and communication rooms:

- All telecommunications rooms must be physically secured. Remote locations, which are not secured, by a guard or within line of sight of personnel, must be secured by a card access system and/or video cameras.
- The Network Connections (NC) group is responsible for installing routers, switches (along with Cisco Staff when applied) and station drops. They also patch connections and troubleshoot LAN cabling.
- System Administrators requiring routine maintenance of data communications equipment should call the Customer Support Desk when new devices or reconfigurations are required.

2.7.2 Telecommunications Installation Contractor's Responsibilities

1. Adherence to all of the above specifications
2. Assurance of labor harmony by providing installation technicians whom currently maintains appropriate union membership
3. The contractor must supply all cable, blocks, brackets, connectors, jacks, housings, face plates, special tools, etc., as necessary to perform an installation which is satisfactory to the Port Authority.
4. The contractor must label every workstation (jack faceplate) and the corresponding cross connect point (punch down block or patch panel) in accordance with the cable identification management plan, as previously described.
5. Install all Category 5e cabling in the proper manner, with the appropriate number of twists, to maintain Category 5e integrity and capabilities, as outlined in the TIA/EIA 568-B.2 standard.
6. The contractor must ensure that cable connections are in accordance with

FOR USE IN RFPS

standard telecommunications practices and that all cabling maintains normal connectivity and continuity.

7. All materials must be agreed upon by PA Network Services prior to the start of installation.

8. All computer or network communication rooms and closets are to be isolated, locked, and secured. No other equipment, storage area, or smoking area are to be located in this room. This room must provide appropriate cooling and ventilation. Access to this room will be reserved to TSD staff and an agreed upon Facility Manager or designee of the site where the PAWANET equipment is located. This procedure is to ensure the security and the integrity of the Port Authority's computer network and its users.

2.7.3 Electrical Requirements

The following power and receptacles should be installed to support different equipment requirements such as:

- Standard 110/120 volt power receptacles
- Standard and/or NEMA 5L630P 220/240 volt 30 amp power receptacles
- Dedicated circuit breaker per AC feed, with alternate power source.
- Server rack electrical requirements are specified in the appropriate design document.

Currently, services obtained through the PA's contract are required to have the APC (American Power Conversion) UPS included in the delivered service.

2.7.4 Telephone Company Interface

The following items are needed for the telephone company interface, if needed for a specific vendor solution:

a) Install a dedicated wallboard for Telco demarcs (if none available for implementation)

b) Standard Telco demarcs:

- P66 Block
- Network Termination Unit (Rj48 interface) Smartjacks
- Network Termination Unit (DB15-pin female interface)
- Network Termination Unit (V.35/V.36 female interface)
- Digital Signal X-connect (DSX)
- Basic T1 CSU/DSU
- Basic DS3 handoff coax/HSSI unit
- High-speed dialup modems for network trouble-shooting when needed

2.8 Documentation

It is the responsibility of the System Administrator to update and maintain a library of all documentation designated as standard by the Port Authority. These include archived system files and system backups. Vendors will be provided our "Guide to Systems Administration" during the implementation phase of a project. The "Guide to Systems Administration" covers the provisioning and setup of computing & networking resources to successfully implement a project within the Port Authority.

3.0 Virus Scanning & Management

3.1 Overview

This section describes the standards and guidelines for the prevention, detection and removal of computer viruses, (malware). Its purpose is to minimize the risk and negative impact of computer virus infections in the work environment by establishing clearly defined roles, responsibilities and

FOR USE IN RFPS

procedures for the effective management of computer viruses.

3.2 Standards

Standard virus protection software must be installed on all network servers and personal computers, and updated on a regular basis. The Port Authority currently uses McAfee ePolicy Orchestrator (ePO) v4.5 to monitor, manage and maintain the virus definition (DAT files) of the Agency desktop computing platform. The McAfee ePO Management Agent (v4.6), and VirusScan / AntiSpyware Enterprise (v4.8), are part of the standard desktop core image.

3.3 Acquisition and Installation

The Technology Services Department maintains current versions of standard virus protection software and virus detection files, (DATs), including configuration-specific instructions for downloading and installing the software on network servers and desktops

3.4 Virus Detection and Response

The Port Authority's IT support vendor is responsible for responding to all virus outbreaks, as well as eradicating them and, where possible, preventing them.
The speedy reporting of all computer viruses is essential for the protection of the information stored on Port Authority LANs. Much of that information is important to the safety of the public, as well as the day–to-day business of the PA.
If the anti-virus software has detected a virus and cleaned it, no further action is required on the end user's part. If the virus is not cleaned, or the end-user suspects that a virus still exists, the end-user should immediately contact the Customer Support Desk, and they will work to remove the virus.
The Port Authority IT support vendor will respond quickly to all such alerts by doing the following:

Assess the risk

- Confirm the existence of a virus.
- Take appropriate measures to quarantine the virus so that it does not infect other Port Authority devices.

Notify Appropriate Parties

- Contact the originating party who introduced the virus to the Port Authority.
- If it is a new virus, contact our antivirus vendor, McAfee, for further assistance.

Remove the virus

- Work with appropriate parties until the virus is removed.

In addition, the Port Authority's IT support vendor will report on all such outbreaks on a weekly basis. The report must include:

Support Ticket Number
User Name
Virus Name
Information which was lost, (if any)
Time to correct the problem, (lost staff time)
Virus Origin, (if this can be determined; Diskette, CD, Internet)

4.0 Electronic Mail

4.1 E-Mail Overview

The Port Authority's Electronic Mail System (E-Mail) is designed to facilitate business communication among employees, job shoppers, contractors, consultants, and outside business associates. This E-Mail system is comprised of Microsoft Outlook desktop software accessing e-mail stored on Microsoft Exchange servers. This solution also includes group calendaring and workgroup collaboration.

FOR USE IN RFPS

4.2 E-Mail System Architecture

The Port Authority's E-Mail system is hosted by AT&T Corp, who acquired USinternetworking, a managed application service provider; and consists of Microsoft Exchange servers connected to the Port Authority's enterprise network. Authorized Port Authority staff access their corporate e-mail through Microsoft Outlook desktop software on the network. The system has multiple Exchange servers containing mailboxes and Public Folders. Additional servers host Outlook Web Access, BlackBerry services, and perform Internet-based e-mail services including anti-spam and anti-virus e-mail checking.

The hosted Exchange site is on a Windows resource domain with a one-way trust to the Port Authority's corporate user account Windows domain located on the Port Authority network. This Port Authority Windows domain is used for Windows authentication services when the Outlook client is opened. In addition, the Port Authority hosts DNS servers to satisfy requests from the Outlook client as needed.

High-speed, secure, and redundant network connections connect the AT&T's data center and network to the Port Authority network.

4.3 E-Mail Environment: Design Considerations and Infrastructure

The E-mail environment is further described below:

- The E-Mail system is comprised of Microsoft Outlook 2007 desktop software accessing e-mail (via MAPI mail protocol) stored on several Microsoft Exchange 2007 servers
- E-mail is protected by TrendMicro's InterScan Messaging Security Suite and ScanMail for Microsoft Exchange virus protection software products on the Exchange servers.
- Incoming Internet-based e-mail is also scanned for Spam and for viruses through McAfee (MX Logic), a web-based service provider.
- The servers are currently configured for the following messaging protocols:
  o MAPI (Microsoft's Messaging Mail protocol) and SMTP
- IMAP4 and POP3 mail protocols, NNTP news protocol, and LDAP directory protocol are disabled.
- Front-end Exchange servers running TrendMicro's InterScan Messaging Security System (IMSS) are being used to send and receive Internet SMTP mail. No other mail system connectors (such as Lotus Notes) are in place.
- RIM's BlackBerry Enterprise Server software for Exchange provides wireless e-mail and calendar access to BlackBerry wireless handheld device users.
- There are several forms of SMTP addresses used at the Authority. Exchange Active Sync is used to provide email and calendar access to Apple iPads/iPhones and Windows Mobile devices.
- Exceptions are governed by the Authority's directory services structure and user account requirements.
- Each individual e-mail message and its file attachments have a combined limit of 10MB.
- Each regular user mailbox has the following size limits:
- 80 MB - user receives warning notice
- 90 MB - user is prohibited from sending
- 100 MB - user is prohibited from sending or receiving
- Other mailbox sizes exist on an exception basis.
- This E-Mail system also includes group calendaring and workgroup collaboration.
- Public Folders are supported based on departmental and agency-wide requirements and, in general, are used for dynamic items for a form of workgroup collaboration. Static documents like corporate

FOR RFP TEMPLATE

policy statements are placed on the corporate intranet (EmployeeNet) and not on the Public Folders. Documents requiring long-term storage are stored elsewhere such as on Windows file servers.

4.4 Integrating Applications Server with Port Authority Email System

4.4.1 Requesting SMTP Services

The vendor will request SMTP services from and coordinate its work with the Technology Services Department

Port 25 needs to be available to utilize it for SMTP services.

4.4.2 Email Restrictions

The following restrictions are in place to protect the SMTP system and the "reputation" of Agency mail servers on the Internet:

- Forged email headers are STRONGLY discouraged, but applications for circumvention will be entertained, and valid business justifications must be included. The "From" and "Reply-to" fields should be valid users on the system sending email.
- Settings: The maximum number of recipients per email is currently 90. This includes "To", "cc", and "bcc"; maximum size with attachments is 10MB. Emails that do not conform to these restrictions will be rejected by the SMTP servers.
- Mail will be relayed only if your server has an entry in the SMTP access database.

Note: SMTP logs are checked periodically for policy violations. Repeated violations and failure to correct them will result in SMTP services being disabled for the offending system.

5.0 Intranet

5.1 Intranet Overview

The Port Authority EmployeeNet (eNet) is intended to provide timely information and resources to employees via the web browser on their desktops. eNet is a decentralized collection of web pages, data lookup services and applications that are managed as if they were a centralized enterprise resource. It is accessible to all personal computer workstations on the Port Authority Wide-Area Network (PAWANET). eNet is housed on servers at the Teleport.
Examples of business information hosted on eNet include:

Departmental Websites
Directories
Corporate Announcements
Reference Materials
Document Collections
Library Services
News Displays
Enterprise and Departmental Applications

5.2 Direction of eNet Development

eNet is intended to provide a convenient, timely and accurate source of information for Port Authority employees as well as providing access to enterprise and departmental applications. The

FOR USE IN RFPS

owner of content on eNet is responsible for authorizing its publication, its accuracy and timeliness. Technology Services provides a common infrastructure and technical support for those departments that electronically publish agency information or make available electronic resources. Infrastructure standards and guidelines are recommended to ensure compatibility and facilitate maintenance. Departments requesting specific applications should discuss their requirements with eNet staff to determine a solution that best meets the department's business needs.

5.3 eNet Software Infrastructure Standards & Guidelines

Category	Software Name	Minimum Version
Browser:	Microsoft Internet Explorer	7.0
Browser Plug-in:	Windows Media Player	10.0
	Adobe Acrobat Reader	9.0
	Macromedia Shockwave Player	9.0
Web Server Software:	Sun One Web Server	6.1
	Microsoft IIS	5.0
Media Server Software	Microsoft Media Server	9.0
Application Server Software:	Adobe Cold Fusion 9	7.0
Development and Design Tools:	Adobe CS5	11.0
Database	Oracle Database	9i
	MS SQL Server	2008
	MS Access	2007
Programming Language/Scripts	ColdFusion MX Java PERL for Windows JavaScript	7.0 6.0 5.0 1.0
Search Engine Software:	UltraSeek	5.7
Web Performance Monitoring:	WebTrends Marketing Lab 2	2.0

FOR USE IN RFPS

Category	Software Name	Minimum Version
Content Management:	Stellent	7.5
	Open Text Website Management	10.1

5.3.1 Design Guidelines

We have developed the following guidelines to ensure that all web pages on eNet have a consistent look, feel and navigation scheme, while providing creative flexibility.

Departmental Web Site Standards and Guidelines

Prescribed standards are assigned to only the following items:

Resolution:	Pages are designed for optimal viewing at the 1024x768 setting.
Page Width:	Each page has a fixed page width of 960 pixels.
Page Justification:	The entire page is center-justified within the browser window.
Page Layout:	Each web page will follow the same, basic layout: A Global Navigation strip; A Masthead; A Local Navigation strip; A Body area (with a 1-column, 2-column or 3-column layout); A Footer.

5.3.2 Accessibility Guidelines

TSD's eBusiness Unit is committed to making all eNet content accessible to persons with disabilities. In order to ensure that all eNet web content is in compliance with accessibility guidelines and applicable legal requirements, contact the Webmaster via email at webmaster@panynj.gov, or call 212-435-3294.

6.0 Workstation Hardware and Operating System Software

6.1 Overview

The Port Authority makes extensive use of computers (workstations) networked into an Enterprise Wide Area Network to accomplish its business objectives. For the purpose of this section, the term computer and/or workstation will be used to reference desktop, laptop and CAD computing devices. In order to ensure compatibility with the agency's enterprise network and to make optimal use of its resources, this section defines the standards governing workstations and their configuration and use.

6.2 Workstation Operating System Standard

The Port Authority's standard operating system for workstations is Microsoft's Windows XP Professional. . The following are operating systems used within the Agency:

- Microsoft Windows XP SP3
- Microsoft Windows 7
- Apple OS X

FOR USE IN RFPs

6.3 Workstation Configuration

6.3.1 Workstation Naming Conventions

All departmental workstations must contain a unique computer name which is the machine's serial number.

Example: Workstation name: 23AAH86

System Administrators are responsible for naming workstations and maintaining an up- to-date inventory of equipment and names used.

6.3.2 Automated Software Distribution for Computers

The Port Authority currently uses Microsoft System Center Configuration Manager (SCCM) 2012 to, at a minimum, do the following:

- Install new, or upgrade existing, software on Agency desktop, laptop, and CAD computers.
- Create packages to automate system tasks (e.g. data migrations of desktop computers, eDiscovery requests, etc.).
- Bare Metal Provisioning of Servers.

6.3.3 Remote Workstation Management

The Port Authority also distributes software applications and upgrades via Novell's ZENworks. Each workstation should have Novell's Workstation Management module installed as part of the NetWare workstation client. This will enable remote distribution and updates of software, hardware inventory and workstation troubleshooting.

6.3.4 Drive Mappings

Computer drive mappings are automatically accomplished using a Microsoft login script. The script is executed upon successful login to the Agency's Microsoft domain.

FOR USE IN RFPS

6.3.5 Standard Workstation Hardware Configurations

There are standard configurations established for workstations and laptops. The standards specify the product approved for the following devices: processor, memory, storage, CD/DVD-ROM/multimedia and monitor. The following is current workstation standard:

Lenovo ThinkStation D30 4223-CC9 - Custom PA configuration based on Lenovo Model 4223-69U; (1) Intel Xeon E5-2650 2.0Ghz 8core – (2) x 8GB RAM - (2) 500GB SATA HDD - NVIDIA Quadro 4000 2GB - Windows 7 Professional x64.
Lenovo ThinkPad T430 2347-EZ4 - Custom PA configuration based on Lenovo Model 2347-G6U; i5-3320M, (2) x 4GB RAM, 14.0" High Definition+ Wide Screen Display, 720p Camera, 500GB 7200rpm Hard Drive, Backlit Keyboard-None, Intel 6205 PCIe mini card, PCIe WWAN upg, Finger Print Reader, Blue Tooth, Battery Cells 9, Intel vPro, Windows 7 Professional x64.
Lenovo ThinkCentre M92p 3212-C14 - Tower - Custom PA configuration based on Lenovo Model 3212-C7U; 4x5 i5-3550, (2) x 4GB RAM 1600MHz, 250GB 7200 rpm hard drive, Bay DVD±RW, Media Reader-None, High Definition 2500 Graphics Card, Display Port Dongle-None, Chassis Intrusion Switch-None, Energy Star 5.2, Intel vPro, Global Program-None, Windows 7 Professional x64.
MONITORS
NEC AccuSync AS191WM-BK Flat Panel display- TFT-19 " widescreen1440 x 900 /250 cd/m2 1000:1 5ms 56 - 75 Hz Analog RGB 0.7 Vp-p/75 Ohms DVI-D and VGA 15-pin D-Sub
NEC MultiSync EA243WM-BK - LED monitor - 24" - 1920 x 1200 - TN - 250 cd/m2 - 1000:1 - 25000:1 (dynamic) - 5 ms - HDMI, DVI-D, VGA, DisplayPort - speakers - black

6.3.6 Standard Workstation Software

The following software is the standard Port Authority software for departmental workstations. New computer installations should conform to the existing standard.

6.3.6.1 Standard Workstation Software

The following list is a compilation of the core software components found on the computer Arc Build (commonly referred to as an image).

Windows XP, Professional Edition
Lumension Patchlink
System Center Configuration Manager - SCCM
McAfee Antivirus
Internet Explorer
Microsoft Office Professional

Because technology is rapidly changing, TSD should be consulted to obtain the most recent versions of standard software.

6.3.7 Enterprise Software

The following is a list of standard enterprise application software used in the Agency. The applications supported by third party service providers are: PeopleSoft, SAP and Livelink Content Management

6.3.8 Other Business Applications

Other Enterprise applications are deployed on occasion to user workstations. This includes systems like the Business Expenses system, (BEAM) and BudgetPro. System Administrators are responsible for deploying the workstation clients and network server software according to standards and guidelines provided by the Technology Services Department.

Current list of Enterprise applications, is shown below –

AutoCAD	Oracle
BudgetPRO	PeopleSoft
Cognos Client Software	Primavera
Livelink	SAP
Microsoft Server	Schedulesoft
MS SQL	TRIM

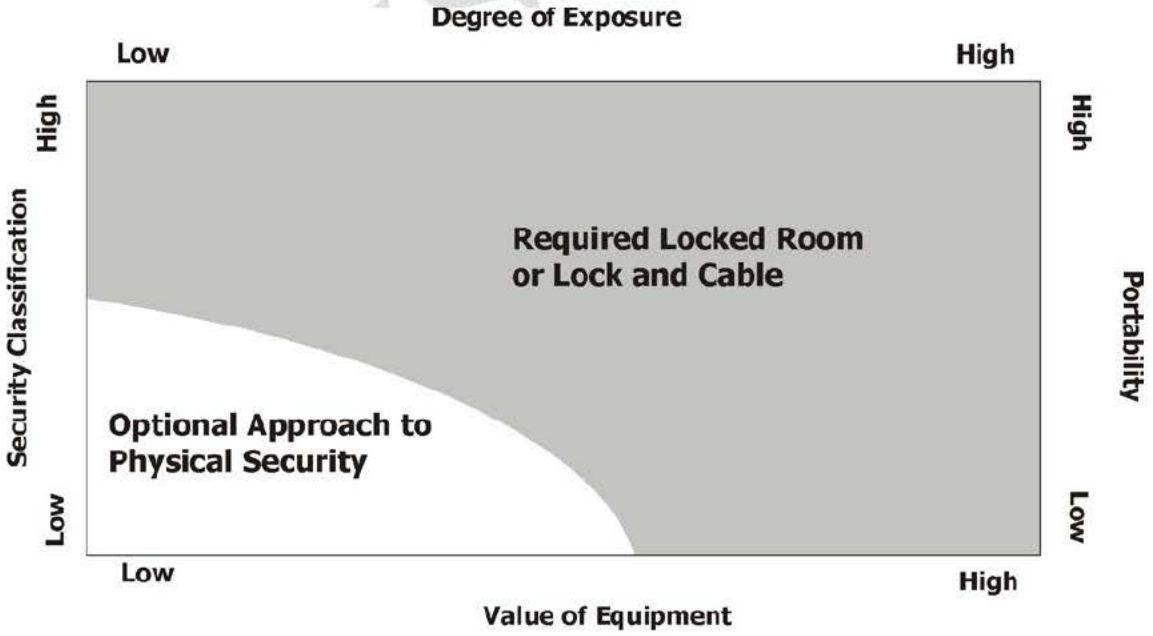
6.4 Workstation Security

Workstation users and their managers are responsible for the security of computer equipment and safeguarding critical corporate data and access to Port Authority network resources. This includes both the physical securing of equipment as well as logical safeguarding equipment and data.

6.4.1 Physical Security

The method of control should be based on the value of the equipment, the sensitivity of the data, its portability and the degree of exposure to theft. The department's Business Manager should make the appropriate determination of physical security required based on their best business judgment.

The graph below provides general guidance to Business Managers in determining the level of physical security required.



In all cases, laptops must be secured with a Lock/Cable product (e.g., Kensington).

6.4.2 Logical Security

The Technology Services Department (TSD) is responsible for providing for the security of computer resources and devices:

- Workstations are protected with Novell and Microsoft directory security mechanisms.
- Screen saver passwords are implemented with a maximum of a fifteen (15) minute time-out.
- All critical data are backed up nightly onto either external media or a network drive.

7.0 Distributed Systems Environment

7.1 Overview

A number of enterprise servers provide critical application and system services. Different operating systems and configurations may be required for specific applications. This section provides information on the standards and guidelines for supported systems within the Port Authority.

7.2 Microsoft Windows Servers

The standard for general-purpose application servers and File and Print Computing is IBM servers. Microsoft Windows 2003 & 2008 Server (Enterprise) are supported Operating Systems for application servers.

7.2.1 Virtual Environment

The standard for Virtualization Computing is both IBM and NEC FT host servers. The Port Authority will provide a VMware ESX-based Guest Virtual Machine (VM) to operate all Contractor-provided applications software on one of the above host computing platforms depending on the critical nature of the application.

All applications software shall be capable of operating in a virtual environment under VMware ESX server and shall operate in a VMware ESX-based Guest Virtual Machine (VM) on a 'shared' host-computing platform for Contractor application, unless performance or other requirements mandate a dedicated system.

7.2.2 Windows Data Encryption

For those applications that require additional data security measures, TSD offers additional tools that provide encryption services to protect the data stored in the application's database, even from authorized individuals that have physical access to the applications and database servers but not the decryption key.

7.3 Unix

Sun/Oracle Solaris is the currently supported UNIX operating system for infrastructure (e.g., SMTP services) and corporate servers. RedHat Enterprise Linux Server is the supported operating system for infrastructure and corporate servers (e.g., SAP, Peoplesoft).

7.3.1 Unix Security

Unix and Linux servers must be physically and logically secured from unauthorized access. Operating system logical security is defined by the Technology Services Department (TSD).

7.3.2 Backup

Critical system backup must be performed regularly (daily and/or weekly) utilizing our centralized backup strategy and associated tools. Extra copy of backup is kept offsite for disaster recovery purposes if required.

7.3.3 Download Scripts in the Unix/Linux Environment

- The script must be written in a generally supported language: Perl, Korn shell and Powershell. Powershell should be consistent with Microsoft standards and best practices.

FOR USE IN REPS

- The script must be limited in access, as well as the script's owner's user account. The owner of the script should be able to read, edit, and execute the script, but no one else (with the exception of the root or administrator accounts).
- If the content being downloaded is public information or widely available on the Internet, File Transfer Protocol (FTP) may be used.
- For all other content, Secure FTP must be used, and a key exchange made with the entity who is providing the content. A username and password must be used when retrieving the content.
- If the entity cannot accommodate the use of SFTP, ftp may be used as long as the content is encrypted with a secure, widely used utility like PGP.
- Information and guidance on securing passwords should follow Recommendations of the National Institute of Standards and Technology.

7.4 z/OS

z/OS (currently release 1.5) is the IBM-supplied operating system on the IBM 2096-R07. This hardware/software supports multiple users and multiple applications. Provided on this platform for transaction-processing applications are TSO/E, ISPF, and CICS. The database is DB2, although other file structures are also supported.

7.4.1 Databases

Oracle 10.2.0.5 or higher and MS/SQL 2005 Server or higher are the supported database platforms for Port Authority systems. Auditing trail enabled for all database accounts with administrator privileges.

7.4.2 Geospatial Databases

This GIS environment is built on an ESRI platform using ArcSDE for the spatial database. ArcGIS Server 10 and ArcSDE Version 10 are the supported platforms for the current GIS environment.

7.5 Application Security

TSD recognizes the critical importance of application security and maintains a Best Practices document containing rules and recommendations for purchased applications, and those developed in-house.

7.6 Server Physical Security

All servers and communication equipment must be located in locked rooms or secured with a cable and lock with the keyboard secured to prevent tampering and unauthorized usage. The Business System Manager is responsible for determining the appropriate access control method (receptionist, metal key lock, magnetic card door locks, etc.) This person must also maintain a list of persons authorized to enter secured areas. Technology Services Department staff is available to provide technical assistance in making this determination.

7.7 Load Balancing – Failover Architecture

Depending on the requirements of the application, load balancing and failover architectures are supported.

8.0 Vendor Provided Dedicated Systems

8.1 Overview

Vendor Provided Dedicated Systems refers to the application software and possibly the computer hardware that may be furnished and/or installed by an outside contractor. These systems are usually procured through either a Request for Proposal (RFP), or a "Low Bid" contract and are

FOR USE IN RFPS

specifically engineered to support a dedicated application.

These systems generally support Capital Projects, which are usually large scale, multi-year engagements, requiring specialized technical and management staff, as well as, Systems Integration support. These projects normally have significant construction components and require the coordination, design and support from many diverse Engineering and Technology disciplines.

On all technology related projects a representative from the Technology Services Department (TSD) provides a single point of contact for technology oversight, accountability, adhering to standards and systems integration, which is required under the Roles and Responsibilities of the Director and is expected by our client departments.

To ensure a successful project implementation and honoring our responsibility to the Agency and our customers, one of the steps undertaken by TSD is to provide guidance and focus attention on, adherence to and compliance with the Port Authority Technology Standards and Guidelines.

By following the Standards and Guidelines, it enables the Port Authority to

- Leverage large discounts negotiated in the various requirements contracts.
- Ensure that the seamless integration of equipment with other existing systems.
- Ensure that long-term maintenance and systems administration contracts are focused on the same product lines.
- Ensure that the relevant sections of the Standards and Guidelines are included in either, the basic design of a low bid contract or as requirements in an RFP. Responses to RFP's shall be reviewed for their compliance with the Standards and Guidelines.
- Deployment, integration and testing shall be monitored by TSD to ensure that equipment or infrastructure is not duplicated, that the integration and migration plan will not adversely affect existing systems, and to integrate new systems under existing maintenance contracts where applicable.

In cases where a specific vendor or system is so specialized that it normally does not adhere to the hardware, software, infrastructure and operations guidelines of the Standards and Guidelines, the vendor shall be directed to work with TSD in exploring all options. If an exception is required, the vendor should work with TSD to prepare the necessary business case scenarios to receive written concurrence from the Director for this deviation from the Port Authority Technology Standards and Guidelines.

8.2 Physical Security Technology Standards

8.2.1 Agency Standard for Digital Video Recording, Access Control and Alarm Monitoring

Based upon the Agency's investment and positive experience with Lenel's Systems Onguard access control and alarm monitoring application offering as well as Verint Nextiva, CCTV and Digital Video recording technologies, these product sets are the Agency's standard. Below is a description of when these standards apply.

The Port Authority has long recognized the need for a corporate architecture for its security systems that would allow us to integrate digital video and access control recording compatible technologies agency-wide. Using these standards will improve the Agency's security posture and will permit us to leverage additional operations and business benefits while keeping our operations resources, maintenance and support costs at a minimum.

The standard will also improve:

- Access to and the sharing of information from a centralized location
- Centralized monitoring of all facilities from an Emergency Operations Center
- The operational and cost-effectiveness of adding a variety of modular features to the core systems, such as paging, e-mail, fire systems, facility management, etc.
- Alarm notification, response, and acknowledgement
- Operational flexibility for facility and Public Safety staff
- Single learning curve

- Reduce the cost for maintenance and system administration

Guidelines for using the Verint Nextiva standard include:

1. If the CCTV system needs to be recorded
2. When an existing system is in place, at a PA facility or at a tenant facility that is monitored/reviewed by PA personnel, and needs to be upgraded or expanded to accommodate a particular project.
3. When rule based intelligence is to be added like motion detection and other related algorithm processes, all efforts should be made to ensure compatibility, functionality, maintainability (version upgrade resiliency) with the existing Verint system.
4. If WEB based video needs to be made available
5. When monitoring at remote locations is needed to view on site operations and archived events via the corporate WAN
6. When live video monitoring is required
7. When distributed recording is required i.e. at multiple locations, concurrently
8. When network transport (communication) medium has limited bandwidth and the video needs to be sent to designated workstations on the network. All network transport tasks and bandwidth planning is required to be discussed with Technology Services Department before proposing any solutions
9. On all new projects where Verint Nextive is the current site base system
10. When the Office of Emergency Management (OEM) department needs override capabilities in the event of an emergency
11. If third party technology (non-Verint supplied) is required to be integrated with the current Verint system at a facility, that technology must be compatible with the existing Verint system at the particular facility. Any third party integrations need to be reviewed and approved by the Technology Services Department and be approved for use by the manufacturer (Verint) for the software version in production at the facility. When a (Verint) software upgrade is required in order to deploy a third party interface, that upgrade will have to be coordinated through TSD, the facility, and the appropriate contractors(s).
12. Any server or workstation supplied in conjunction with a particular system must comply with the hardware and software requirements of both the Port Authority and the manufacturer of the video management software.
    For more information regarding CCTV standards, reference the CCTV Standards and Guidelines documentation.

Guidelines for using the Lenel OnGuard standard include:

1. All new or upgrade projects that require electronic card access and / or alarm monitoring
2. All projects that will have security that needs to be monitored by PA personnel or contractors (airports are monitored by contractors)
3. All new projects where Lenel OnGuard is the site base system currently
4. Where access is required to work with ID cards that exist and are compatible with the agency standard
5. When the OEM department needs override capabilities in the event of an emergency
6. If third party technology (non-Lenel supplied) is required to be integrated with the current Verint system at a facility, that technology must be compatible with the existing Verint system. Any third party integrations need to be reviewed and approved by the Technology Services Department and be approved for use by the manufacturer (Lenel) for the software version in production at the facility. When Lenel software upgrade is required in order to deploy a third party interface, that upgrade shall have to be coordinated through TSD, the facility and the appropriate contractor(s).
7. Any expansion of card access systems (added card readers, sensors, etc.) need to be reviewed and approved by the Technology Services Department to ensure that the new devices meet the agency standards for card access(including but not limited to: card formats, badge layouts, encryption algorithms, etc.)
8. Any server or workstation hardware required in conjunction with a specific system must be provided by the Technology Services Department.

Currently the Access Control Task Force is working on the Access Control Standards for the Agency. The work is tentatively scheduled to complete by year-end 2013. The Access Control Standards documentation will be available upon completion.

8.2.2 Situational Awareness Platform Software

The Situational Awareness Platform Software (SAPS), is a software application that allows multiple, independently manufactured and installed security, life safety, and building systems to all interoperate under a single, common operating picture, giving a user access to information spreading across multiple systems as if they were all one single system. This "common view" is made even more valuable by the incorporation of powerful, rules-based tools within the SAPS system, which allows intelligent linking of seemingly unrelated events into "Situations" that represent patterns of activity that pose a threat to security or site-wide operations.

The SAPS objective is to monitor the identity and event data from the various systems, identify incidents and anomalies, and detect trends that could be a threat to our facilities. SAPS turns data into actionable intelligence when an incident is detected. SAPS have the capability to automatically alert the security operations staff and push the information to security control centers and first responders.

- Provide a software platform to enable integrating the various electronic systems across all agency sites
- Provide a single software perform solution for situational awareness.
- Provide a single system database for reports
- The SAPS will provide transparent notification of security related events for all agency security systems.

8.3 Communications Infrastructure Standards

The Port Authority Standard for Communications Infrastructure is Cisco. This applies to all future systems, as well as, upgrades to existing systems. This standard ensures the interoperability of all deployed systems and permits the full integration of systems into PAWANET. In addition, all Cisco equipment either designed in a low bid contract or specified in an RFP must be purchased through the Cisco Requirements contract, which is administered by TSD and permits the Agency to purchase equipment, maintenance and support services under the high discounts negotiated in the Requirements Contract.

This standard applies but is not limited to; Layer 2 and 3 Ethernet switches, Routers, Wireless Access Points (WAP), Mobile Access Routers (MAR), GIG E (Gigabit Ethernet) switching and networking and SONET (Synchronous Optical NETwork) equipment. Deviation from this standard requires the written consent of the Director.

8.4 Server Infrastructure Standard

The Port Authority's standard platform for File & Print and Application servers is IBM.

Technology Services has contracted discounted pricing with our service provider for its servers and hardware support. In order for the agency to take full advantage of these savings, any new Application servers or File & Print servers must be built using IBM hardware purchased by TSD. This includes turnkey and distributed systems where File & Print or Application servers are specified in the design. Any replacement File & Print or Application servers must be IBM servers. Deviation from this policy will not be allowed without prior approval of the Director or his designee.

9.0 Wireless Technologies

9.1 Wireless Guidelines

9.1.1 Purpose and Scope

This section references the standard policies and procedures for all wireless devices and

FOR USE IN RFPS

technologies including voice and data capabilities that store, process, transmit or access data. This includes but is not limited to commercial and unlicensed wireless networks and laptops, cellular devices, scanning devices, messaging devices (email devices) and PDAs.

9.1.2 General Policy

Employees will only use PA owned wireless devices to store, process, transmit or access PA data. The following must be considered:

- Wireless Technologies Vulnerabilities Protection
- Minimum Requirements
- Identification and authentication at both the device and network level.
- Confidentiality encryption of data transmitted is required.
- Data end-to-end over an assured channel (a communication link with security protocol such as Secured Sockets Layer).
- At the device level, implement file system encryption where applicable.
- Devices should not be connected to PA systems for data synchronization, data transfer, or any other purpose without virus protection, mobile code restrictions (executable information delivered to information system and directly executed on any architecture that has appropriate host execution environment) and other preventative measures.

9.1.3 Personal Area Networks - PAN

PAN technologies should not be used for transmitting information without encryption.

Bluetooth security alone is unacceptable because it is not encrypted and does not use Federal Information Processing Standardization (FIPS) 140-1/2.

Wireless devices should be procured without Bluetooth embedded transmitters, when not possible transmitter should be disabled.

9.1.4 Wireless Local Area Networks – WLANs

9.1.4.1 Overview

Business requirements have arisen throughout various Port Authority locations for the improved use of Wireless LAN technology to facilitate local user mobility. Research performed on the different technologies support the use of Cisco as opposed to various wireless vendors in an attempt to produce a standard that will provide the agency with a secure, robust and scalable solution as WLAN's continue to grow within the agency.

In summary, the current Port Authority Wireless LAN standards are based upon IEEE 802.11n draft 2.0 technologies. (802.11n is backwards-compatible with existing 802.11a/b/g network adapters.)

The physical infrastructure is now based upon a centralized WLAN architecture that relies upon Cisco wireless bridges, access points, mesh routers and newly implemented controllers. WLAN's should be standardizing on the 4404 and 4402 controllers at this time as described further in this document.

Wireless LAN technology is continually developing with rapidly evolving industry standards, government regulations, and vendor products. As a result, the WLAN Standard presented in this document will likely be superseded in the future as the technology and products change.

9.2 Scope

The scope of this document shall present some standards for the Agency Wireless LAN and the specification of all devices and configurations.

FOR USE IN RFPS

9.3 Principles

At the highest level, the principles for the Wireless Standard are based upon the following attributes:

- Security - use of strong encryption (e.g. WPA-TKIP / WPA2- AES) for use as authentication of all traffic on a port-to-port basis, with the use of credentials stored on a back-end RADIUS server utilizing key distribution.
- Scalability - with LWAPP access points & use of LWAPP tunnels
- Reliability - via authentication of users to the networking enterprise mode.
- Manageability - via secured ports and VPN / FW access.

9.4 Compliance Requirements

All specifications defined in this document may be effective upon approval of and complete concurrence with TSD's Director, to update wireless standards and policies as per IEEE and Wi-Fi Alliance Standards

9.5 Device Specifications

The following sections will provide the various hardware components, and related firmware versions, that are specified for use in the Port Authority's WLAN solution.

9.5.1 Access Point (AP) Standard

Standards Details:

- 3600 AP's are the agency standard for WLAN deployment. These AP's have 802.11n 2.0 radios. Backward compatible to 802.11 a/b/g.
- 1310 AP/ Bridge is certified for use in unique situations where both internal and external antennae are supported. The major distinction is that of a more rugged chassis designed for higher-stress outdoor-type conditions. 3250 mobile routers for mesh deployments.
- AP Deployments will be Lightweight Access Point (LWAP)
- AP Standard Summary:
  a) Two cables per pull during wiring for wired to wireless.
  b) AP's & controller placements via RF propagation results.
  c) PA supported standard AP's need to be verified with TSD
  d) If wireless is primary connection-'load-balance' AP' cabling connection to two different network switches
- WLAN Controller Standard
  This standard is in the process of being upgraded to Network Control System (NCS) & Identity Services Engine (ISE) Appliance to accommodate more advanced wireless deployments.

- **Best Practice**

The following information is industry best practices for wireless hardware implementation agency-wide deployments, not for wireless device configuration practices.

WLAN Best Practices Add-ons:

1. Ensure that the PA maintains an up-to-date wireless hardware inventory.
2. Identify rogue wireless devices via wireless intrusion prevention systems (IPS)
3. Enable automatic alerts on the wireless IPS
4. Perform stateful inspection of connections.
5. Augment the firewall with a wireless IPS
6. Mount AP in location that do not permit easy physical access
7. Secure handheld devices with strong passwords
8. Enable WPA and WPA2 under ENTERPRISE mode
9. Synchronize the AP's clocks to match networking equipment.

FOR ISLN RFPS

10. Manage remote physical locations of all access points which support an isolated network that needs access to PAWANET for server farms and internet access.
11. Maintain cryptographic strength range from 128-bits to 256-bits with matching symmetric algorithms AES-128 to AES-256

Wireless Control System (WCS):

1. Single license
2. Secure "WIRELESS LOCATION APPLIANCE" with real-time client tracking & RF fingerprinting
3. Secure Windows-Based deployment as minimum, for example, windows server 2003; intel dual-core; 3.2 GHz; 4-GB RAM; 80-GB hard drive; IPS devices; IOS firewall routing; HTTP port 80; HTTPS port 443.
4. Multi-homed server (i.e., two NIC cards)
5. Secure WCS and IIS (i.e ,internet information service), installation sequence
6. Create configuration group (configurate multiple controllers)
7. Secure auto provisioning with filtering
8. Secure WCS with RF modeling for heat map planning
9. Secure 15 second alarm summary refresh

9.1.5 Portable Electronic Devices (PEDs) – Cell Phones, PDAs, messaging devices, laptops and tablets

If a device receives information via a wireless technology, and that device allows that information to be placed directly into the corporate network at the workstation level, then all perimeters and host-based security devices have been bypassed. Therefore, the following procedures apply:

- PEDs connected directly to a PA wired network via a hot sync connection to a workstation shall not be permitted to operate wirelessly at the same time. Wireless solutions could create backgrounds into corporate networks.
- IR, Bluetooth and 802.11 peer to peer should be set to "off" as the default setting. Mobile code should be downloaded only from trusted sources over assured channels.
- Anti-virus software should be on devices and workstations that are used to synchronize/transmit data, if available. Where not available on a device, you need to disable the synchronization capability or provide server or workstation based handheld anti-virus protection.
- PEDs are easily lost or stolen therefore approved file system/data store encryption software should be installed.
- PEDs need to be capable of being erased or overwritten to protect data. If the device is no longer needed and cannot be erased or overwritten, it must be physically destroyed.

9.1.6 Cellular and Wireless Email

Cellular and wireless email devices are subject to several vulnerabilities (e.g. interception, scanning, remote command to transmit mode, etc). Therefore, the following procedures apply:

- These devices are not to be allowed into an area where classified information is being discussed unless it is rendered completely inoperable.
- Must have end-to-end encryption.
- PC based redirectors are not allowed as it requires the PC to be active at all times only server based redirectors should be used.
- Electromagnetic sensing shall be periodically performed to detect unauthorized LANs, Bluetooth transmitters etc.

9.1.7 Synchronization

Some synchronism systems will operate even if the workstation is locked and the wireless or handheld device is not registered with the sync application on the workstation. As long as the workstation is on, the user is logged on, the data application client (e.g. MS Outlook) is active, and the "hot sync" cable is attached to the workstation; any person can place a compatible wireless or

FOR USE IN RFPS

handheld device in the "hot sync" cradle and download data. Therefore, the following procedures apply:

- "Hot sync" cable or cradle has significant security risks, therefore perform "hot sync", and then remove immediately once "hot sync" operation is complete.
- Secure "hot sync" cables and cradles.
- Use only PA approved third party sync access control software installed on all workstations.
- PA owned devices may only be synchronized with PA owned computer systems

9.1.8 Responsibilities of Technology Services Department

- Monitor and provide oversight of all PA wireless activities, insure interoperability of wireless capabilities across the agency.
- Develop appropriate technical standards and guidelines for secure wireless and handheld solutions.
- Establish a formal coordination process to ensure protection of PA information with PA information systems employing wireless technologies.
- Review and evaluate wireless technologies, products, solutions that meet PA requirements.
- Identify approved monitoring mechanisms for wireless devices to ensure compliance with policy.
- Periodically review approved wireless technology standards and procedures to ensure products and solutions remain compliant.
- Support risk management activities associated with evaluating wireless services
- Act as central coordination point and final approval authority for any exceptions to this policy.
- Define or approve acceptable wireless devices, products, services and usage.
- Provide immediate consultation to PA units.

9.1.9 Responsibilities of Technology Services Voice Networks Group

- Adhere to wireless procedures and standards, establish procedure for reviewing and approving requests for using wireless devices to store, process, or transmit information.
- Establish procedures for periodically reviewing approved wireless devices and services to ensure that the business requirement for device/service/system is still valid and meet current PA guidance.
- Establish procedures for inventory and control of wireless devices and equipment.
- Establish procedures and implementation plans for auditing wireless connections to the network.
- Provide user training.

9.1.10 Responsibilities of Wireless and Handheld Device Users

- Coordinate all requests through Technology Services Department…
- Read and follow standards and guidelines.
- Access information systems using only approved wireless hardware, software, solutions and connections.
- Take appropriate measures to protect information, network access, passwords and equipment.
- Use approved password policy and bypass automatic password saving features.
- Use extreme caution when accessing PA information in open areas where non-authorized persons may see PA info (airport lounge, hotel lobby).
- Protect PA equipment and information from loss or theft at all times, especially when traveling.
- Keep current anti-virus software on devices.
- Use appropriate Internet behavior (e.g. approved downloads).
- Exercise good judgments in efficient cooperative uses of these resources and comply with

FOR USE IN REPS

current and future standards of acceptable use and conduct at all times.

- Report any misuse of wireless devices, services or systems to management.

9.2 Paging Device Policy

9.2.1 Policy

The Port Authority obtains its paging services under governmental contracts. All orders for paging service or equipment must be placed under these contracts. If the contract service provider cannot meet the paging requirements, a memorandum requesting approval to obtain paging service outside of the contract's must be sent to the Director.

9.3 Cellular Phone & Wireless Modem Policy and Procedures

9.3.1 Policy

The Port Authority obtains cellular service under governmental contracts. All orders for cellular service or equipment must be placed under these contracts. If the contract service provider cannot meet the requirements, a memorandum requesting approval to obtain cellular service outside of the contracts must be sent to the Director.

9.4 Technology Services Mobile Device (Windows Mobile and Apple) Policy

9.4.1 Introduction

Mobile devices are a class of handheld computers that currently offer limited functionality with compact size and portability. Mobile devices are designed to replace the paper organizer; functionality typically includes maintaining a date book, address list, to-do lists, email, etc. Additional functionality such as Word and Excel are already included in many Mobile devices, with further enhancements predicted.

In order to better serve the PA, and to limit the expense of supporting a wide variety of Mobile device hardware and software, Technology Services will support the use of the Windows and Apple IOS based devices.

With a Mobile device, a user can maintain their calendar, address book, to-do list, and e-mail on a platform that is very portable and easy to use. Integration with Outlook makes it possible for users to keep identical, synchronized copies of data on both the desktop application and the Mobile devices.

9.4.2 Hardware – Hyper Link

Manufacturers using the current Windows Mobile or Apple IOS software are supported.

9.4.3 Software

The current version of Windows Mobile or Apple IOS software are supported.
Microsoft ActiveSync is used for connecting to the corporate E-Mail system.
Any software found to interfere with normal operation must be uninstalled in order to receive support from Technology Services.

9.4.4 Support

Support for Mobile devices hardware and software is provided by Technology Services through the Customer Support Desk. TSD will support the physical hardware connection (PDA cradle to PC) and software to support this connection. No software can be added to company owned mobile devices without TSD's assistance and director approval.

9.4.5 Training

Training will be available covering basic mobile devices use and integration with Outlook at the time of installation of the equipment. Training classes for the mobile devices may be provided in the future depending on user demands.

FOR USE IN RFPS

9.4.6 Acquisition

The PA will purchase Mobile devices for employees with a business need for the mobile device. Employees are responsible for obtaining management approval. TSD also recommends that a protective case (preferably a zippered case) be purchased to reduce damage to the units.
Since the PA owns the device, if an employee leaves the PA, the device is returned to the director's office of their department.

9.4.7 Personal Acquisition

Employees, who purchase their own mobile devices, will not be allowed to connect to the PA corporate network or equipment, unless approved by Technology Services.
Customer Support Desk personnel will support all PA owned and authorized mobile devices.

9.4.8 Data Security Considerations

Since in most cases the data residing on a mobile device is not encrypted or password-protected, data can be easily browsed by anyone having possession of the device. Users should carefully consider what type of information they store on their mobile. Extreme caution should be taken when using company confidential data on the mobile units.

All mobile devices accessing corporate resources should be password protected.

At the present time, Technology Services is researching options for encrypting mobile data using a third-party application. Until a solution is found, great care should be taken to ensure that important or confidential information does not end up in the wrong hands.

9.4.9 Data Backup

Though it does not happen often, it is possible to lose, damage or duplicate the data that resides in the mobile devices and PC applications. Technology Services will provide assistance in attempting to recover files or data from data corruption.

9.5 BlackBerry Device Policy & Procedure

The Port Authority provides corporate wireless e-mail services using the BlackBerry device from RIM.

The BlackBerry is a palm-sized device designed to synchronize with Outlook and other e-mail systems. With a BlackBerry device, one can read, compose and respond to e-mail messages and meeting requests, which are transmitted through the Port Authority's E-Mail System. The BlackBerry contains the user's synchronized Outlook "Contacts" address book, Outlook Calendar, memo pad and task list as well as a calculator and an Internet browser.

9.6 BlackBerry Guidelines

9.6.1 Introduction

BlackBerry devices (data only or combined data (e-mail) & voice) are available from most wireless carriers in the Port District. Combined BlackBerry devices are designed to replace stand-alone cellular telephones and stand-alone BlackBerry data devices and they operate on the same wireless network as a stand-alone cellular telephone from the same carrier.

9.6.2 Support

Support for BlackBerry devices is provided by Technology Services through the Customer Support Desk. The Customer Services/PMO Group provides additional support as needed.

9.6.3 Breakage and Loss

Be aware that the screen used on a BlackBerry device is very fragile. Dropping a device from the height of a desktop can result in breakage. It is also sensitive to water damage. Once this happens, the device is likely to be unusable. Broken, lost or stolen devices should be reported to the Customer Support Desk at 212-435-7469, who will notify the appropriate staff for further action.

FOR USE IN RFPS

As with all PA equipment, BlackBerry devices should be used for business purposes only.

9.6.4 Data Security Considerations

Data residing on a BlackBerry device can be easily browsed by anyone having possession of the device. Agency policy automatically activates the password security available on the device. Users should not disable this security feature. Users should carefully consider what type of information they store on their devices. Extreme caution should be taken when using company confidential data on the devices.

9.6.5 Data Backup

Though it does not happen often, it is possible to lose, damage or corrupt the data that resides on the BlackBerry device. There are data backup features on the PC utilizing the BlackBerry Desktop Manager software. We recommend setting the advanced automatic backup to 7 days with the backup of all device application data. In the event of a lost or broken device, this backup may be used to recover lost data.

FOR USE IN RFPS

Appendices

Appendix 1 -- Business Resumption Plan Document Format

I. PURPOSE

- Goals and objectives of plan
- Benefits obtained if plan properly implemented

II. SCOPE OF PLAN

- Planning assumptions
- Facilities and resources included in plan

III. NOMENCLATURE

- Recovery terms
- Definitions and acronyms

IV. DISASTER SEVERITY DEFINITION

Define level of potential disaster based on impact to critical functions. Explain what degree of operational disruption would constitute each level of disaster:

- catastrophic
- serious
- major
- limited

V. OPERATIONS RECOVERY PROCEDURES (Procedures for recovering services)

1. Indicate time frames in which essential operational/business functions must be resumed.

2. Specify sequence of operations recovery events and individuals responsible for activity. Note any specific activities required for particular levels of disaster severity. For example:

    - Notifications
    - Preliminary evaluation
    - Activate operations recovery personnel
    - Coordinate with emergency personnel
    - Evaluate recovery options and issue directive which details:
        - Assigned tasks
        - Project schedule/time frame
        - Coordination required
        - Identify relocation activities, if required
        - External/internal status updates

3. Identify items required for backup of critical functions. For example:

    - Alternate work site
    - Hardware/software
    - Personal computers

FOR USE IN RFPS

- Necessary software packages
- Documentation
- Peripherals (printers, modems, etc.)
- Databases
- Emergency equipment
- Communications
- Transportation
- Supplies
- Security
- Operations and procedures manuals

VI. OFFICE/FACILITY BUSINESS SITE RESTORATION PROCEDURES

(Procedures for restoring physical facilities)

- Identify restoration responsibilities
- Assess damage
- Develop restoration plan/time frames

VII. BRP UPDATE PROCEDURES

- Specify responsibility for updating and communicating BRP changes
- Indicate frequency of review/update

FOR USE IN RFPS

Appendix 2 -- Communication Rooms/Closets Standards

SPACE

All data communication rooms must be designed with required and estimated space to meet immediate requirements, as well as, future growth.

ENVIRONMENTAL

The following conditions must be met:

a) Doorways/Entrances must be designed to support at least the minimum space requirements of 90"Hx72" Wx60" D.
b) The room's cooling capabilities must be sufficient to support the heat dissipation requirements for the equipment. This requirement will be measured in minimum and maximum BTUs powered by AC-powered systems. Equipment specs will be supplied by TSD upon request.
c) Backup UPS systems are necessary to avoid equipment damage in case of site power failure.
d) Telco demarcs must be located in a central location with sufficient space to house Telco termination equipment.
e) The room should be designed with the appropriate fire safety regulations such as a sprinklers, pre-action of FM 2000 systems.
f) Cables trays must also be installed in the communications room ceiling where appropriate, to support the routing of data communications and Telco cables.
g) Basic 24"W/30"D/84"H cabinets with 19" racks must be installed to house communications equipment such as: routers, switches, hubs, DSUs/CSUs and monitors.
h) To create more wall space the use of wall mount racks can be installed. Appropriate sized plywood must be installed prior to mounting racks.
i) Category 5e/6 cable must be terminated in wall/rack mounted patch panel.
j) Fiber patch panel must be installed in fiber IDF panel with SC female interface.
k) The fiber must be neatly tie wrapped and enclosed in flexible inner-duct.
l) Telephone access must be installed in the appropriate location to provide for basic trouble-shooting and vendor support.
m) All communications equipment and cabinets must have ample room for easy access and proper ventilation.

Appendix 3 – Standard Cabling Schemes

a) Teflon-coated cables will be installed per fire code regulations.
b) Overhead cable trays and drop post must be installed for cable routing.
c) Cabling scheme must be used to label and identify all cables. All cables must be neatly tie-wrapped.

FOR USE BY RFPS

Appendix 4 -- Unified Wiring Plan

To satisfy existing and future voice and data communications requirements, while minimizing the need for wiring changes and additions, the Port Authority has adopted the following lateral wiring specifications for all workstations being constructed. This plan is applicable to all PA locations, except when specifically noted.

LATERAL CABLE:

Voice and data telecommunications requirements for each workstation will be provided by a combination of three individual cables, installed between the workstation and the serving telephone closet / intermediate distribution frame (IDF), in a "home run" configuration. All cabling installed will be of plenum type, fire retardant (FEP) rated.

Cable specifications:

(3) Cables capable of supporting Category 5e capabilities as outlined in the TIA/EIA-568-B.2 standard. Specifically:

Gauge: 24 AWG Pair

Size: 4

Insulation: Plenum, fire code rating (FEP)

Cable allocations will be as following:

Cable #1: Voice** Cable

#2: Data

Cable #3: Data

- *100.0MHz is the speed the PA wants to deliver to the desktop.
- **Cable #1 is to be split in the workstation to support 2 telephones.

Technical specs for the Cat 5e cable is as follows.

TECHNICAL DATA--ELECTRICAL				
	Horizontal		Patch	
Frequency MHz	Attenuation dB/100 m max.	Next dB min.	Attenuation dB/100 m max.	Next dB min.
1	2	62.3	2.4	62.3
4	4.1	53.2	4.9	53.2
10	6.5	47.3	7.8	47.3
16	8.2	44.2	9.8	44.2
20	9.3	42.7	11.1	42.7
31.25	11.7	39.8	14.1	39.8
62.5	17	34.3	20.4	34.3
100	22	32.3	26.4	32.3

TECHNICAL DATA--PHYSICAL			
	CMR	CMP	CM (Patch)*
Conductor diameter-in. (mm)	.020 (0.52)	020 (0.52)	024 (0.61)

FOR USE IN RFPS

Cable diameter-in. (mm)	.195 (5.0)	165 (4.2)	215 (5.5)
Nominal cable weight-lb./kft. (kg/km)	21 (31)	21 (31)	23 (34.2)
Max. installation tension-lb. (N)	25 (110)	25 (110)	25 (110)
Min. bend radius-in. (mm)	1.0 (25.4)	1.0 (25.4)	1.0 (25.4)
* Patch cables utilize stranded tinned copper conductors			

PARAMETRIC MEASUREMENTS		
	Horizontal	Patch
Mutual Capacitance	4.6 nF/100 m nom.	5.6 nF/100 m nom.
DC resistance	9.38 Ohms/100 m Max.	9.09 Ohms/100 m max.
Skew	45 ns/100 m max.	45 ns/100 m max.
Velocity of	72% nom. Non Plenum	72% nom.
Propagation	72% nom. Plenum	
Input Impedance	100 + 15% 0.7772-100 MHz	100 + 15% 0.772-100MHz
	ISO/IEC 11801	

COLOR CODE			**TEMPERATURE RATING**	
Pair 1	White/Blue	Blue	Installation	0 degrees C to +50
Pair 2	White/Orange	Orange	Operation	-10 degrees C to +60
Pair 3	White/Green	Green		
Pair 4	White/Brown	Brown		

FOR USE IN RFPs

Appendix 5 -- Telephone Closet / IDF Termination Blocks

Lateral Data cabling serving each workstation will be terminated on a CAT5e/6 patch panel (RJ45 face, 110 punch rear) in the telephone closet. For analog phone service, termination is to be on 110 blocks in telephone closet, allowing access to the telephone riser. For data, a patch cord is installed between patch panel and IT device. The patch panel can be mounted on the wall with a wall mount kit or in a rack if one is needed and should be appropriately numbered with the workstation number. The patch panel must be capable of supporting Category 5e/6 the TIA/EIA-568-B.2 standard. The patch panel shall have a swing away faceplate or rack mountable.

NOTE: The Category 5e/6 patch panel should be equivalent to the AMP SL series 110Connect Category 5e/6 patch panel or approved Category 6 patch panel. The number of ports may vary.

Each workstation shall be assigned a unique station identification number.

Appendix 6 -- Workstation Jacks

Workstations will be equipped with various components of the AMP Communications Outlet system (AMP equivalent can be used with TSD approval). Each workstation will be installed with (1) double-gang jack housing box and matching face plate, capable of securely mounting three Category 5e cables or Category 6 and four modular data connectors, maintaining the integrity of category 5e/ Category 6 capabilities as outlined in the TIA/EIA-568-B.2 standard. All workstation jacks will be wired in accordance with the TIA/EIA-568-B.2 standard. All modular jacks are to be labeled in accordance with TSD number schema.

Appendix 7 -- Standard Switches Inside the Department

Any switches in the following Cisco series are acceptable (Vendors will consult with the Technology Services Department (TSD) to determine the appropriate switch configuration at the time of proposal submission):

Cisco 3000 series – low capacity
Cisco 4000 series – medium capacity
Cisco 6000 series – high capacity
Cisco Nexus 7000 series – high capacity

Appendix 8 -- Workstation and Lateral Cable Identification Management

WORKSTATION AND LATERAL CABLE IDENTIFICATION/MANAGEMENT (Facility)

All lateral cabling installed to workstations at the Port Authority Facilities must be designated in accordance with the Port Authority's workstation and lateral cable identification code: This code consists of two elements, as follows:

1 - Room number or department name (acronyms are acceptable).
2 - Workstations (3 numeric digits)

The cable identification code for Workstation 10 in room 3801 at LGA CTB is 3801-010. The cable identification code for Workstation 15 in PA Automotive shop is Auto-015

FOR USE IN RFPS

Appendix 9 – Fiber Optic Specification for Network Services - PAWANET

General Scope of Work

1. Conduct a walk thru based on the specific Scope of Work for the job in question.
2. Note that all diagrams and or sketches that may be provided are approximates and not to scale.
3. All fiber optic cable is to be installed in rigid conduit or, where applicable, in plenum rated flexible inner duct.
4. Contractor shall furnish and install fiber optic cable as designated in the specific Scope of Work.
5. Fiber optic cable type for interoffice use shall be loose tube, with aramid yarn water block:
   - Singlemode Fiber – 8.3/125/250 micron diameter (core/cladding/coating) manufactured by General Cable or approved equal.
6. Fiber optic cable attenuation from the factory, before installation, shall not exceed:
   - Singlemode – 4db per km @ 1310nm/.3 db per km @ 1550nm
7. All fiber optic cable is to be labeled on each end and at any junction or patch panel with, 28 gauge, 2" wide embossed with ¼" high letters. The labels are to be fastened to the fiber optic cable using sealed wrap around labels or pliable Velcro ties.
8. Fiber optic cable shall be installed in accordance with the manufacturer's specifications. Any portion of the cable damaged during installation will be repaired or replace by the contractor without any additional cost to the Port Authority of New York New Jersey.

Fiber Optic Terminations

1. Fiber optic terminations will use **SC** connectors unless otherwise specified in the Scope of Work.
2. Fiber optic terminations shall not yield more than 1db per mated (at the bulkhead) connector.

Fiber Optic Testing

1. Fiber optic testing shall be performed by the contractor and certified fiber optic technicians.

Fiber optic technicians will be prepared to complete test procedures with the following equipment:

- Source and power meter testing to provide optical loss measurements.
- Reference test cables and mating adapters that match the cables to be tested.
- Cleaning materials – lint free cleaning wipes and pure alcohol.
- OTDR test set with the proper launch cables and adapter types.
- Power loss testing from both ends.

2. Fiber optic technicians will perform OTDR test on all terminated fibers unless otherwise noted in the Scope of Work.

3. Fiber optic test results shall be recorded, and reports provided to the PA in hardcopy and via a readable txt file (PDF or RTF is acceptable).

FOR USE IN RFPs

Appendix 10 -- Public Telephone Ordering Guidelines

Technology Services (TSD) staff is responsible for the management of the permit for public telephone service are available to answer any questions and provide direction for any matter relating to public telephones.

General Guidelines

All public telephone requests – that is both coin and non coin in any Port Authority space or any area of the tenant space – both "public" and "club" locations will be coordinated by the Port Authority to cover both New York and New Jersey.

Process

When the Facility, Property Manager, tenant or their representative (e.g. designer, architect, general contractor) has a public telephone requirement, they will contact the Technology Services Department (TSD) whom will review the request and provide coordination with the appropriate service provider.

FOR USE IN RFPS

20 Attachment 9 – ECH to VECTOR Transition Plan

-THIS PAGE INTENTIONALLY LEFT BLANK-

ECH Upgrade Transition Methodology

This is the methodology we used to ensure the successful implementation of the large-scale Maryland Transportation Authority Next Generation (MdTA NG) project. We believe this innovative transition methodology will work well for your proposed ECH Upgrade.

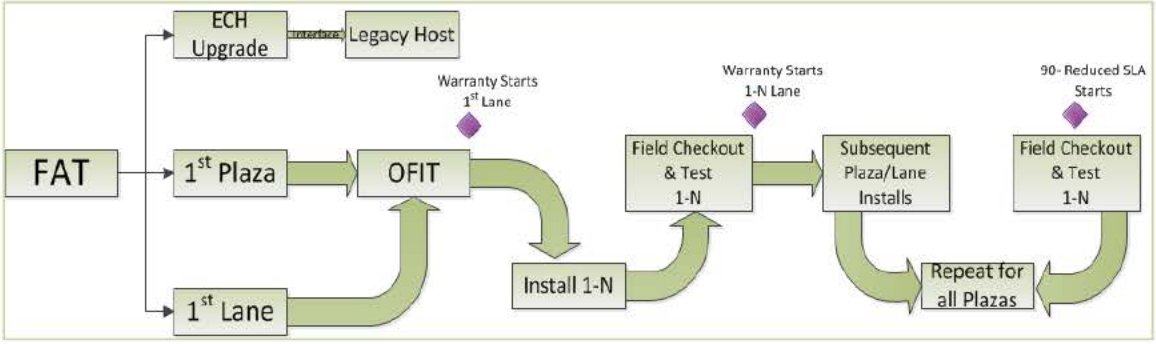


Figure 1: ECH Upgrade Transition Process Methodology

We will deliver this transitional approach in several phases. This process is designed to maintain the existing ETC functionality while seamlessly delivering the proposed ECH Upgrade solution. Our transition team will work closely with you to maintain open communication as to the project tasks, phases, and final delivery status. We will ask you to authorize and accept each phase prior to moving to the subsequent phase.

Pre Transition Phase

Prior to the transition of the ECH, plaza, and lanes, we will make all lane and plaza network upgrades at the current plaza. After each network upgrade is complete we will start the process of transitioning the lanes.

Phase One

After you approve the FAT, we will begin to transition to the new ECH, plaza and lanes. This stage will have the plaza workstations installed concurrently with the ECH Upgrades. As part of the transition, we will develop an interface between the Legacy ECH and the New ECH so that the Legacy Host can remain in service and transition at any time within the installation schedule. The New ECH will push all lane transactions to the Legacy Host in real-time. This will provide a seamless and transparent view to the operations personnel.

Using existing ITCS reports, you will be able to monitor the performance of the lanes, compare old ITCS to new ITCS/TRCS reports, and continue training on the new application prior to final transition.

We will transition the first upgraded lane at the selected Goethals Plaza location. It will be fully tested and certified for proper operation of the new equipment and the new lane system functionality during the onsite first installation test (OFIT).

At the successful completion of the OFIT and with your authorization, we will install the remaining lanes of that plaza. We will begin to transition the lanes in other plaza at this point.

For subsequent plazas, we will install the first lane and begin the commissioning testing. This process will continue until all the lanes have been successfully transitioned.

We will program the new lanes to communicate with the New ECH system. This approach enables us to install them so they appear as an integrated component within the audit and reconciliation infrastructure on the existing host system.

The new lane(s) will communicate with the new ECH host via JAVA Messaging Services (JMS). The new ECH will transmit all transaction in near real time to the existing legacy hosts so that the existing host functionality will remain and the existing host will continue to communicate with the existing CSC. Figure 2 shows the status of the ETC system after the first lane in one plaza has been converted to the new lane system.

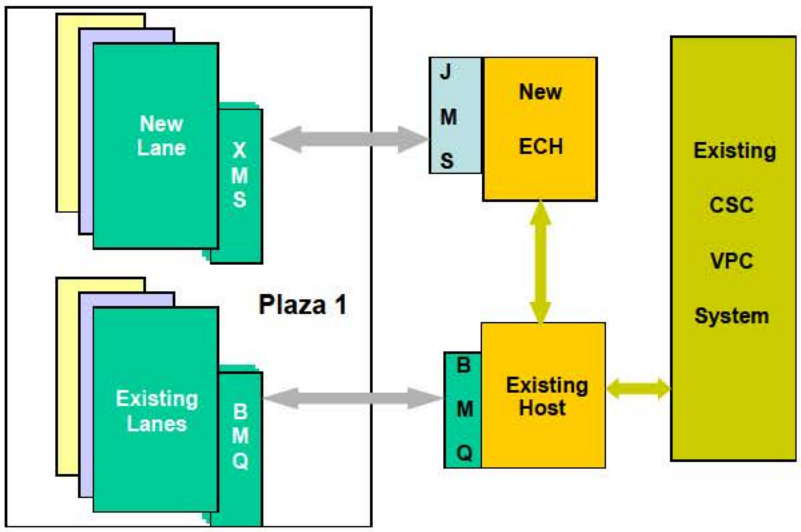


Figure 2: Begin Transition of Lanes – Phase One

Phase Two

During Phase Two, the transition to the new lane systems (Phase One) completes and the deployment of the remaining Plaza and Lane system begins. This process will continue until all plazas have been installed.

All the lanes will communicate with the new plaza system and the new ECH will communicate with the existing host. Audit and reconciliation functions will continue at the existing host and the existing host will continue to communicate with the existing Customer Service Center (CSC).

For those locations that have not received the new lane and plaza systems, the lanes will continue to communicate with the existing host as in Phase One. Figure 3 depicts the status of the ETC system after all lanes in one plaza have been converted to the new lane, plaza, and ECH systems have been installed.

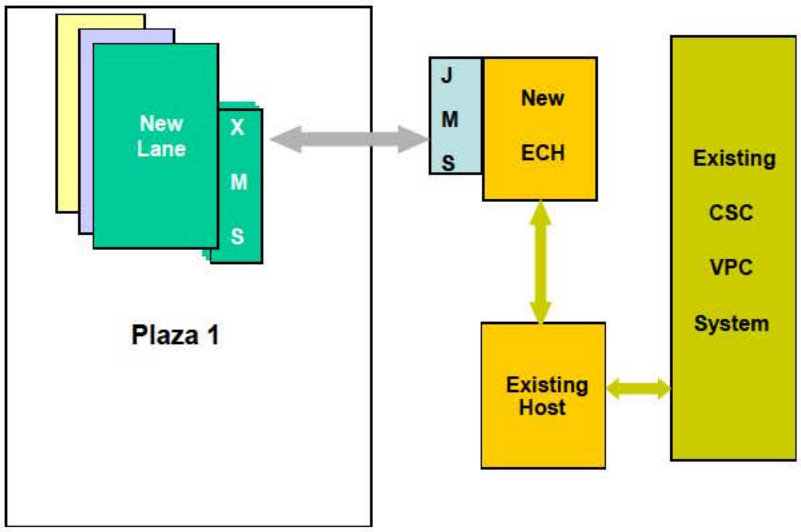


Figure 3: Plaza 1 Transition Completed while Remaining Lane Transition Starts – Phase Three

Phase Three

Phase Three consists of implementing the new host functionality as it relates to its interaction with the CSC and the plaza operations.

The New ECH host will be pointed to the existing CSC. Transactions from the new lanes, plazas, and hosts will be forwarded from the new ECH to the existing CSC. For continued data validation, the transactions will continue to be transmitted to the existing host at the same time and supported for 90 days. After 90 days, transactions can continue to be transmitted to the existing ECH, but Xerox support for this server and application will cease. The plaza workstations will be reconfigured to execute the new ITCS (new Xerox TRCS) plaza application within the New ECH system.

At this phase of the transition, the existing host will cease communicating with the existing CSC.

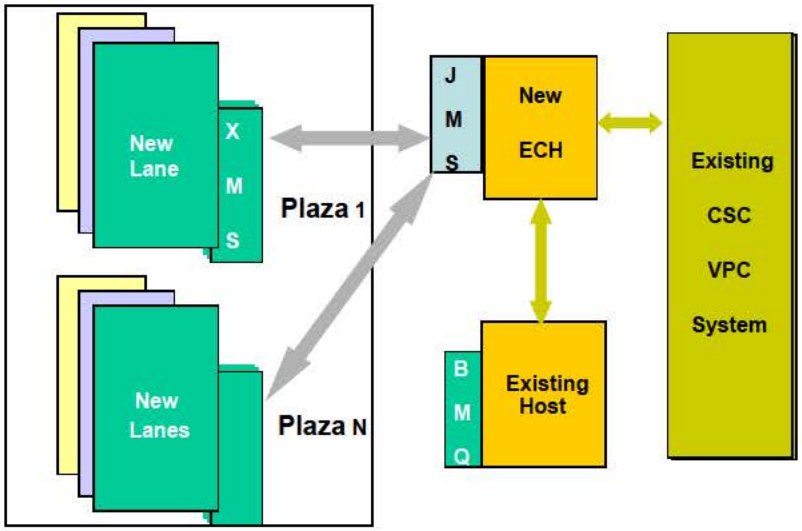


Figure 4: All Plaza and Lane Conversations Completed – Phase Three

Figure 4 shows the system after all plazas and corresponding lanes have been completed. All plazas are communicating with the new host. The New ECH continues to communicate with the existing host for additional data validation. The New ECH now communicates with the existing CSC.

21 Attachment 10 – Revenue Accounting Reconciliation and Toll Collector Audit Processes

-THIS PAGE INTENTIONALLY LEFT BLANK-

Revenue Accounting

Reconciliation and Toll Collector Audit Processes

Prepared for
The Port Authority of New York and New Jersey

By

117 Executive Drive, Suite 400
New Windsor, NY 12553

Version 4.0 **DRAFT**
April 11, 2014

Contents

1 Introduction 2
2 E-ZPass and Violation Reconciliation 2
2.1 Reconciliation 3
2.2 Recording Entries on the General Ledger 4
2.3 EZG Reciprocity 5
3 Toll Collector Deposit 6
4 Cash Reconciliation 6
4.1 Bank Reconciliation 7
4.2 Toll Collector Auditing Process 9
4.3 Recording Revenue 16
4.4 Audit Trail 16
Attachment 1. ITCS Deposit Slip 17
Attachment 2. PA379 – Toll Collector Exception Log 18
Attachment 3. Manual PA235 – Toll Collector's Report 19
Attachment 4. Manual PA62 – Bank Deposit Slip 20
Attachment 5. D64 – Form Sample 21

DRAFT

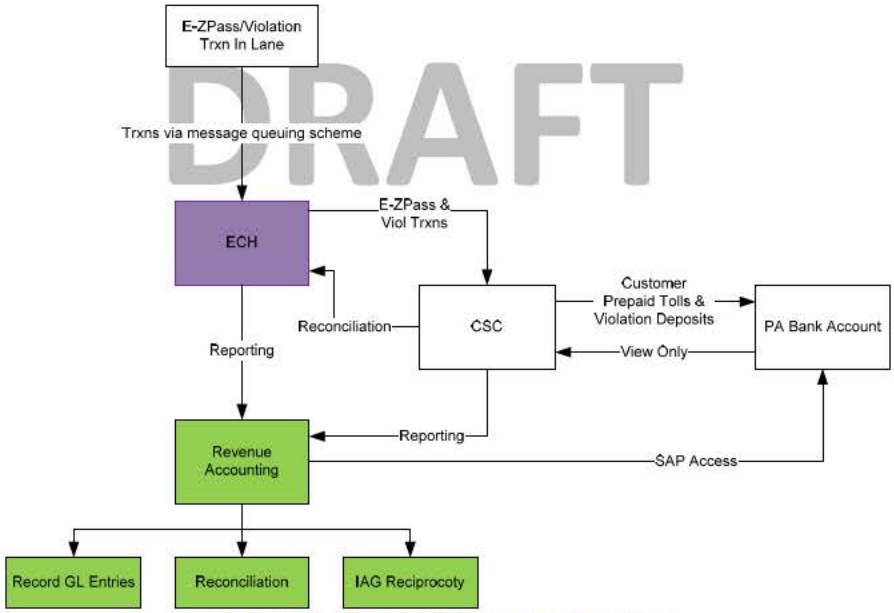
1 Introduction

Revenue Accounting is responsible for auditing and recording toll revenue including E-ZPass, violations and cash on a daily and monthly basis. The audited data resulting from their reconciliation process is used to book revenue, perform settlement with the E-ZPass Group (EZG) and generate daily and monthly reports used by other departments.

Revenue Accounting uses various systems in the performance of its work:

- The Integrated Toll Collection System (ITCS), which is comprised of the toll collection hardware and software including the E-ZPass Central Host (ECH).
- The Integrated Toll Revenue Audit Control System (ITRACS). ITRACS, the main tool utilized by Revenue Accounting, is a system that interfaces with ITCS and is used to perform toll collector cash audits and reconciliation.
- The NY Customer Service Center (NYCSC) system, which is used to generate various settlement and revenue related reports.

2 E-ZPass and Violation Reconciliation



DRAFT

Figure 1 - E-ZPass & Violation High Level Flow

E-ZPass and violation transactions are sent from the lanes to the ECH, which sends both transaction types to the Customer Service Center (CSC), where the transactions are posted to accounts, rejected or processed as violations. Funds are deposited into the Port Authority bank account when patrons replenish their account or pay violations. These deposits are then swept into the Port Authority main account.

There are three functions that Revenue Accounting performs for E-ZPass and Violations:

1. Reconciliation
2. Record Entries on the General Ledger
3. EZG Reciprocity

2.1 Reconciliation

Revenue Accounting uses the following reports in performing reconciliation

Reconciliation Report	Transaction Type
Deposit Summary Report from the NYCSC	Prepaid Tolls
Infomaker Query - Transaction Reconciliation Summary. ITCS style data shown in Figure 2 below and sample incorporating CO103 type data shown in Figure 4.	Toll Postings to Accounts (PANYNJ Accounts on PANYNJ facilities)
Infomaker Query - Transaction Reconciliation Summary. ITCS style data shown in Figure 3 below and sample incorporating CO103 type data shown in Figure 4.	Toll Postings to Accounts (EZG Accounts (non-PANYNJ) on PANYNJ facilities)
None	Violations in Lane
Deposit Summary Report from NYCSC	Violation Payments
Q8M (from NYCSC) and NYCSC Monthly Credit Card Reconciliation	Credit Card Fees
IAG6A and Q13 from NYCSC	Disputes, Unused commuter trips from MTA and PA Truck Volume Discount

DRAFT

Plaza	Date	PANYNJ Trx	Rev
BB	1/1/2014	691	$ 4,728.50
BB	1/2/2014	1547	$ 14,736.00
BB	1/3/2014	658	$ 5,447.50
BB	1/4/2014	800	$ 6,387.00
BB	1/5/2014	651	$ 5,220.50
BB	1/6/2014	1718	$ 15,470.00
BB	1/7/2014	1677	$ 14,307.00
GB	1/1/2014	2801	$ 22,653.50
GB	1/2/2014	4541	$ 52,489.50
GB	1/3/2014	1789	$ 18,686.00
GB	1/4/2014	3080	$ 32,563.50
GB	1/5/2014	2463	$ 21,043.00
GB	1/6/2014	5228	$ 60,192.00
GB	1/7/2014	4946	$ 57,968.50

Figure 2 - Infomaker Query Results for PANYNJ Trxns on PANYNJ Facilities

		MTA		NYSTA		DELDOT		DRJTBC		Total	
Plaza	Date	Trx	Rev	Trx	Rev	Trx	Rev	Trx	Rev	Trx	Rev
BB	1/1/2014	2471	$ 17,839.00	74	$ 1,066.50	4	$ 38.00	7	$ 67.00	4025	$ 30,222.00
BB	1/2/2014	4073	$ 38,697.00	131	$ 2,826.50	1	$ 11.00	5	$ 164.00	7095	$ 73,729.00
BB	1/3/2014	1550	$ 11,893.50	43	$ 914.00	2	$ 22.00	3	$ 85.00	2772	$ 23,330.50
BB	1/4/2014	2527	$ 21,330.00	98	$ 2,054.50			9	$ 210.00	4463	$ 40,064.50
BB	1/5/2014	2469	$ 19,751.50	73	$ 977.50	4	$ 42.00	6	$ 118.00	4060	$ 34,150.00
BB	1/6/2014	4538	$ 44,034.50	140	$ 3,202.00	4	$ 149.50	8	$ 203.00	7980	$ 82,935.50
BB	1/7/2014	4236	$ 41,326.00	123	$ 2,180.00	2	$ 37.00	7	$ 225.00	7543	$ 75,308.50
GB	1/1/2014	15108	$ 128,621.00	795	$ 12,820.00	87	$ 1,001.00	39	$ 421.50	23362	$ 211,030.00
GB	1/2/2014	14162	$ 156,334.50	1039	$ 30,052.00	87	$ 1,280.00	45	$ 690.50	25772	$ 336,990.50
GB	1/3/2014	5731	$ 54,852.50	472	$ 13,593.50	47	$ 787.50	26	$ 369.00	10984	$ 126,949.50
GB	1/4/2014	12387	$ 116,291.00	803	$ 18,108.50	117	$ 1,800.00	57	$ 772.00	22143	$ 239,876.00
GB	1/5/2014	12284	$ 110,669.50	738	$ 15,420.50	88	$ 1,106.00	41	$ 609.50	20000	$ 196,982.50
GB	1/6/2014	14875	$ 164,335.50	1154	$ 33,795.00	70	$ 1,203.50	36	$ 625.00	27998	$ 362,527.00
GB	1/7/2014	13926	$ 152,829.50	1156	$ 32,752.00	64	$ 1,272.50	36	$ 843.50	26437	$ 341,938.00

Figure 3 - Infomaker Query Results for EZG Trxns on PANYNJ Facilities

Recon Type	POSTED

		Plaza ID								
Agency	Data	BB	GB	GWBL	GWBP	GWBU	HT	LT	OBX	Grand Total
DelDOT	Sum of Trans	93	2,520	1,117	188	3,764	1,370	2,160	1,150	12,362
	Sum of Collected Rev	$ 1,536.50	$ 40,135.00	$ 11,174.50	$ 1,942.00	$ 102,039.00	$ 13,947.00	$ 22,673.00	$ 25,369.00	$ 218,816.00
DRJTBC	Sum of Trans	252	1,360	2,210	139	3,071	2,861	3,296	1,301	14,490
	Sum of Collected Rev	$ 6,045.00	$ 22,716.00	$ 22,097.00	$ 1,397.00	$ 51,126.00	$ 28,999.00	$ 34,831.00	$ 22,497.50	$ 189,708.50
I-Pass	Sum of Trans	116	1,309	914	291	5,560	1,162	1,602	529	11,483
	Sum of Collected Rev	$ 3,787.50	$ 45,543.00	$ 9,694.00	$ 2,967.00	$ 223,123.00	$ 11,968.50	$ 19,539.00	$ 17,636.50	$ 334,258.50
ITRCC	Sum of Trans	6	58	49	11	222	117	152	30	645
	Sum of Collected Rev	$ 60.00	$ 884.00	$ 503.00	$ 103.00	$ 5,559.50	$ 1,358.00	$ 2,056.50	$ 468.00	$ 10,992.00
MassDOT	Sum of Trans	557	2,136	5,280	1,020	21,248	3,837	6,470	1,169	41,717
	Sum of Collected Rev	$ 12,398.50	$ 47,943.00	$ 53,572.00	$ 10,348.00	$ 523,319.00	$ 47,680.00	$ 91,408.00	$ 21,262.50	$ 807,931.00
MdTA	Sum of Trans	156	5,891	2,672	501	9,878	3,448	5,643	1,861	30,050
	Sum of Collected Rev	$ 3,005.50	$ 95,921.00	$ 27,187.00	$ 5,162.00	$ 277,361.00	$ 35,250.00	$ 60,224.50	$ 32,728.00	$ 536,839.00
MeTA	Sum of Trans	21	233	338	48	2,227	142	193	103	3,305
	Sum of Collected Rev	$ 378.00	$ 7,128.00	$ 3,478.00	$ 496.00	$ 74,538.50	$ 1,452.00	$ 2,199.00	$ 2,566.50	$ 92,236.00
MTAB&T	Sum of Trans	113,978	440,053	444,395	168,299	452,328	396,526	314,727	452,371	2,782,677
	Sum of Collected Rev	$ 1,050,740.00	$ 4,538,480.00	$ 4,365,596.00	$ 1,639,630.50	$ 7,082,275.50	$ 4,177,831.00	$ 3,692,271.00	$ 3,875,160.50	$ 30,421,984.50
NCTA	Sum of Trans	0	37	17	3	102	13	26	14	212
	Sum of Collected Rev	$ -	$ 371.00	$ 169.00	$ 31.00	$ 1,148.50	$ 133.00	$ 262.00	$ 172.00	$ 2,286.50
NHDOT	Sum of Trans	28	258	669	139	2,984	380	568	100	5,126
	Sum of Collected Rev	$ 393.50	$ 4,128.50	$ 6,721.50	$ 1,429.00	$ 50,262.00	$ 3,854.00	$ 5,852.00	$ 1,270.00	$ 73,910.50
NJ	Sum of Trans	41,117	164,627	337,831	63,815	325,593	304,394	528,980	181,750	1,948,107
	Sum of Collected Rev	$ 497,211.00	$ 2,316,843.00	$ 3,375,439.00	$ 637,296.50	$ 5,324,674.50	$ 3,170,421.50	$ 6,112,309.50	$ 1,916,369.00	$ 23,350,564.00
NYSTA	Sum of Trans	3,863	32,129	100,216	137,340	145,308	33,266	67,440	19,862	539,424
	Sum of Collected Rev	$ 74,747.00	$ 824,205.50	$ 1,001,729.00	$ 1,363,745.00	$ 4,752,196.00	$ 350,181.00	$ 847,033.00	$ 607,233.50	$ 9,821,070.00
OTIC	Sum of Trans	31	485	147	80	710	236	312	105	2,106
	Sum of Collected Rev	$ 1,237.00	$ 23,418.00	$ 1,478.00	$ 827.00	$ 18,769.50	$ 2,372.00	$ 3,545.00	$ 2,666.00	$ 54,312.50
PANYNJ	Sum of Trans	46,658	141,377	322,865	102,327	212,982	178,705	237,236	204,035	1,446,185
	Sum of Collected Rev	$ 373,504.00	$ 1,491,040.00	$ 3,141,025.50	$ 989,486.00	$ 3,238,876.00	$ 1,770,141.50	$ 2,659,434.50	$ 1,631,348.50	$ 15,294,856.00
PTC	Sum of Trans	672	14,443	9,027	1,104	20,403	13,639	18,510	7,112	84,910
	Sum of Collected Rev	$ 9,555.50	$ 206,327.50	$ 91,267.00	$ 11,274.00	$ 374,813.50	$ 139,690.50	$ 200,090.50	$ 115,607.00	$ 1,148,625.50
RITBA	Sum of Trans	21	143	495	62	2,033	229	280	75	3,338
	Sum of Collected Rev	$ 332.00	$ 2,292.00	$ 4,941.00	$ 630.00	$ 25,430.50	$ 2,417.00	$ 3,039.00	$ 1,301.50	$ 40,383.00
VDOT	Sum of Trans	168	3,429	1,679	303	5,375	2,192	3,962	1,159	18,267
	Sum of Collected Rev	$ 1,887.00	$ 46,574.00	$ 16,899.00	$ 3,084.00	$ 100,360.50	$ 22,478.50	$ 42,384.00	$ 16,062.50	$ 249,729.50
WV	Sum of Trans	10	137	18	11	649	21	36	55	937
	Sum of Collected Rev	$ 583.50	$ 7,195.50	$ 178.50	$ 105.00	$ 38,826.00	$ 327.50	$ 649.50	$ 2,800.50	$ 50,666.00
Total Sum of Trans		207,747	810,625	1,229,939	475,681	1,214,437	942,538	1,191,593	872,781	6,945,341
Total Sum of Collected Rev		$ 2,037,401.50	$ 9,721,145.00	$ 12,133,149.00	$ 4,669,953.00	$ 22,264,698.50	$ 9,780,502.00	$ 13,799,801.00	$ 8,292,519.00	$ 82,699,169.00

Figure 4 - Sample Posted Report using CO103 style data

2.2 Recording Entries on the General Ledger

Revenue Accounting uses the following reports in reconciling and recording E-ZPass and Violation expenses, liabilities and receivables on the General Ledger.

Report	Transaction Type	GL Entry
Deposit Summary Report from the NYCSC	Prepaid Tolls	Liability
Tolls by Lane Plaza (Q4P) from the NYCSC	Toll Postings to Accounts (PANYNJ Accounts on PANYNJ facilities)	Revenue
Casual Use (Q8M) from the NYCSC	Toll Postings to Accounts (EZG Accounts (non-PANYNJ) on PANYNJ facilities)	Revenue, receivables and liability
Query of V-Transactions from ITCS (sample incorporating CO103 type data shown in Figure 5 below).	Violations in Lane	Net Zero
Deposit Summary Report from (funds from collections agency are reported separately)	Violation Payments	Violation Revenue
Spreadsheet prepared by each agency based on the Q8M and NYCSC Monthly Credit Card Reconciliation	Credit Card Fees	Expense

DRAFT

			Charged Class										
Revenue Type	Recon Type	Data	1	2	3	4	5	6	7	8	9	11	Grand Total
Video Toll	DISMISSED	Trans	36	2	1	0	2	0	0	1	0	0	42
		Expected Rev	$ 299.00	$ 68.00	$ 51.00	$ -	$ 85.00	$ -	$ -	$ 22.00	$ -	$ -	$ 525.00
	INTERIM	Trans	1,319	41	33	3	78	0	1	11	8	3	1,497
		Expected Rev	$ 12,225.00	$ 816.00	$ 1,581.00	$ 204.00	$ 5,150.00	$ -	$ 27.00	$ 220.00	$ 176.00	$ 13.00	$ 20,412.00
	PAID	Trans	372	8	2	2	9	0	0	1	1	0	395
		Expected Rev	$ 3,705.00	$ 204.00	$ 102.00	$ 136.00	$ 680.00	$ -	$ -	$ 22.00	$ -	$ -	$ 4,849.00
	REJECTED	Trans	692	92	200	33	376	6	34	57	21	6	1,517
		Expected Rev	$ 6,116.00	$ 1,932.00	$ 9,258.00	$ 2,028.00	$ 26,220.00	$ 612.00	$ 900.00	$ 946.00	$ 418.00	$ 39.00	$ 48,469.00
Video Toll Trans			2,419	143	236	38	465	6	35	70	30	9	3,451
Video Toll Expected Rev			$ 22,345.00	$ 3,020.00	$ 10,992.00	$ 2,368.00	$ 32,135.00	$ 612.00	$ 927.00	$ 1,210.00	$ 594.00	$ 52.00	$ 74,255.00
Violation	DISMISSED	Trans	1,599	45	37	8	33	1	36	8	6	2	1,775
		Expected Rev	$ 18,800.00	$ 1,428.00	$ 1,803.00	$ 476.00	$ 2,635.00	$ 102.00	$ 944.00	$ 176.00	$ 132.00	$ 26.00	$ 26,522.00
	INTERIM	Trans	42,787	1,263	1,149	165	1,381	20	157	652	317	70	47,961
		Expected Rev	$ 538,354.00	$ 39,753.00	$ 57,376.50	$ 10,568.00	$ 113,962.50	$ 1,972.00	$ 4,504.00	$ 14,058.00	$ 6,787.50	$ 883.00	$ 788,218.50
	PAID	Trans	17,951	330	102	59	328	7	86	93	17	18	18,991
		Expected Rev	$ 222,700.00	$ 10,518.00	$ 5,077.50	$ 3,740.00	$ 26,777.50	$ 714.00	$ 2,316.00	$ 1,936.00	$ 352.00	$ 208.00	$ 274,339.00
	REJECTED	Trans	29,439	2,514	3,980	1,030	7,669	225	1,350	2,128	1,164	106	49,605
		Expected Rev	$ 351,212.00	$ 78,398.00	$ 195,870.00	$ 65,864.00	$ 628,452.50	$ 22,251.00	$ 36,400.00	$ 45,710.50	$ 20,689.00	$ 1,210.00	$ 1,446,037.00
Violation Trans			91,776	4,152	5,268	1,262	9,411	253	1,629	2,881	1,504	196	118,332
Violation Expected Rev			$ 1,131,066.00	$ 130,097.00	$ 260,127.00	$ 80,648.00	$ 771,827.50	$ 25,039.00	$ 44,164.00	$ 61,880.50	$ 27,940.50	$ 2,327.00	$ 2,535,116.50
Total Trans			94,195	4,295	5,504	1,300	9,876	259	1,664	2,951	1,534	205	121,783
Total Expected Rev			$ 1,153,411.00	$ 133,117.00	$ 271,119.00	$ 83,016.00	$ 803,962.50	$ 25,651.00	$ 45,091.00	$ 63,090.50	$ 28,534.50	$ 2,379.00	$ 2,609,371.50

Figure 5 - Sample Violation/Video Toll Report using CO103 style data

2.3 EZG Reciprocity

For tolls, Revenue Accounting uses the Q8M Casual Use report, to verify the wire transfer amounts coming in from and going out to the EZG. For credit card reciprocity, a spreadsheet maintained by the EZG agencies (based on Q8M data) is used. Revenue Accounting also uses the IAG6A for disputes and the Q13 for Unused commuter trips from MTA and PA Truck Volume Discount. Wire transfers are prepared by Revenue

Accounting and released to General Accounting, which provides information to Treasury, which then releases the wire transfer.

3 Toll Collector Deposit

Cash funds and non-revenue tickets are collected in the toll lane by the toll collectors. At the end of a tour, the Toll Collector counts the funds and non-revenue tickets collected. Toll Collectors enter deposit information on an ITCS screen, including name, employee number, proximity card number, facility, shift and cash by denomination. ITCS prints out multiple copies of the deposit slip as follows (see Attachment 1):

- Toll House
- Ticket Bag
- Original
- Bank

Toll Collectors prepare two bags - white and red. The "Original" deposit slip is included with the cash in the white bag. The Collector's original PA379 (Toll Collector Exception log – Attachment 2), original PA235 (ticket count form – Attachment 3), physical non-revenue tickets and the "Ticket Bag" deposit slip are included in the red bag.

The "Toll House" deposit slip is attached to the duplicate PA235 and placed in a bin. The duplicate PA379 is placed in a bin marked PA379. The deposit slip marked "Bank" is placed separately in a bin.

DRAFT

In some cases a manual drop is required, as follows:

- A manual deposit was done when ITCS was not available
- A second deposit was done for extra cash that was omitted from the Collector's original deposit
- A recount was required and the recounted amount differs from the original ITCS count

In all of these cases, the toll collector fills out a manual PA62 (shown in Attachment 4), which are included in the appropriate bag.

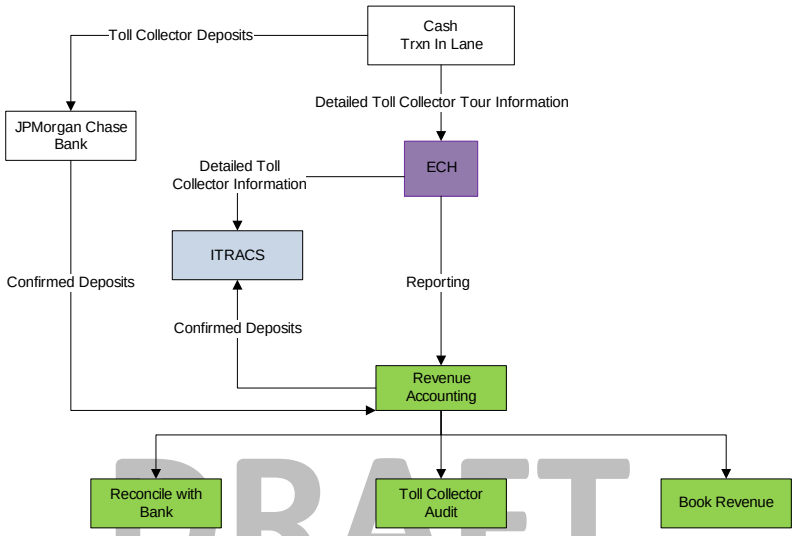
At the end of each day, facility staff combines (manifests) individual Toll Collector drops for bank pick-up.

4 Cash Reconciliation

On a scheduled basis, the bank picks up cash and ticket bags from each facility. When received by the bank, the toll collector deposit slips (ITCS or PA62) included with the manifest are keyed by the bank and associated with the date the funds were picked up from the facility (the Pickup Date – referred to on the bank statement as DEPDATE). The Authority receives a conditional credit to its bank account for these Claimed Amounts

(the amount indicated by the toll collector on the ITCS deposit slip/PA62) keyed by the bank. Afterwards, the bank counts the actual contents of the bags and transmits a file with this confirmed deposit amount to the Authority along with the confirmed paper PA62's.

ITCS and ITRACS reports indicate the amount of cash collected for a day, which is recognized and reported by Revenue Accounting as revenue. Adjustments to this revenue are made based on actual cash counts and bank deposits.



DRAFT

Figure 6 - Cash Reconciliation High Level Flow

4.1 Bank Reconciliation

The Port Authority's bank, JP Morgan Chase, sends confirmed deposit amounts and non-revenue ticket counts to Revenue Accounting via a text file. Revenue Accounting executes a process to load this information into ITRACS. Deposit data from the ECH is also loaded into ITRACS (see below). Bank Reconciliation is the process of comparing this confirmed deposit information from the bank to the deposit data from the ECH and resolving any discrepancies that may exist.

The confirmed deposit amount records from the bank are known as PA62 records in ITRACS and the non-revenue ticket count records are known as PA235 records in ITRACS. The Claimed Amount (or Deposit Record) is the amount of money counted by the Toll Collectors at each facility. The tour deposit record (ITCS10 in ITRACS), toll collector segments (ITCS12 in ITRACS) and exceptions records (ITCS16 in ITRACS) are pulled into ITRACS from the ECH database.

Revenue Accounting begins the cash reconciliation process with the Bank Dollar Proof function in ITRACS. The purpose of this function is to confirm that the amount of money shown on the bank statement matches that received via the PA62 records. This is done by facility, by pick-up date. Below is a screen shot of this function for the Holland Tunnel.

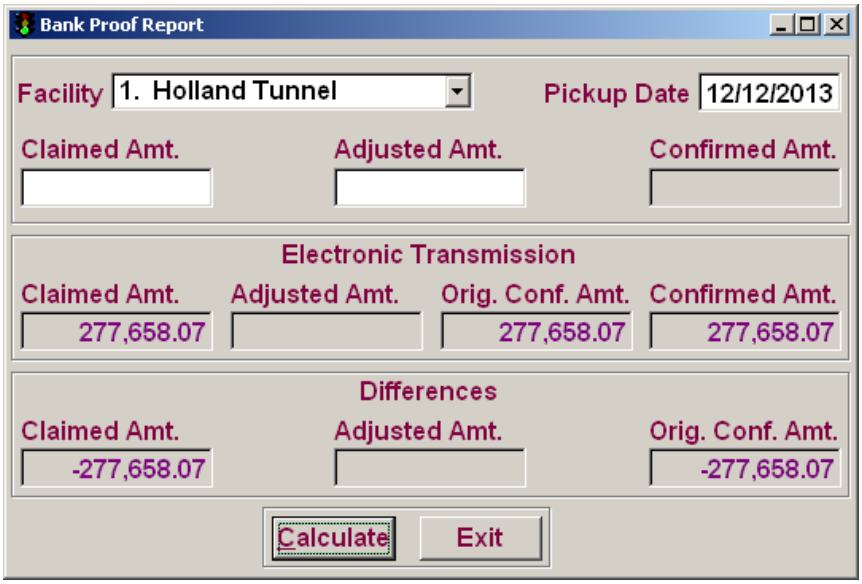
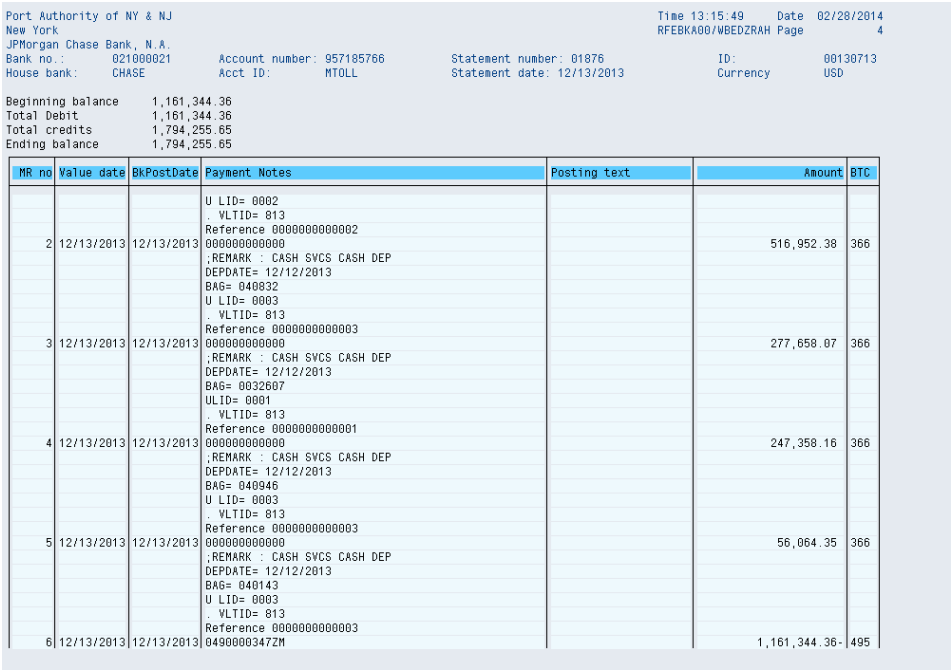


Figure 7 - Bank Dollar Proof Screen

Revenue Accounting reconciles the summary deposit slip from the Bank (shown below) against the information in the Bank Dollar Proof. This step is essentially a check of the transmission file received from the Bank.



Port Authority of NY & NJ
New York
JPMorgan Chase Bank, N.A.
Time 13:15:49 Date 02/28/2014
RFEBKA00/WBEDZRAH Page 4

Bank no.: 021000021 Account number: 957185766 Statement number: 01876 ID: 00130713
House bank: CHASE Acct ID: MTOLL Statement date: 12/13/2013 Currency USD

Beginning balance 1,161,344.36
Total Debit 1,161,344.36
Total credits 1,794,255.65
Ending balance 1,794,255.65

MR no	Value date	BkPostDate	Payment Notes	Posting text	Amount	BTC
			U LID= 0002 . VLTID= 813 Reference 0000000000002			
2	12/13/2013	12/13/2013	000000000000 ;REMARK : CASH SVCS CASH DEP DEPDATE= 12/12/2013 BAG= 040832		516,952.38	366
			U LID= 0003 . VLTID= 813 Reference 0000000000003			
3	12/13/2013	12/13/2013	000000000000 ;REMARK : CASH SVCS CASH DEP DEPDATE= 12/12/2013 BAG= 0032607		277,658.07	366
			ULID= 0001 . VLTID= 813 Reference 0000000000001			
4	12/13/2013	12/13/2013	000000000000 ;REMARK : CASH SVCS CASH DEP DEPDATE= 12/12/2013 BAG= 040946		247,358.16	366
			U LID= 0003 . VLTID= 813 Reference 0000000000003			
5	12/13/2013	12/13/2013	000000000000 ;REMARK : CASH SVCS CASH DEP DEPDATE= 12/12/2013 BAG= 040143		56,064.35	366
			U LID= 0003 . VLTID= 813 Reference 0000000000003			
6	12/13/2013	12/13/2013	0490000347ZM		1,161,344.36-	495

Figure 8 - Online Bank Statement from SAP

If there are discrepancies in this information, each individual Toll Collector deposit slip (ITCS or PA62) may need to be reviewed in order to reconcile.

4.2 Toll Collector Auditing Process

The purpose of the Toll Collector audit process is to identify any classification/revenue discrepancies for the purpose of collector performance evaluations.

The first step in this process is to verify that all ITCS tours are matched to confirmed deposit counts (i.e., bags) from the bank. A process in ITRACS attempts to match individual toll collector tours (ITCS10 records) with confirmed deposits (PA62 records) based on matching criteria - facility, shift date, employee number and claimed amount.

Revenue Accounting confirms the entire deposit to ensure that all tours and deposits are matched up. Unmatched tours and unmatched bags (cash or ticket) are researched manually by Revenue Accounting, using the Unmatched PA62 screen below or the Unmatched PA235 screen shown in Figure 14. The right-side of the screen shows unmatched ITCS Toll Collector deposit (ITCS10) records and the left-side shows unmatched bank PA62 records.

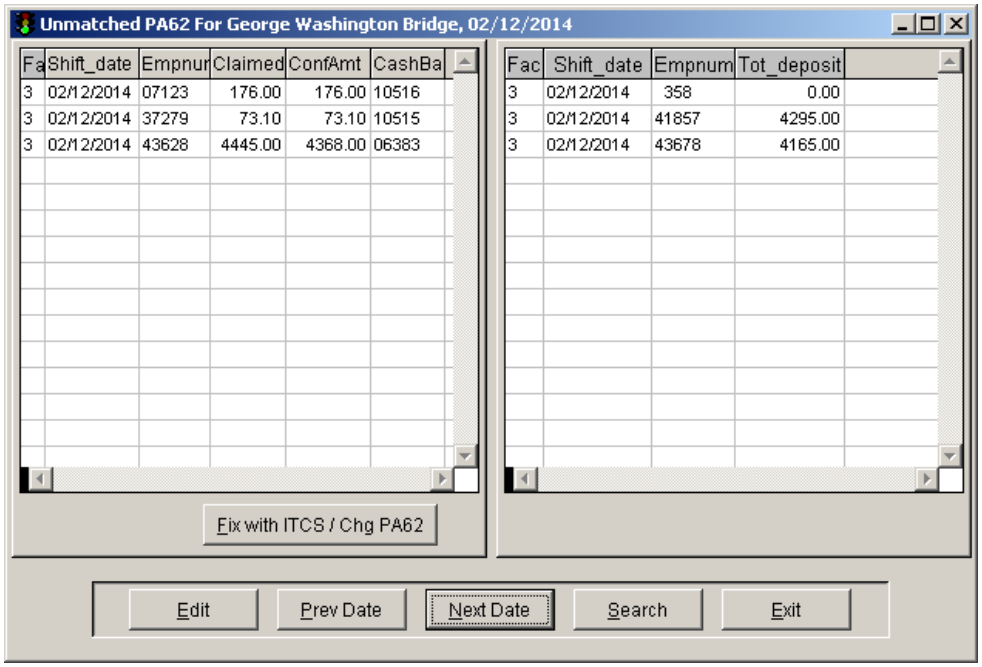


Figure 9 - Unmatched PA62 Screen

Once a record is selected from the screen, Revenue Accounting can edit the information to reconcile the tour. Editing can be done on the PA62 side (shown below).

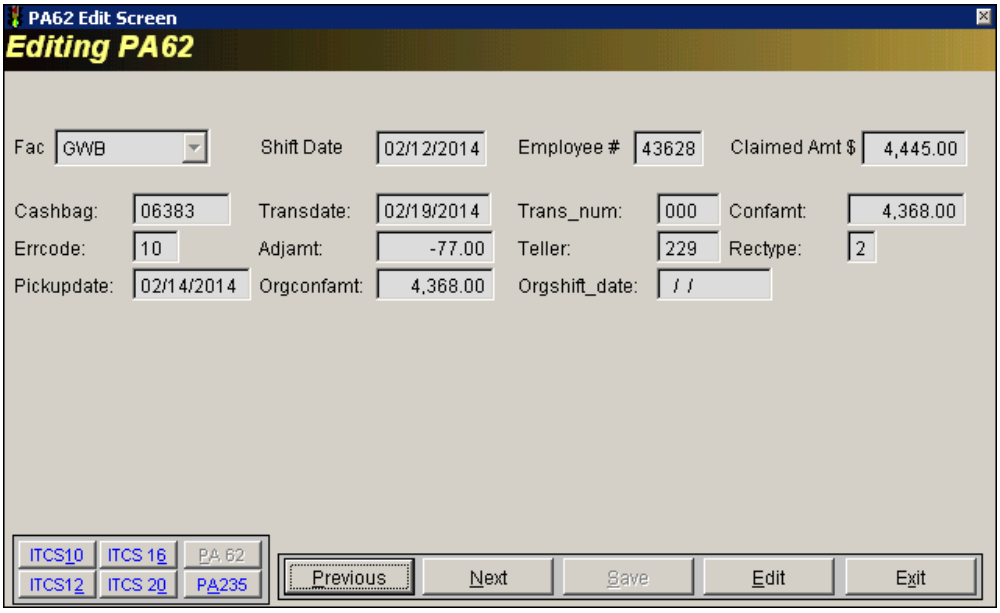


Figure 10 - Unmatched PA62 Editing Screen

Editing tours can also be done on the ITCS side, shown below.

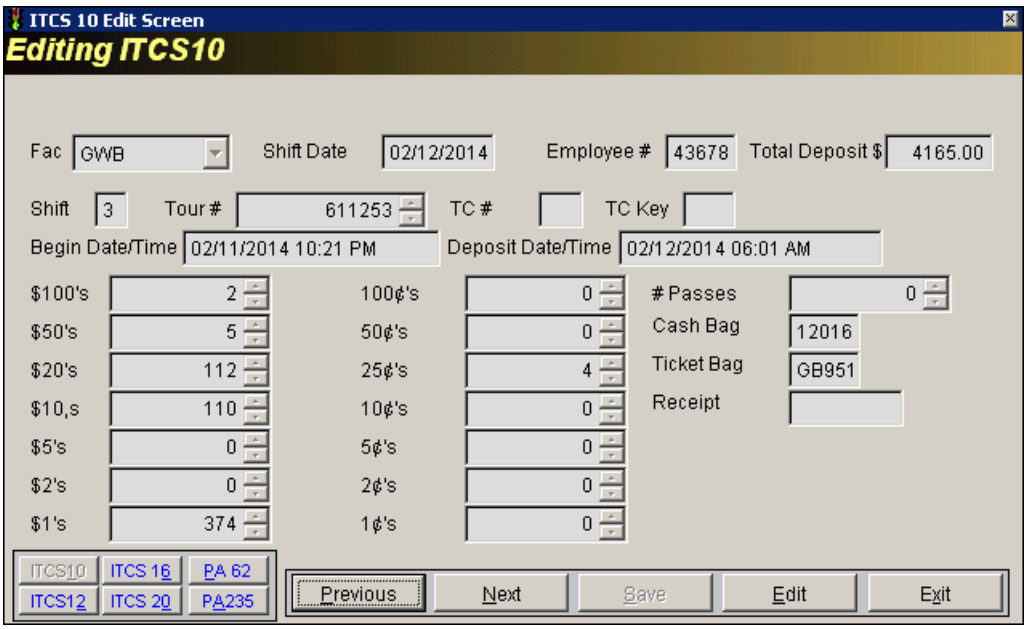
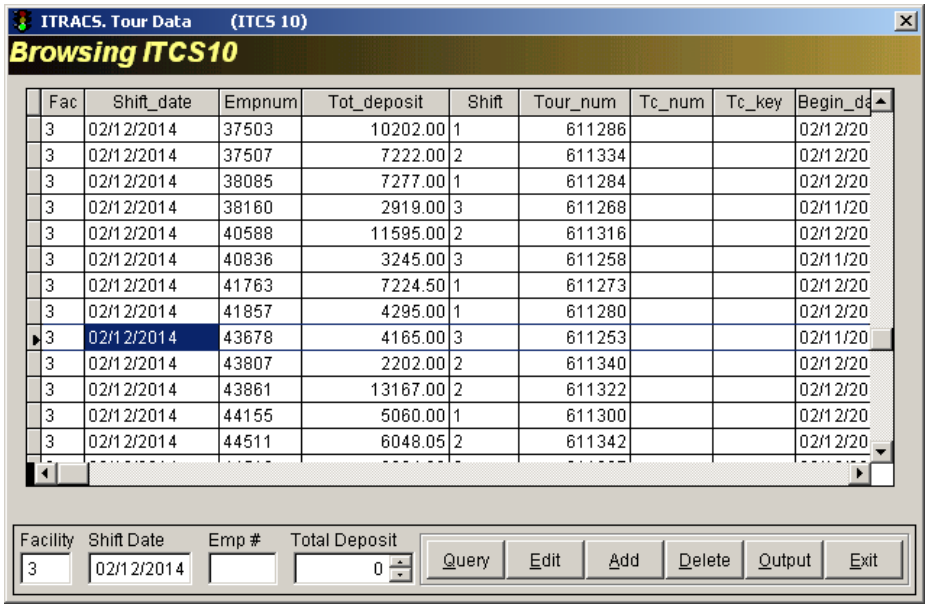


Figure 11 - Editing ITCS10 Screen

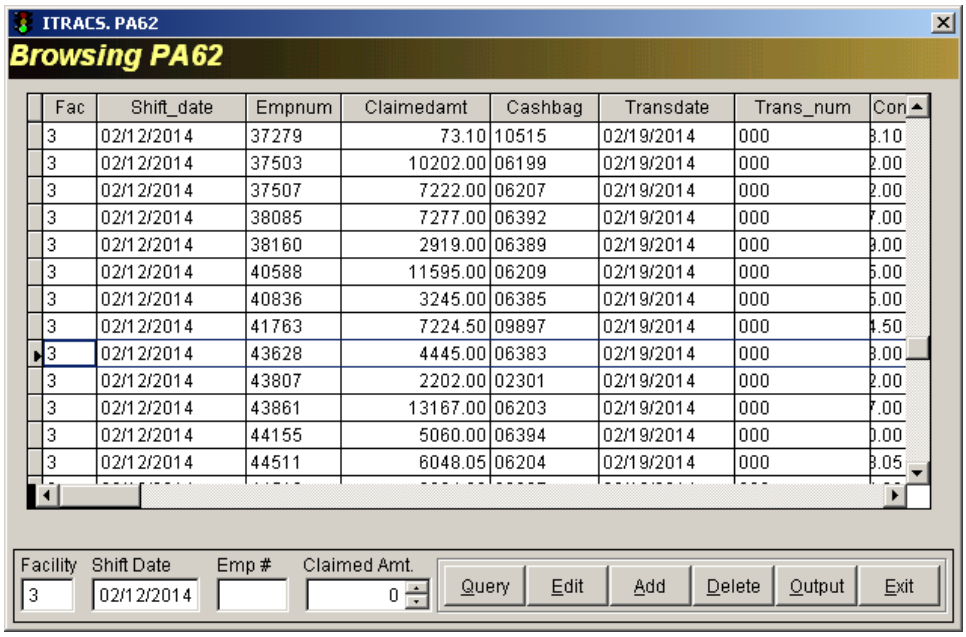
Revenue Accounting can also search for ITCS tours by facility, shift date, employee number or total deposit (claimed amount) using the screen below.



Fac	Shift_date	Empnum	Tot_deposit	Shift	Tour_num	Tc_num	Tc_key	Begin_da
3	02/12/2014	37503	10202.00	1	611286			02/12/20
3	02/12/2014	37507	7222.00	2	611334			02/12/20
3	02/12/2014	38085	7277.00	1	611284			02/12/20
3	02/12/2014	38160	2919.00	3	611268			02/11/20
3	02/12/2014	40588	11595.00	2	611316			02/12/20
3	02/12/2014	40836	3245.00	3	611258			02/11/20
3	02/12/2014	41763	7224.50	1	611273			02/12/20
3	02/12/2014	41857	4295.00	1	611280			02/12/20
3	02/12/2014	43678	4165.00	3	611253			02/11/20
3	02/12/2014	43807	2202.00	2	611340			02/12/20
3	02/12/2014	43861	13167.00	2	611322			02/12/20
3	02/12/2014	44155	5060.00	1	611300			02/12/20
3	02/12/2014	44511	6048.05	2	611342			02/12/20

Figure 12 - Browsing ITCS10 Screen

If tour records are missing, Revenue Accounting can use the screen above to add an ITCS10 record. They can also use this screen to edit or delete a tour record.

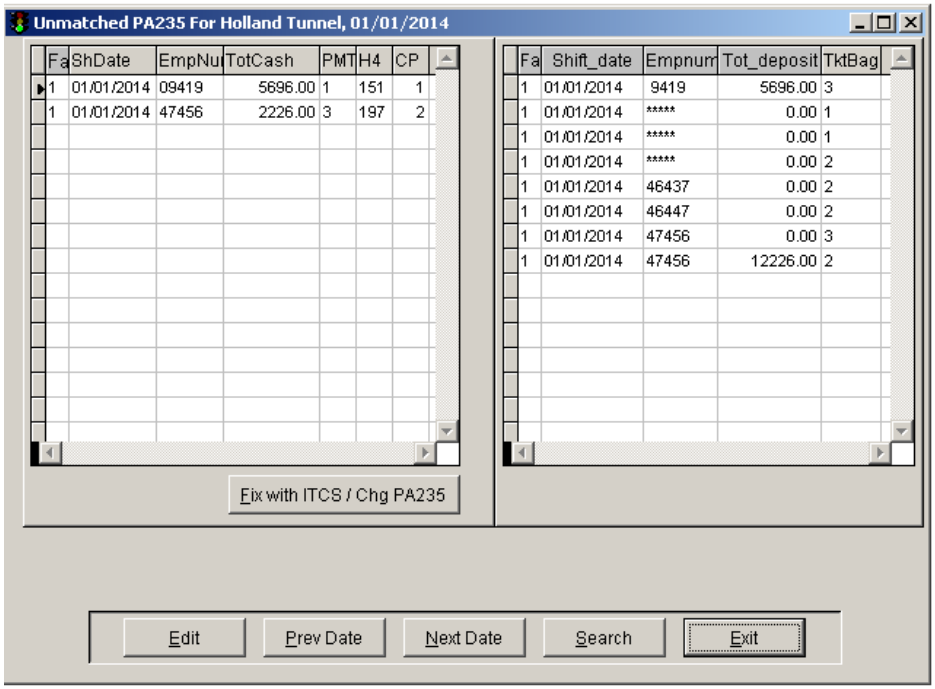


Fac	Shift_date	Empnum	Claimedamt	Cashbag	Transdate	Trans_num	Con
3	02/12/2014	37279	73.10	10515	02/19/2014	000	3.10
3	02/12/2014	37503	10202.00	06199	02/19/2014	000	2.00
3	02/12/2014	37507	7222.00	06207	02/19/2014	000	2.00
3	02/12/2014	38085	7277.00	06392	02/19/2014	000	7.00
3	02/12/2014	38160	2919.00	06389	02/19/2014	000	9.00
3	02/12/2014	40588	11595.00	06209	02/19/2014	000	5.00
3	02/12/2014	40836	3245.00	06385	02/19/2014	000	5.00
3	02/12/2014	41763	7224.50	09897	02/19/2014	000	4.50
3	02/12/2014	43628	4445.00	06383	02/19/2014	000	3.00
3	02/12/2014	43807	2202.00	02301	02/19/2014	000	2.00
3	02/12/2014	43861	13167.00	06203	02/19/2014	000	7.00
3	02/12/2014	44155	5060.00	06394	02/19/2014	000	0.00
3	02/12/2014	44511	6048.05	06204	02/19/2014	000	3.05

Figure 13 - Browsing PA62 Screen

Similar to the Browse ITCS10 screen, Revenue Accounting can search for Bank PA62 records by facility, shift date, employee number or total deposit (claimed amount) using the screen above.

Revenue Accounting also reconciles non-revenue tickets. Using the Unmatched PA235 screen shown below, Revenue Accounting can select records and edit either ITCS10 records or the PA235 records.



Fa	ShDate	EmpNu	TotCash	PMT	H4	CP
1	01/01/2014	09419	5696.00	1	151	1
1	01/01/2014	47456	2226.00	3	197	2

Fa	Shift_date	Empnum	Tot_deposit	TktBag
1	01/01/2014	9419	5696.00	3
1	01/01/2014	*****	0.00	1
1	01/01/2014	*****	0.00	1
1	01/01/2014	*****	0.00	2
1	01/01/2014	46437	0.00	2
1	01/01/2014	46447	0.00	2
1	01/01/2014	47456	0.00	3
1	01/01/2014	47456	12226.00	2

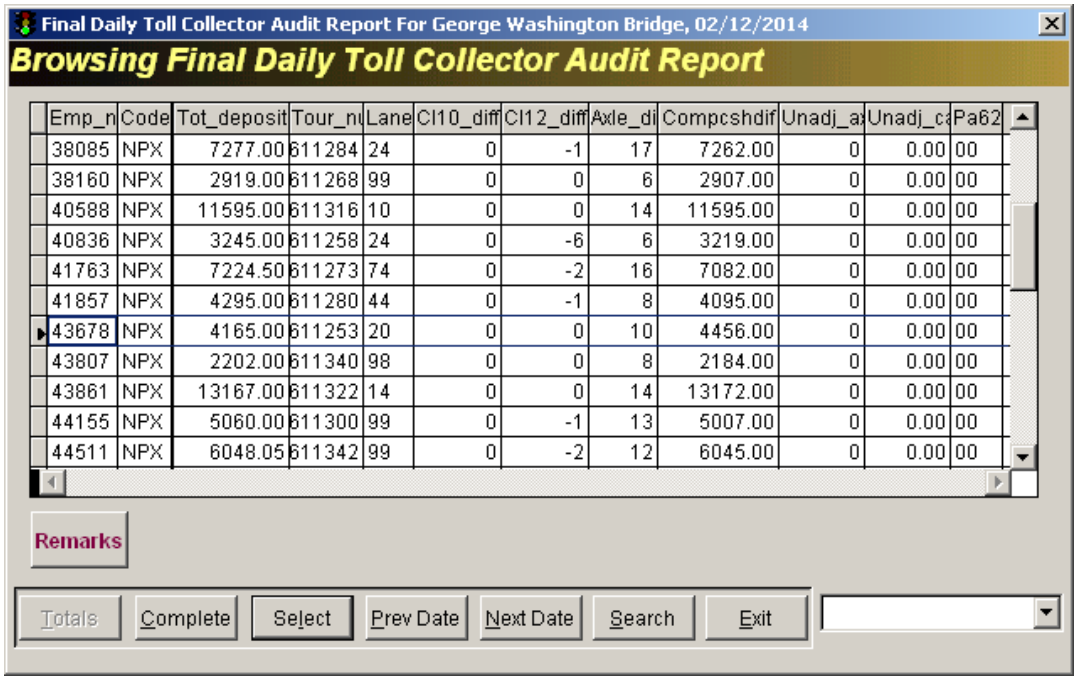
Figure 14 - Unmatched PA235 Screen

Similar to the Browse PA62 screen, Revenue Accounting has a Browse PA235 screen that allows them to add, edit or delete a PA235 record.

Once tours and bags are matched, Revenue Accounting initiates an ITRACS process that attempts to reconcile and generate the following:

- Plus/Minus axles and cash
- Plus/Minus unadjusted axles and cash
- Calculation of the cash, axle and ticket errors
- Computed Cash

The results of this process are shown on the Final Cash Monitoring Screen shown in Figure 15.



Emp_n	Code	Tot_deposit	Tour_nu	Lane	Cl10_diff	Cl12_diff	Axle_di	Compcshdif	Unadj_a	Unadj_c	Pa62
38085	NPX	7277.00	611284	24	0	-1	17	7262.00	0	0.00	00
38160	NPX	2919.00	611268	99	0	0	6	2907.00	0	0.00	00
40588	NPX	11595.00	611316	10	0	0	14	11595.00	0	0.00	00
40836	NPX	3245.00	611258	24	0	-6	6	3219.00	0	0.00	00
41763	NPX	7224.50	611273	74	0	-2	16	7082.00	0	0.00	00
41857	NPX	4295.00	611280	44	0	-1	8	4095.00	0	0.00	00
43678	NPX	4165.00	611253	20	0	0	10	4456.00	0	0.00	00
43807	NPX	2202.00	611340	98	0	0	8	2184.00	0	0.00	00
43861	NPX	13167.00	611322	14	0	0	14	13172.00	0	0.00	00
44155	NPX	5060.00	611300	99	0	-1	13	5007.00	0	0.00	00
44511	NPX	6048.05	611342	99	0	-2	12	6045.00	0	0.00	00

Figure 15 - Final Daily Cash Monitoring Screen

Revenue Accounting uses the **Unadj _axles** and **Unadj_cash** columns shown in the screen above to determine if a detailed audit of any Toll Collector tours is necessary.

DRAFT

Any tours with unadjustable differences in excess of $60 or short 20 axles are researched by Revenue Accounting to determine if the tour should be included or excluded from Performance Report (also known as the 404 report). Revenue Accounting has different methods of researching tours. The following reports or documents may be used for this process:

- PA379 (collector exception log)
- Detailed Transaction report (run from ITCS)
- Tour of Duty report

Codes selected by Revenue Accounting determine whether a tour is included or excluded from the Performance Report. Revenue Accounting selects the appropriate code from the lower right-hand box in the screen above. The following selections are available.

Code	Definition	Included in 404
FYI1	Problem with Axles	No
FYI2	Special cases	No
FYI3	Problem with Register	No
NP	Not Posted Not Exceeding Threshold	No
NPA	No Posted – Auditor Discretion	No
NPX	Not Posters Exceeding Threshold	No
P	Posters Not Exceeding Threshold	Yes
PA	Posted – Auditor Discretion	Yes
PX	Posters Exceeding Threshold	Yes
WU	Write-up	Yes

An example of the Performance Report is shown below.

THE PORT AUTHORITY OF NY & NJ

Performance - By Collector
Facility: George Washington Bridge
For February, 2014
(Printed 03/28/2014 10:09 AM)

COLLECTOR: [redacted]
EMPLOYEE NUMBER: [redacted] ORG# 165

Facility: George Washington Bridge

DAY	FAC	TOUR	LANE	TOTAL TRANS	10 S/B 1	1 S/B 10	10 S/B 12	12 S/B 10	CLASS 10	CLASS 12	PLUS OR MINUS AXLES	PLUS OR MINUS CASH	----------ERRORS---------- CASH	TKTS	AXLE	TOTAL	PLUS OR MINUS UNADJ AXLES	PLUS OR MINUS UNADJ CASH	PA62 ERROR CODE
02/02/2014	3	2	54	435															
02/03/2014	3	3	99	73															
02/04/2014	3		10	151															
02/06/2014	3	1	74	655															9
02/09/2014	3	1	99	350															
02/10/2014	3	1	20	347															9
02/11/2014	3	3	24	237															
02/12/2014	3	1	20	315							10	-88.00	2			2	5	-3.00	10
02/17/2014	3	2	12	867															
02/18/2014	3	2	20	352															
02/22/2014	3	3	12	769															
02/23/2014	3	3	24	443															
02/24/2014	3	3	10	486															
02/25/2014	3	3	20	371															
02/28/2014	3	3	99	282															
TOTALS				6,132									2			2	5	-3.00	

TOTALS - UNADJUSTED AXLES AND CASH OVER 5
TOTALS - UNADJUSTED AXLES AND CASH SHORT -3.00

TOTAL AXLE, CASH AND TICKET ERRORS
PER 1000 TRANSACTIONS---------- 0.32

TIMES ON TOLLS---------- 15

Page 1

Figure 16 - Toll Collector Performance (404) Report

Revenue Accounting prepares a D65 Memo based on the information above from ITRACS, for any Toll Collectors that remain short/over by $60 or more. The memo is sent to each facility for Toll Collector performance reviews (e.g. counseling/disciplinary action) and includes the 417 Report, Performance Report, Tour of Duty report, and the D65 form (see Attachment 5). The D65 memo is shown below.

THE PORT AUTHORITY OF NY & NJ

MEMORANDUM

Comptroller's Department

To: [redacted] General Manager, Holland Tunnel
From: [redacted]
Date: April 17, 2013
Subject: **AUDIT – TOLL COLLECTOR, [redacted] EMPLOYEE #[redacted]**
HT 02-01

Copy To: [redacted]

The audit of collector [redacted]'S tour of 02/20/13 disclosed a:

$72.00 shortage

We are enclosing the D65 Report and related Toll Collector's Report, Collector's Non-Revenue Report, Deposit Slip, and Tour of Duty Report.

[redacted]
Senior Accounting Supervisor
Comptroller's Department

Figure 17 - D65 Memo

As referenced above, an example of the Tour of Duty report is shown below. This report summarizes Toll Collector activity and transactions. It is used by Revenue Accounting to search for anomalies during their reconciliation process.

DRAFT

100%

COLLECTOR TOUR OF DUTY

George Washington Bridge - 02/12/2014

02/20/2014 01:48 PM

EMP. NUM: [redacted] EMP. NAME: [redacted] TOUR#: 611253 SHIFT#: 3

	CASH	SCRIP	CLASS 10	H4	KEY# CARPOOL	NON-REV TOTAL	EXTRA TKTS		
DEPOSITED:	4,165.00	0.00	0	0	0	11	(3)	NON-ALLOWABLE EXCEPT	0.00
INDICATED:	4,456.00	0.00	0	0	0	11		SCRIP DIFFERENCE	0.00
DIFFERENCE:	(291.00)	0.00	0	0	0			DIFF (COMP - IND CASH	0.00
COMPUTED:	4,456.00								

	NON-REV	REVENUE	VIOL		QTY	VALUE	SCRIP
CLASS 1	1	302	0	ESCORT	0		
CLASS 2	0	2	0	CLEARS	4		
CLASS 3	0	0	0	SCRIP	0	0.00	
CLASS 4	0	1	0	ANNUAL PASS	0		
CLASS 5	0	3	0	EMERGENCY	1		
CLASS 6	0	0	0	TOLL EVADER	10		
CLASS 7	0	4	0	TURNAROUND	0		
CLASS 8	0	2	0	SPECIAL	0	0.00	
CLASS 9	0	0	0	OFF ROUTE	0		
CLASS 11	0	0	0	PWOF	0	0.00	
CALC. AXLES	648			EXTRA AXLES	1	13.00	
ACT. FWD. AXLES	638						
ACT. REV. AXLES	0			FUNDS UNDER (C)	0	0.00	
AXLE DIFF (CALC-NET)	10			FUNDS UNDER (S)	0	0.00	
TRANSACTIONS	325			FUNDS OVER (C)	0	0.00	
				FUNDS OVER (S)	0	0.00	

LANE	START	END
20	10:21 PM	12:33 AM
20	01:09 AM	03:11 AM
20	04:19 AM	05:59 AM

EXCEPTIONS

EXCEPT TIME	LANE	EXCEPT CODE	EXCEPT VALUE	DIFF (IND-COMP)	EXCEPTION DESCRIPTION	EXCEPTION CLASS	DATA FIELD A	DATA FIELD B	WITNESS INITIALS	MORE DETAIL
04:37 AM	20	33	0.00		Emergency Vehicles	1	0.00	0.00	Rers	EMERG

Figure 18 - Tour of Duty Report

4.3 Recording Revenue

Using Report 417 (which lists all computed cash and overages and shortages, by facility by month), Revenue Accounting books revenue for the month. An Example of 417 is shown below.

THE PORT AUTHORITY OF NY & NJ

417 Report
Facility: Holland Tunnel
For December, 2013

(Printed 01/29/2014 12:14 PM)

Date	Computed Cash	Collector Over / Short	Deposited Cash	Ticket Sales (142)	Customer Over / Short	142 Bank Confirm	157 Misc	Bank Deposit
12/01/2013	146,090.00	-374.15	145,715.85					145,715.85
12/02/2013		114,662.16	114,662.16					114,662.16
12/03/2013	98,766.94	1,945.99	100,712.93					100,712.93
12/04/2013	95,248.00	2,312.37	97,560.37					97,560.37
12/05/2013	100,637.00	1,517.20	102,154.20					102,154.20
12/06/2013	108,982.00	1,738.55	110,720.55					110,720.55
12/07/2013	135,270.00	545.05	135,815.05					135,815.05
12/08/2013	118,086.05	749.30	118,835.35					118,835.35
12/09/2013	101,442.00	3,101.12	104,543.12					104,543.12
12/10/2013	76,658.00	1,879.34	78,537.34					78,537.34
12/11/2013	96,032.00	2,286.98	98,318.98					98,318.98
12/12/2013	103,498.00	2,011.26	105,509.26					105,509.26
12/13/2013	118,155.00	2,193.65	120,348.65					120,348.65
12/14/2013	104,449.00	-7,372.00	97,077.00					97,077.00
12/15/2013		102,351.75	102,351.75					102,351.75
12/16/2013	107,888.00	1,680.96	109,568.96					109,568.96
12/17/2013	81,460.00	1,932.16	83,392.16					83,392.16
12/18/2013	97,599.00	1,891.65	99,490.65					99,490.65
12/19/2013	107,219.00	1,960.10	109,179.10					109,179.10
12/20/2013	123,128.50	2,163.08	125,291.58					125,291.58
12/21/2013	157,635.00	952.40	158,587.40					158,587.40
12/22/2013	134,890.00	1,118.25	136,008.25					136,008.25
12/23/2013	121,633.70	2,312.90	123,946.60					123,946.60
12/24/2013	125,106.00	1,556.78	126,662.78					126,662.78
12/25/2013	132,387.00	1,294.90	133,681.90					133,681.90
12/26/2013	119,396.00	2,062.70	121,458.70					121,458.70
12/27/2013	136,208.00	1,696.53	137,904.53					137,904.53
12/28/2013	150,833.00	642.00	151,475.00					151,475.00
12/29/2013	142,765.00	795.55	143,560.55					143,560.55
12/30/2013	131,124.00	2,496.98	133,620.98					133,620.98
12/31/2013	130,153.00	2,457.01	132,610.01					132,610.01
Prepd Tkts								
Total:	**3,402,739.19**	**256,562.52**	**3,659,301.71**					**3,659,301.71**

Figure 19 - Computed Cash Report 417

4.4 Audit Trail

All edits performed using ITRACS result in an audit trail with searchability and associated audit reports.

Attachment 1. ITCS Deposit Slip

DEPOSIT SLIP

THE PORT AUTHORITY
OF NEW YORK AND NEW JERSEY

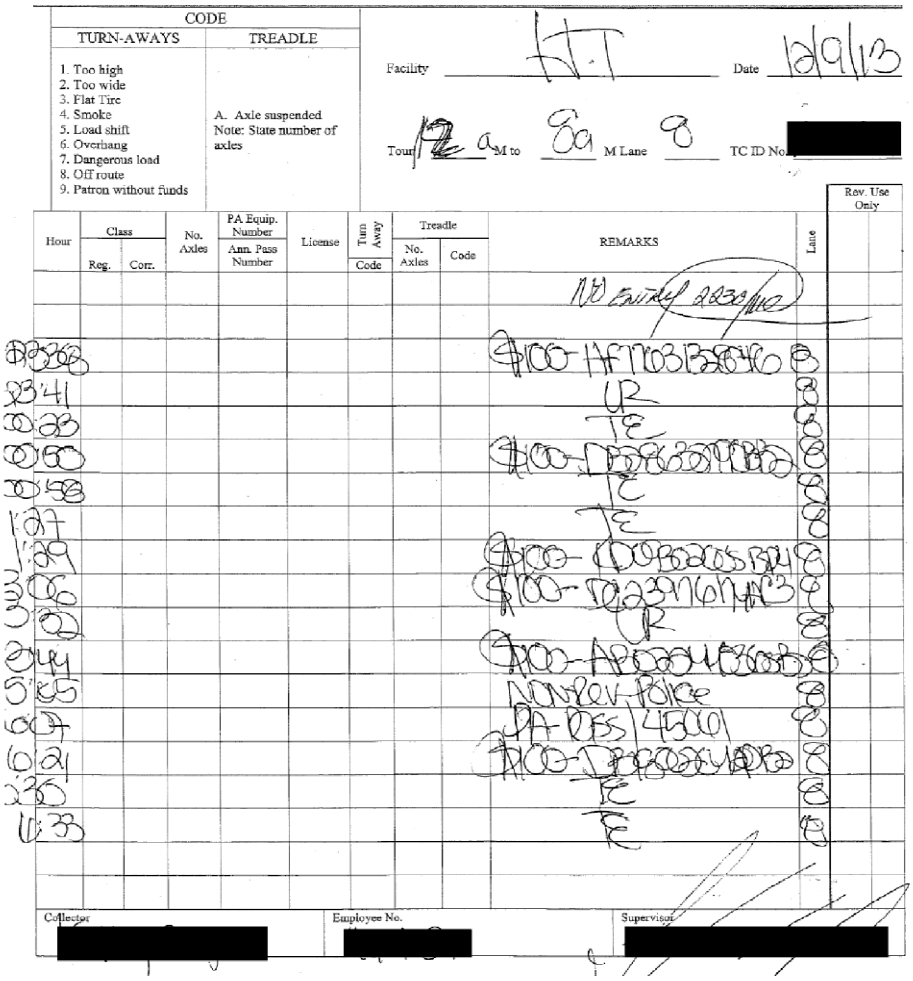
Facility : HT
Date : FRI 7-FEB-2014 09:09:49
Shift : 2
Collector Name : Training
Employee # : 6404 Key # : 6404

Curr	Qty	Amount	Coin	Qty	Amount
$100	2	200.00	1.00	0	0.00
$50	5	250.00	0.50	0	0.00
$20	10	200.00	0.25	0	0.00
$10	5	50.00	0.10	0	0.00
$5	30	150.00	0.05	0	0.00
$2	0	0.00	0.01	0	0.00
$1	600	600.00			

Total Cash : $ 1450.00
Qty Passes : 5
Money Bag # : ii321123
Ticket Bag # : 11456654

TOLL HOUSE

Attachment 2. PA379 – Toll Collector Exception Log



CODE	
TURN-AWAYS	TREADLE
1. Too high 2. Too wide 3. Flat Tire 4. Smoke 5. Load shift 6. Overhang 7. Dangerous load 8. Off route 9. Patron without funds	A. Axle suspended Note: State number of axles

Facility H.T. Date 12/9/13

Tour 12 a M to 8a M Lane 8 TC ID No. [redacted]

Hour	Class Reg.	Class Corr.	No. Axles	PA Equip. Number / Ann. Pass Number	License	Turn Away Code	Treadle No. Axles	Treadle Code	REMARKS	Late	Rev. Use Only
									NB Entry 2230/no		
23:28									$100 HF7103132646	8	
23:41									UR	8	
0:33									TE	8	
0:50									$100- [illegible]	8	
0:58									TE	8	
1:27									TE	8	
1:39									$100- [illegible]	8	
3:06									$100- [illegible]	8	
3:22									UR	8	
3:44									$100- [illegible]	8	
5:55									NonRev Police	8	
6:07									PA-DSS 45001	8	
6:21									$100- [illegible]	8	
2:30									TE	8	
4:33									TE	8	

Collector [redacted] Employee No. [redacted] Supervisor [redacted]

Attachment 3. Manual PA235 – Toll Collector's Report

TOLL COLLECTOR'S REPORT - CASH AND TICKETS COLLECTED PA 0235 / 10-08

COLLECTOR (PRINT)		EMPLOYEE NUMBER
DATE	FACILITY	TC ID NO.

LANES REGULAR COLLECTOR	EXACT REPORTING TIME ☐ AM ☐ PM	TOUR	12-8	8-4	4-12
LANE NO.			FOR COMPTROLLER'S DEPT. USE ONLY TICKETS COLLECTED		
RELIEF COLLECTOR LANE NO.			TYPE	NO.	
From To M M					
From To M M					
From To M M			$ .25		
From To M M			$ .50		
Lane No.			$ .75		
From To M M			$ 1.00		
From To M M			$ 1.50		
From To M M	NON-REVENUE	SPECIAL PERMITS	$ 2.00		
Lane No.	Passes / No.	Number / Class / Excess Amount	$ 2.25		
From To M M	REGULAR		$ 3.00		
From To M M	TOTAL PASSES		$ 4.00		
From To M M			$ 4.50		
Lane No.					
From To M M			$ 6.00		
From To M M			$ 7.50		
From To M M			$ 8.00		
Lane No.					
From To M M			$ 12.00		
From To M M		Total Excess Amounts From Special Permits $	$ 15.00		
From To M M		BAG NUMBERS	$ 16.00		
Lane No.		MONEY	$ 18.00		
From To M M		TICKETS	$ 20.00		
From To M M	TOTAL DEPOSITS – FORM PA 62 $		$ 24.00		

Attachment 4. Manual PA62 – Bank Deposit Slip

THE PORT AUTHORITY OF NY & NJ

BANK DEPOSIT SLIP **PA 0062 / 03-11**

DEPOSITED BY
THE PORT AUTHORITY
OF NEW YORK AND NEW JERSEY

FACILITY

PREPARED BY (PRINT)

EMPL. NO. LANE NO.

TC ID NO. DATE / /
Mo. Day Year

Number	Currency	Amount	For Bank Use
	$100	.00	
	50	.00	
	20	.00	
	10	.00	
	5	.00	
	2	.00	
	1	.00	
	Coins $1.00		
	.50		
	.25		
	.10		
	.05		
	.01		
TOTAL			

COLLECTOR'S INITIALS AND EMPLOYEE NUMBER
MUST BE WRITTEN ON EACH WRAPPER

ORIGINAL AND DUPLICATE
WITH DEPOSIT

ORIGINAL

Attachment 5. D64 – Form Sample

Collector Name: _____ Emp.#: _____
Date worked: _____ Facility: _____
Amount Over/Short: _____ Auditor: _____

D65 Procedures

	Done By	Date
1. After completing cash audits, the first full audits to be done are those with overages or shortages of at least $60.00 (unadjustable cash)		
2. Tickets are rechecked and then fanned for possible scrip mix-ups.		
3. Check for compensating differences (day before and after, tour before and after and relief collectors during the tour in question).		
4. Match the Tour of Duty Report to the PA235 for possible keypunch errors.		
5. Hand count tickets.		
6. Recheck tickets counted before and after to insure that tickets were no mixed with another collector's.		
7. Check that time and date stamped on tickets corresponds with the segments listed on the Tour of Duty Report.		
8. Check data sent from bank (PA62's, tapes, etc.)		
9. Check for unusual figures		
a. too many special permits		
b. disproportionate number of scrip to transactions		
c. unusual amount of transactions or scrip in any classification		
10. Check for any D-65 which could be matched with a corresponding difference.		
11. Check log for Short Change Inquiries or Change Bank memos		
12. Check with other auditors regarding collector, lanes or other D-65's.		
13. Reconcile deposit slip (PA62) (check addition and extension, bank tapes, etc.)		
14. Verify that the confirmed PA62 amount (from the bank) is keypunched correctly.		
15. Get feedback from other auditors regarding the bank teller.		
16. Check Toll Collector's PA379.		
17. Write up D65		
18. Give D-65 and tickets to supervisor		
19. Prepare and sign letter or transmittal		
20. Make all necessary copies and distribute to facilities.		

DRAFT

22 Attachment 11 – ITRACS Algorithm Calculations

-THIS PAGE INTENTIONALLY LEFT BLANK-

ITRACS Algorithm Calculation

This document provides a detailed explanation of the algorithm employed by iTRACS to calculate "Errors" (Cash, Ticket and Axle) based on Ticket, Axle and Cash overages/shortages and the logic used to adjust the Axle/Cash overages/shortages.

Starting with raw values (i.e., values before any adjustments are made) for Ticket over/short, Cash over/short and Axle over/short (over is positive, short is negative) for a single Tour of Duty, the algorithm calculates Errors and adjusted values for Axles and Cash. The following columns displayed on the *Performance by Collector Report* (aka, the 404 Report) are relevant to the adjustment algorithm described in this document:

- **Class 12** is the Tour of Duty's raw value for Ticket over/short.
- **Plus or Minus Axles** is the Tour of Duty's raw value for Axle over/short, adjusted by the raw value of Ticket over/short as described below.
- **Plus or Minus Cash** is the Tour of Duty's raw value of Cash over/short.
- **Errors / Cash** is the count of vehicle-level adjustments (referred to below as *err_a_cash*), added to the count of unadjusted vehicle-level cash errors (referred to below as *err_u_cash*).
- **Errors / Tkts** is the count of vehicle-level errors that correspond to Ticket over/short.
- **Errors / Axle** is the count of unadjusted vehicle-level axle errors (referred to below as *err_u_axle*).
- **Errors / Total** is the sum of Errors / Cash, Errors / Tkts, and Errors / Axle.
- **Plus or Minus Unadj Axles** is the Axle over/short remaining after the program algorithm is finished.
- **Plus or Minus Unadj Cash** is the Cash over/short remaining after the program algorithm is finished.

The algorithm described by this document includes logic coded into the Visual FoxPro file *negaxle_poscash_allcases_nxnc_pxpc.txt* provided by the Authority. Ticket over/short logic, not included in the code module, has been incorporated into this document as procedures for:

- Determining a value for **Errors / Tkts**; and
- Determining a value for **Plus or Minus Axles**.

If a fare change alters the traditional sequence of least to most expensive fares, this algorithm should be reviewed and re-tested. If axle counts for a vehicle class change, the algorithm as well as the code module should be reviewed and updated as appropriate.

ITRACS Algorithm Calculation

The algorithm works as follows.[1]

Preliminaries:

Initialize variables:

- set *err_a_cash* to zero
- set *err_u_cash* to zero
- set *err_u_axle* to zero
- set Cash over/short to the raw value of Cash over/short

Set values for **Errors / Tkts, Plus or Minus Axles,** and Axle over/short before beginning the algorithm body contained in *negaxle_poscash_allcases_nxnc_pxpc.txt*. Perform the following assignments in sequence:

- Set **Errors / Tkts** to the absolute value of Ticket over/short. For example, both a ticket shortage of 3, and a ticket overage of 3 would cause **Errors / Tkts** to be set to 3.
- Set **Plus or Minus Axles** to the sum of the raw value of Axle over/short, plus twice the value of Ticket over/short. For example, for a Tour of Duty that is 4 axles short (expressed as -4), and 3 tickets over (expressed as +3), **Plus or Minus Axles** would be set to -4 + 2*(+3) = +2.
- Set Axle over/short equal to **Plus or Minus Axles.**

Algorithm Body (all that follows is taken from *negaxle_poscash_allcases_nxnc_pxpc.txt)*:

Perform the following Chained Conditional, covering logical Case I - Case IV[2]. The logic attempts to reduce values of Axle over/short and Cash over/short in a structured fashion, meanwhile incrementing the error counters *err_a_cash, err_u_cash,* and *err_u_axle*:

(Case I) If Axles are short (negative) or zero, and Cash is either short (negative) or zero:

- set *err_u_cash* equal to the count of Class 1 fares that divide into the absolute value of the cash shortage, rounded up to the next whole number. E.g., shortage of $10 becomes 1, shortage of $15 becomes 2 (assuming $13 Class 1 fare).

[1] The original code allows a Case III Tour of Duty to continue processing as a Case IV, if toll rates are sufficiently different from what they have been historically. This means that, in the original code, changes in toll rates could cause the original code to behave in an unexpected fashion, and differently than the algorithm documented here. However, because it appears that the intention of the original algorithm was to treat Negative Axles/Positive Cash as one case, and Positive Axles/Negative Cash as a distinct second case, the algorithm as written in this document separates the two cases explicitly.

[2] Case III appears to include conditionals that cannot logically be met because prior conflicting conditionals were satisfied. These sub-conditions are marked with '**' in this document. In some cases, these are caused by the toll rate change for buses (Classes 8 and 9) that causes them to now be charged more than Class 1 vehicles (where previously, they were charged less).

- set *err_u_axle* equal to the absolute value of: the remaining axle shortage expressed as a positive number, divided by two, then rounded to the next whole number. For example, shortage of 2 becomes 1; shortage of 3 becomes 2; shortage of 4 becomes 2; etc.[3]

else ***(Case II)*** – if Axles are over (positive) or zero, and Cash is either over (positive) or zero:

- set *err_u_cash* equal to the count of Class 1 fares that divide into the cash overage, rounded up to the next whole number.
- set *err_u_axle* to 0

else ***(Case III)*** – if Axles are over (positive), and Cash is short (negative):

1. **LOOP:** While axle overage is at least 2, and cash shortage is at least a Class 1 Fare, repeatedly execute the following Chained Conditional for Case III. Each time a conditional in the table is satisfied, in addition to reducing Axle Overage and Cash Shortage, also increment *err_a_cash* by one.

If Cash is short by… (check the following in sequence and execute only the first that matches):	Example using current fares	And Axles are over by		Then, reduce Axle Overage By	and reduce Cash Shortage by	Example using current fares
At least the sum of Class 1 and Class 8 rates, but less than the sum of Class 1 and Class 2 rates	>= $35 and < $47	At least 4		3 axles	Class 7 fare	$27
At least the Class 7 rate, and at most the Class 3 rate	>= $27 and <= $51	Exactly 3		3 axles	Class 9 fare	$22
At least the Class 9 rate, and at most the Class 7 rate	>= $22 and <= $27	Exactly 3		2 axles	Class 8 fare	$22
At least the Class 8 rate, and at most the Class 3 rate	>= $22 and <= $51	Exactly 2		2 axles	Class 1 fare[4]	$13

[3] In the original, Case I and Case IV *err_u_axle* calculations are inconsistent. Both cases calculate *err_u_axle* as `ABS(CEILING (adj_axle/2))` where adj_axle is the axle shortage remaining after the algorithm has completed. But in Case I, *adj_axle* is a negative number, and in Case IV, *adj_axle* has been changed to a positive number for the purposes of Case IV's axle shortage reduction algorithm. The result is that *err_u_axle* calculations are inconsistent between Case I and Case IV. A shortage of 3 axles would result in *err_u_axle* of 1 for Case 1, and 2 for Case IV. Compare, using the current iTracs report, Holland Tunnel Tours of Duty for Employee 31145 on 2/13/2014 (3 axles short, Case I assigned 1 axle error) against the same employee's Tour on 2/27/2014 (3 axles short, Case IV assigned 2 axle errors). In this document, the Case I *err_u_axle* calculation has been changed to match Case IV.

[4] The original code contains a $12 reduction in Cash Overage rather than a Class 1 rate reduction in Cash Overage. However, because an increment is also added to a locally scoped variable holding Class 1 adjustment count, and because a dated comment next to the hard-coded $12 is dated 2008, when Class 1

ITRACS Algorithm Calculation

If Cash is short by… (check the following in sequence and execute only the first that matches):	Example using current fares	And Axles are over by		Then, reduce Axle Overage By	and reduce Cash Shortage by	Example using current fares
At least the Class 5 rate	>= $85	Exactly 7		5 axles	Class 5 fare	$85
At least the Class 6 rate	>= $102	At least 6		6 axles	Class 6 fare	$102
At least the Class 4 rate	>= $68	Exactly 6		4 axles	Class 4 fare	$68
At least the Class 5 rate	>= $85	At least 5		5 axles	Class 5 fare	$85
At least the Class 3 rate	>= $51	Exactly 5		3 axles	Class 3 fare	$51
At least the Class 4 rate	>= $68	At least 4		4 axles	Class 4 fare	$68
At least the Class 2 rate	>= $34	Exactly 4		2 axles	Class 2 fare	$34
At least the Class 2 rate	>= $34	At least 3		2 axles	Class 2 fare	$34
At least the Class 3 rate	>= $51	At least 3		3 axles	Class 3 fare	$51
At least the Class 7 rate	>= $27	Exactly 3		3 axles	Class 7 fare	$27
At least the Class 2 rate	>= $34	At least 2		2 axles	Class 2 fare	$34
At least the Class 7 rate	>= $27	At least 3		3 axles	Class 7 fare	$27
At least the Class 1 rate	>= $13	At least 2		2 axles	Class 1 fare	$13
**At least the Class 8 rate	>= $22	Exactly 2		2 axles	Class 8 fare	$22
**At least the Class 9 rate	>= $22	At least 3		3 axles	Class 9 fare	$22
**Else, if cash is short, then: **set *err_u_cash* equal to the number of Class 1 fares that divide into the cash shortage, rounded up to the next whole number (i.e., a non-negative number, rounded in a positive direction), and **set *err_u_axle* equal to zero.						

This is the End of the Chained Conditional for Case III.
This is the End of the Loop for Case III.

2. After the Case III loop:

fares were in fact $12, and because all other overage and shortage reductions are specified in terms of current toll rates, in this document $12 was changed to Class 1 Fare.

- set *err_u_cash* equal to the count of Class 1 fares that divide into the absolute value of the remaining cash shortage rounded up to the next whole number. E.g., shortage of $10 becomes 1, shortage of $15 becomes 2 (assuming $13 Class 1 fare).
- set *err_u_axle* set to zero.

else ***(Case IV)*** – if Axles are short (negative) and Cash is over (positive):

1. **LOOP:** Execute the following Chained Conditional for Case IV repeatedly, until axle shortage is less than 2, or axles are over, or cash overage is less than a Class 1 Fare, or cash is short, or until the conditional has been executed more than 1000 times.

   For each reduction performed to Cash Overage, also increment *err_a_cash* by one.

ITRACS Algorithm Calculation

a) If cash is over by at least the sum of Class 1 and Class 8 rates, and less than the sum of Class 1 and Class 2 rates, and axles are short by at least 4:

IF….		
If Cash is over by	**Example using current fares**	**And Axles are short by**
At least the sum of Class 1 and Class 8 rates, and less than the sum of Class 1 and Class 2 rates	>= $35 and < $47	At least 4

THEN….						
If Cash is over by… (check and execute each of the following in sequence as applicable):	**Example using current fares**	**And Axles are short by**		**Then, reduce Axle Shortage By**	**and reduce Cash Overage by**	**Example using current fares**
At least the Class 7 rate, and at most the Class 3 rate	>= $27 and <= $51	At least 3		3 axles	Class 7 fare	$27
At least the Class 9 rate, and at most the Class 7 rate	>= $22 and <= $27	At least 3		3 axles	Class 9 fare	$22
At least the Class 8 rate, and at most the Class 3 rate	>= $22 and <= $51	At least 2		2 axles	Class 8 fare	$22
At least the sum of Class 1 and Class 8 rates, but less than the sum of Class 1 and Class 2 rates	>= $35 and < $47	At least 4		2 axles	Class 1 fare[5]	$13

[5] The original code contains a $12 reduction in Cash Overage rather than a Class 1 rate reduction in Cash Overage.

ITRACS Algorithm Calculation

b) Else if cash is over by at least the Class 7 rate, and at most the Class 3 rate, and axles are short by exactly 3:

ELSE IF….						
If Cash is over by			**Example using current fares**		**And Axles are short by**	
At least the Class 7 rate, and at most the Class 3 rate			>= $27 and <= $51		Exactly 3	
THEN….						
If Cash is over by… (check and execute each of the following in sequence as applicable):	**Example using current fares**	**And Axles are short by**		**Then, reduce Axle Shortage By**	**and reduce Cash Overage by**	**Example using current fares**
At least the Class 7 rate, and at most the Class 3 rate	>= $27 and <= $51	At least 3		3 axles	Class 7 fare	$27

c) else if cash is over by at least the Class 9 rate, and at most the Class 7 rate, and axles are short by exactly 3:

ELSE IF….						
If Cash is over by			**Example using current fares**		**And Axles are short by**	
At least the Class 9 rate, and at most the Class 7 rate			>= $22 and <= $27		Exactly 3	
THEN….						
If Cash is over by… (check and execute each of the following in sequence as applicable):	**Example using current fares**	**And Axles are short by**		**Then, reduce Axle Shortage By**	**and reduce Cash Overage by**	**Example using current fares**
At least the class 7 rate, and at most the class 3 rate	>= $27 and <= $51	At least 3		3 axles	Class 7 fare	$27
At least the Class 9 rate, and at most the Class 7 rate	>= $22 and <= $27	At least 3		3 axles	Class 9 fare	$22

d) else if cash is over by at least the Class 8 rate, and at most the Class 3 rate, and axles are short by exactly 2:

ELSE IF….						
If Cash is over by				**Example using current fares**	**And Axles are short by**	
At least the Class 8 rate, and at most the Class 3 rate				>= $22 and <= $51	Exactly 2	
THEN….						
If Cash is over by… (check and execute each of the following in sequence as applicable):	**Example using current fares**	**And Axles are short by**		**Then, reduce Axle Shortage By**	**and reduce Cash Overage by**	**Example using current fares**
At least the Class 8 rate, and at most the Class 3 rate	>= $22 and <= $51	At least 2		2 axles	Class 8 fare	$22

e) else if cash is over by at least the Class 6 rate:

ELSE IF….				
If Cash is over by	**Example using current fares**			
At least the Class 6 rate	>= $102			
THEN….				
If Axles are short by… (check the following in sequence and execute only the first that matches):		**Then, reduce Axle Shortage By**	**and reduce Cash Overage by**	**Example using current fares**
Exactly 7		5 axles	Class 5 fare	$85
At least 6		6 axles	Class 6 fare	$102
At least 5		5 axles	Class 5 fare	$85
At least 4		4 axles	Class 4 fare	$68
At least 3		3 axles	Class 3 fare	$51
At least 2		2 axles	Class 2 fare	$37

f) else if cash is over by at least the Class 5 rate:

ELSE IF....				
If Cash is over by	**Example using current fares**			
At least the Class 5 rate	>= $85			
THEN....				
If Axles are short by... (check the following in sequence and execute only the first that matches):		**Then, reduce Axle Shortage By**	**and reduce Cash Overage by**	**Example using current fares**
Exactly 6		4 axles	Class 4 fare	$68
At least 5		5 axles	Class 5 fare	$85
At least 4		4 axles	Class 4 fare	$68
At least 3		3 axles	Class 3 fare	$51
At least 2		2 axles	Class 2 fare	$37

g) else if cash is over by at least the Class 4 rate:

ELSE IF....				
If Cash is over by	**Example using current fares**			
At least the Class 4 rate	>= $68			
THEN....				
If Axles are short by... (check the following in sequence and execute only the first that matches):		**Then, reduce Axle Shortage By**	**and reduce Cash Overage by**	**Example using current fares**
Exactly 5		3 axles	Class 3 fare	$51
At least 4		4 axles	Class 4 fare	$68
Exactly 3		3 axles	Class 3 fare	$51
Exactly 2		2 axles	Class 2 fare	$37

h) else if cash is over by at least the Class 3 rate:

ELSE IF….				
If Cash is over by	**Example using current fares**			
At least the Class 3 rate	>= $51			
THEN….				
If Axles are short by… (check the following in sequence and execute only the first that matches):		**Then, reduce Axle Shortage By**	**and reduce Cash Overage by**	**Example using current fares**
Exactly 4		2 axles	Class 2 fare	$37
At least 3		3 axles	Class 3 fare	$51
Exactly 2		2 axles	Class 2 fare	$37

i) else if cash is over by at least the Class 2 rate:

ELSE IF….				
If Cash is over by	**Example using current fares**			
At least the Class 2 rate	>= $37			
THEN….				
Always		**Then, reduce Axle Shortage By**	**and reduce Cash Overage by**	**Example using current fares**
		2 axles	Class 2 fare	$37

j) else if cash is over by at least the Class 1 rate:

ELSE IF....				
If Cash is over by	**Example using current fares**			
At least the Class 1 rate	>= $13			
THEN....				
Always		**Then, reduce Axle Shortage By**	**and reduce Cash Overage by**	**Example using current fares**
		2 axles	Class 1 fare	$13

This is the End of the Chained Conditional for Case IV.
This is the End of the Loop for Case IV.

2. After the Case IV loop:
   - Set *err_u_cash* equal to the count of Class 1 fares that divide into the cash overage, rounded up to the next whole number.
   - Set *err_u_axle* equal to the remaining axle shortage expressed as a positive number, divided by two, rounded up to the next whole number. E.g., shortage of 2 becomes 1; shortage of 3 becomes 2; shortage of 4 becomes 2, 5 becomes 3, etc.

This is the end of the Chained Conditional covering Case I – Case IV and the Program.

THE PORT AUTHORITY OF NY & NJ

Tunnels, Bridges & Terminals

ITCS Strategic Investment

Change Order #1 to Contract #4600006009 / Purchase Order # 4500043187

Integrated Toll Collection System (ITCS) In-lane Maintenance and System Administration Services and E-ZPass Plus System Administration Services

July 18, 2014

Table of Contents

1 Introduction 7

1.1 Definitions 9

1.2 Change Order Terms and Conditions 12

1.2.1 Adjustments to Service Level Agreement (SLA) 12

1.2.2 Insurance Procured by the Contractor 13

1.2.3 Net Cost Work 14

1.2.4 Compensation for Extra Work 15

1.2.5 Compensation for Emergency Delays 19

1.2.6 Idle Salaried Men and Equipment 19

1.2.7 Delays to Contractor 20

1.2.8 Prevailing Rate of Wage Certification 21

1.2.9 Extensions of Time 22

1.3 Changes to Contract 22

1.3.1 Contract Review and Compliance Audits 22

1.3.2 Authority Access to Records 23

1.4 Pass Thru Equipment 24

1.4.1 IBM, Lenovo and Cisco Procurements 24

2 Hardware Requirements 25

2.1 Non-environmentally Controlled Locations 25

2.2 Environmentally Controlled Interior Locations 25

3 System Requirements 26

3.1 Lane Controller Hardware and Equipment 26

3.2 Lane Controller Software 27

3.3 Violation Enforcement System 28

3.4 Overhead Laser Scanner 29
3.5 Network 29
3.6 Outerbridge Crossing (OBX) Open Road Tolling (ORT) 31
3.7 Close-up Lane Observation Camera Equipment 31
3.8 Lane Mode Sign 32
3.9 Replacement ITCS Supervisor and Deposit Workstations and Interface 33
3.10 ECH/CSC Interface (CSC CO #103) 34
3.11 ECH Re-platform and Upgrade 35
3.11.1 General Hardware & Software Requirements for ECH Re-platform and Upgrade 35
3.11.2 Transition Plan & Data Migration 36
3.11.3 Revenue Audit Function 36
3.11.4 Reports 36
3.11.5 Video Tolling Transaction 40
3.11.6 Image Review Process 40
3.11.7 Abusing Tags Management 40
3.11.8 ECH Storage Requirements 40
3.11.9 Off-line Storage 41
3.12 Training 41
3.12.1 Training Manuals and Materials 42
3.13 Lane Installation 42
3.13.1 Decommissioning of Lane 66 ITCS Equipment at GWB Lower Level 42
3.13.2 Relocation of Holland Tunnel Treadles 43
4 Schedule and Management 44
4.1 Kickoff Meeting 44
4.2 System Design Review Meetings 44

4.3 Project Schedule 45
4.4 Project Monthly Progress Report 45
5 Documentation 46
5.1 Detailed Design Documents (DDD) 46
5.2 Implementation Plan 46
5.2.1 Work Sequence 47
5.2.2 Checklists for Completeness of On-site Work 47
5.3 Detail Design Drawings, Shop Drawings, Catalog Cuts and Samples 47
5.3.1 Submittal Schedule 47
5.3.2 Submittal Format 48
5.4 Manuals 48
5.4.1 System Administration Manual 48
5.4.2 Operations Manual 48
5.4.3 Maintenance and Service Manual 48
5.4.4 Toll Collector Operating Manual 48
5.4.5 Toll Supervisor's Operating Manual 49
5.4.6 ECH Re-platform Training Manuals 49
5.5 Disaster Recovery Plan 49
5.6 Documentation Review and Approval Cycle 50
6 Testing 52
6.1 Factory Acceptance Test 53
6.2 On-Site First Installation Test (OFIT) 54
6.2.1 Lane OFIT 54
6.2.2 ECH OFIT 54
6.3 Field Checkout Test (FCOT) 54

6.3.1 Conventional Lane FCOT 54

6.3.2 OBX Express Lane FCOT 55

7 Maintenance and Spares 56

8 Maintenance of Traffic 56

9 Milestone Payments 56

10 Assumptions By Contractor 57

11 Hours of Work 58

12 Staging 60

13 Attachment 1 - CSC CO #103 63

14 Attachment 2 – Bill of Materials and Pricing Templates 65

15 Attachment 3 – Network Diagrams 67

16 Attachment 4 - Xerox Response to Authority Questions on ECH Upgrade and ECH to VECTOR Transaction Detail Mapping 89

17 Attachment 5 - Audit Department Controls Requirements Checklist 91

18 Attachment 6 - Applicable Authority Technical Specifications 99

19 Attachment 7 - Division 1 General Provisions 101

20 Attachment 8 – Technology Services Department (TSD) Standards & Guidelines for Port Authority Technology 157

21 Attachment 9 – ECH to VECTOR Transition Plan 159

22 Attachment 10 – Revenue Accounting Reconciliation and Toll Collector Audit Processes 161

23 Attachment 11 – ITRACS Algorithm Calculations 163

24 Attachment 12 – MOT Reference Drawings 165

-THIS PAGE INTENTIONALLY LEFT BLANK-

1 Introduction

Under this Change Order #1 to Contract #4600006009, Xerox (hereinafter called the "Contractor") shall provide the Port Authority of New York and New Jersey (the Authority) with equipment, software, installation, testing, professional engineering services, and maintenance to extend the life of the existing Integrated Toll Collection System (ITCS) hereinafter referred to as "ITCS Strategic Investment". These investments shall include, but are not limited to, the replacement of the following subsystems:

1. Lane Controller Equipment
2. Lane Controller and Electronic Central Host (ECH) Software
3. Violation Enforcement System (VES) Equipment
4. Overhead Laser Scanner (OLS) Equipment
5. Network Equipment
6. Outerbridge Crossing (OBX) Open Road Tolling (ORT) Equipment
7. Close-up Lane Observation Camera Equipment
8. Lane Mode Signs (LMS)
9. Replacement ITCS Deposit Workstations and Supervisor Workstations
10. ECH Re-platform and Upgrade including:
    a. ECH/CSC (Customer Service Center) Interface CSC CO#103 (hereafter CO#103)
    b. Storage Expansion for Video Tolling
    c. Incorporation of ITRACs functionality

As part of this Change Order, the Contractor shall perform site preparation work summarized below:

1. ARCHITECTURAL
    a. Cutting/patching of existing finishes as needed.
2. PLUMBING:
    a. Connect relocated treadles to existing plaza drainage system at the Holland Tunnel.
3. CIVIL:
    a. Excavation/paving of roadway to facilitate the Holland Tunnel treadle replacement
    b. Cut and patch island and roadway concrete as needed.
4. ELECTRICAL:
    a. Installation of new enclosures and power/communication conduits & cables as needed.
5. STRUCTURAL:
    a. Installation of equipment appurtenances as needed.
6. TRAFFIC:
    a. Construction Maintenance of Traffic (MOT) and Work Area Protection.
7. ENVIRONMENTAL:
    a. Alert the Authority to the potential presence or disturbance of any HAZMAT at any area of Work.
    b. Analysis and removal of incidental HAZ/MAT will be performed by the Authority if encountered by the Contractor at any area of Work.
    c. Allow the Authority approximately 4-6 weeks for removal and disposal of HAZMAT.

In the performance of this work, the Contractor shall comply with Attachment 6 - Applicable Authority Technical Specifications, Attachment 7 - Division 1 General Provisions and Attachment 8 – Technology Services Department (TSD) Standards & Guidelines for Port Authority Technology. Changes shall be deployed to the lanes defined in Table 1-1 below, as well as, at the TeleCenter, the Port Authority Technical Center (PATC) and the TB&T Training Academy at PATC, unless otherwise specified.

The Bayonne Bridge lanes and plaza level equipment are not included in the Scope of this Work.

Plaza	
Lane	Status
Bayonne Bridge	
2	Not Included
4	Not Included
6	Not Included
8	Not Included
Outerbridge Crossing (OBX) (7 lanes)	
2	ORT
4	ORT
8	
10	
12	
14	
16	
Goethals Bridge (8 Lanes)	
2	
4	
6	
8	
10	
12	
14	
16	
George Washington Bridge PIP (7 Lanes)	
34	
36	
38	
40	
42	
44	
46	
George Washington Bridge Lower Level (10 Lanes)	
54	
56	
58	
60	
62	
64	
66	Decommission
68	
70	
72	
74	

Plaza	
Lane	Status
GWB - Upper Level (12 Lanes)	
2	
4	
6	
8	
10	
12	
14	
16	
18	
20	
22	
24	
Holland Tunnel (9 Lanes)	
1	
2	
3	Relocate treadles
4	Relocate treadles
5	Relocate treadles
6	Relocate treadles
7	Relocate treadles
8	
9	
Lincoln Tunnel (14 Lanes)	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
23	
14 (XBL)	

Table 1-1: Lanes to be Upgraded

1.1 Definitions

The term “Contract” refers to “Contract for Integrated Toll Collection System (ITCS) In-lane Maintenance and System Administration Services and E-ZPass Plus System Administration Services Contract #4600006009, Purchase Order No. 4500043187 dated October 4, 2005.

The term "business days" or “working days” refers to a period of time and shall mean consecutive days during regular working hours with Saturdays, Sundays and holidays, excluded.

The term "business week", unless otherwise, specified, shall mean five (5) consecutive business days during regular working hours with Saturdays, Sundays, and holidays excluded.

The term "calendar days" in reference to a period of time shall mean consecutive calendar days, Saturdays, Sundays and holidays, included.

The term "calendar week", unless otherwise specified, shall mean seven (7) consecutive calendar days, Saturdays, Sundays, and holidays included.

The term "month", unless otherwise specified, shall mean a calendar month.

"Work" shall mean all structures, equipment, plant, labor, materials (including materials and equipment, if any, furnished by the Authority) and other facilities, and all other things necessary or proper for, or incidental to the activities at the Site of the Work.

The term "Site of the Work", "Facility" or words of similar import shall mean:

- River Crossings
  - Holland Tunnel
  - Lincoln Tunnel
  - George Washington Bridge
    - Upper Level
    - Lower Level
    - Palisades Parkway (PIP)
  - Goethals Bridge
  - Outerbridge Crossing
- The Port Authority Technical Center (PATC)
- Port Authority TeleCenter

"Director" shall mean the Director of Tunnels, Bridges, and Terminals Department and/or the Director of Aviation for the purpose of this Change Order, acting personally or through one of his/her authorized representatives for the purpose of this Change Order.

"Contract Manager" shall mean the person designated by the Director to manage all aspects of this Change Order or his/her successor in duties for the purpose of this Change Order, acting personally or through his/her duly authorized representative.

"TB&T Project Manager" shall mean the designated operational person or his/ her successor in duties within TB&T responsible for oversight of the functionality, as well as, testing and operational implementation of the toll collection system for the purpose of this Change Order, acting personally or through his/her duly authorized representative.

"Engineer" shall mean the Port Authority Resident Engineer or his/ her successor in duties assigned to administer the Work of this Change Order for the purpose of this Change Order, acting personally or through his/her duly authorized representative.

"Engineer of Record" shall mean a licensed Professional Engineer acting personally or through his/her duly authorized representative on behalf of the Contractor.

"Facility Manager" shall mean the General Manager of each of the "Work Sites" listed above or his/ her successor in duties for the purpose of this Change Order, acting personally or through his/her duly authorized representative.

"Inspector" shall mean the Port Authority Inspector assigned to this Work or his/ her successor in duties for the purpose of this Change Order, acting personally or through his/her duly authorized representative.

No persons other than those specifically identified above shall be deemed a representative of the Director or of the Contract Manager except to the extent specifically authorized in an express written notice to the Contractor signed by the Director or the Contract Manager, as the case may be. Further, no person shall be deemed a successor in duties of the Director unless the Contractor is so notified in writing signed by the Authority's Director of the Purchasing Department. No person shall be deemed a successor in duties of the Contract Manager unless the Contractor is so notified in writing signed by the Director.

"Subcontractor" shall mean anyone who performs Work (other than or in addition to the furnishing of materials, plant or equipment) at or about the Site of the Work directly or indirectly for or on behalf of the Contractor (and whether or not in privity of Contract with the Contractor), but shall not include any person who furnished merely his/her own personal labor or his/her own personal services. ”Subcontractor", however, shall exclude the Contractor or any subsidiary or parent of the Contractor or any person, firm or corporation which has a substantial interest in the Contractor or in which the Contractor or the parent or the subsidiary of the Contractor, or an officer or principal of the Contractor or of the parent or the subsidiary of the Contractor has a substantial interest, provided, however, that for the purpose of the clause hereof entitled "Assignments and Subcontracts" the exclusion in this paragraph shall not apply to anyone but the Contractor.

"Materialmen" shall mean anyone who furnishes materials, plant or equipment (including temporary or consumable materials) to the Contractor or any subcontractor for use at or about the Work Site in the performance of Work.

The term "Authority" refers to the Port Authority of New York and New Jersey.

"Notice" shall mean a written notification.

The term “Detail Design Drawing(s)” refers to a package composed of signed and sealed construction drawings, shop drawings, structural calculations, samples and catalog cuts prepared by the Engineer of Record and submitted to the Engineer for approval, as required to adequately define the scope of work established by this Change Order. The existing ITCS As-Built drawings shall be provided as supporting reference drawings as required to ensure proper documentation of those aspects of the ITCS system that are not impacted by this Change Order. New drawings shall contain the architectural, plumbing, civil, electrical, structural, maintenance of traffic and environmental specifics needed to execute the Work of removal, construction, installation and connection of the replacement equipment at each location. Changes to existing conditions shall be noted in new drawings with supporting reference tables indicating specific changes including, but not limited to, index of drawings, location plans, key plans, general notes, plan view drawings for removal and new installation, part plans, elevations, details, block diagram, cable type & routing, conduit fill ratios, termination details and detailed notes that supersede information in the As-Built reference drawings. Contractor proposed changes to Technical Specifications, if necessary, shall be submitted as Engineering Notes on the drawings for approval by the Engineer over the course of Work performed.

Reference to Work or its performance, "directed", "required", "permitted", "ordered", "designated", "prescribed", and words of similar import shall mean directed, required, permitted, ordered, designated, or prescribed by the Manager; and "approved", "acceptable", "satisfactory" and words of similar import shall mean approved by or acceptable or satisfactory to the Manager; and "necessary", "reasonable", "proper", "correct" and words of similar import shall mean necessary, reasonable, proper, or correct in the judgments of the Manager.

"Integrated Toll Collection System" or "ITCS" shall mean both the electronic toll collection system and the manual toll collection system.

"In-Lane Equipment" shall mean any ITCS related equipment located at a toll plaza at one of the River Crossings.

"Xerox" shall refer to Affiliated Computer Services/A Xerox Company, State and Local Solutions, Inc.

“Legal Holiday” shall refer to the following holidays observed at Port Authority offices and facilities:

New Year's Day Martin Luther King, Jr. Day Presidents Day Memorial Day Independence Day Labor Day	Columbus Day Veteran's Day Thanksgiving Day Day After Thanksgiving Christmas Day

"Regular Working Hours" - as used herein, shall mean 6:30 A.M. to 4:30 P.M., Monday through Friday, excluding legal holidays observed at the Site of the Work as defined above.

1.2 Change Order Terms and Conditions

Work performed under this Change Order shall comply with all national, state and local codes and shall comply with all Authority requirements in Attachment 6 - Applicable Authority Technical Specifications and Attachment 7 - Division 1 General Provisions.

This Change Order also includes an extension of the license to use the Xerox Open Road Tolling [hereafter ORT] software through December 31, 2020.

All other terms and conditions of the referenced Contract remain in effect and are not modified by this Change Order.

1.2.1 Adjustments to Service Level Agreement (SLA)

The Contractor shall implement the functionality described herein and shall continue to meet or exceed the performance levels established in the Contract, with the exception of the Service Level Agreement [hereafter SLA] adjustment provisions defined in Table 1-2 following.

Item	Plaza	Existing Contract	Proposed SLA Adjustment During Commissioning	Proposed SLA Adjustment After Commissioning
1-2a	BB	*Not applicable to this Change Order*		
1-2b	OBX	13.50%	18.5% + LDs threshold set to $1,000	10.60% + LDs threshold set to $2,000
1-2c	GWBL	13.50%	18.5% + LDs threshold set to $1,000	6.25% + LDs threshold set to $2,000
1-2d	GWBP	13.50%	18.5% + LDs threshold set to $1,000	6.30% + LDs threshold set to $2,000
1-2e	HT	13.50%	18.5% + LDs threshold set to $1,000	11.50% + LDs threshold set to $2,000
1-2f	LT	13.50%	18.5% + LDs threshold set to $1,000	11.35% + LDs threshold set to $2,000
1-2g	GB	19.00%	24.0% + LDs threshold set to $1,000	13.00% + LDs threshold set to $2,000
1-2h	GWBU	25.0%	30% + LDs threshold set to $1,000	15.20% + LDs threshold set to $2,000

Table 1-2: Temporary / Permanent SLA Adjustment

During the commissioning period for this Work, the Authority accepts SLA compliance parameters under the column titled "Proposed SLA Adjustment During Commissioning". After commissioning, SLA compliance parameters will change to the values noted in the column titled "Proposed SLA Adjustment After Commissioning".

1.2.2 Insurance Procured by the Contractor

The Contractor shall take out, maintain, and pay the premiums on Commercial General Liability Insurance, including but not limited to premises-operations, products-completed operations, and independent contractors coverage, with contractual liability language covering the obligations assumed by the Contractor under this Change Order and, if vehicles are to be used to carry out the performance of this Change Order, then the Contractor shall also take out, maintain, and pay the premiums on Automobile Liability Insurance covering owned, non-owned, and hired autos in the following minimum limits:

Commercial General Liability Insurance - $5 million combined single limit per occurrence for bodily injury and property damage liability. Such limit may be met through combination of primary and excess liability insurance.

Automobile Liability Insurance - $5 million combined single limit per accident for bodily injury and property damage liability. Such limit may be met through combination of primary and excess liability insurance.

In addition, the commercial general liability and business automobile liability policy(ies) shall name the Port Authority of New York & New Jersey, NYNJ Link LLC or its' designated operator related to this contract, their commissioners, directors, officers, employees and contract-related agents as additional insured, including but not limited to premises-operations, products-completed operations on the Commercial General Liability Policy for claims caused by the negligent acts or omissions of the Contractor. Such additional insured requirements may be met through a blanket additional insured basis. Moreover, the Commercial General Liability Policy shall not contain any provisions for exclusions from liability other than provisions for exclusion from liability forming part of the most up to date ISO form or its equivalent unendorsed Commercial General Liability Policy. The commercial general liability policy(ies) and certificate(s) of insurance shall contain separation of insured conditions and severability of interests clauses. These insurance requirements shall be in effect for the duration of the Change Order to include any warrantee /guarantee period and any maintenance period. An act or omission of one of the insureds shall not reduce or void coverage to the other insureds. Furthermore, the Contractor's insurance shall be primary insurance as respects to the above additional insureds. Any insurance or self-insurance maintained by the above additional insureds shall not contribute to any loss or claim

The certificate of insurance and liability policy(ies) must contain the following endorsement for the above liability coverages:

"The insurer(s) shall not, without obtaining the express advance written permission from the General Counsel of the Authority, raise any defense involving in any way the jurisdiction of the Tribunal over the person of the Authority, the immunity of the Authority, its Commissioners, officers, contract-related agents or employees, the governmental nature of the Authority, or the provisions of any statutes respecting suits against the Authority."

The Contractor shall also take out, maintain, and pay premiums on Workers' Compensation Insurance in accordance with the requirements of law of New Jersey and New York, and Employer's Liability Insurance with limits of not less than $1 million each accident.

The Contractor shall provide at least (30) days prior written notice to the Port Authority of NY and NJ, Att: Facility Contract Administrator, at the location where the work will take place and to the General Manager, Risk Financing in the event of insurance cancellation or nonrenewal.

The Port Authority may change or modify the limits and coverages of insurance at any time during the term of this Change Order. Should the modification or change results in an additional premium, the General Manager, Risk Financing for the Port Authority may consider such cost as an out-of-pocket expense. However, any increase in the types of limits shall be subject to negotiations with the Contractor.

Within five (5) days after the execution of this Change Order and prior to the start of work, the Contractor must submit an original certificate of insurance, to the Port Authority of NY and NJ, Facility Contract Administrator, at the location where the work will take place. This certificate of insurance MUST show evidence of the above insurance policy(ies), stating the Change Order number prior to the start of work. The General Manager, Risk Financing must approve the certificate(s) of insurance before any work can begin. Upon request by the Port Authority, the Contractor shall furnish to the General Manager, Risk Financing, a certified copy of each policy; however, if the Authority requests copies of applicable insurance policies during this Contract, Contractor will make the applicable insurance policy sections available at a local Xerox New York and/or New Jersey Metropolitan Area office or local Xerox's insurance broker's office, only for review purposes within thirty (30) days of such request. The Authority may review such applicable policy sections and take notes but no copies may be made by the Authority.

If at any time the above liability insurance should be canceled, materially changed as relates to this Change Order or nonrenewed so that the insurance is not in effect as above required, then, if the Engineer shall so direct, the Contractor shall suspend performance of the Change Order at the premises unless a renewal or replacement certificate is provided. If the Change Order is not suspended (whether or not because of omission of the Manager to order suspension), then the Authority may, at its option, obtain insurance affording coverage equal to the above required, the cost of such insurance to be payable by the Contractor to the Port Authority.

Renewal certificates of insurance or policies shall be delivered to the Facility Contractor Administrator, Port Authority prior to the expiration date of each expiring policy. The General Manager, Risk Financing must approve the renewal certificate(s) of insurance before work can resume on the facility. If at any time any of the certificates or policies shall become unsatisfactory to the Port Authority, the Contractor shall promptly obtain a new and satisfactory certificate and policy.

The requirements for insurance procured by the Contractor shall not in any way be construed as a limitation on the nature or extent of the contractual obligations assumed by the Contractor under this Change Order. The insurance requirements are not a representation by the Authority as to the adequacy of the insurance to protect the Contractor against the obligations imposed on them by law or by this or any other contract.

1.2.3 Net Cost Work

When and as directed by the Engineer, the Contractor shall perform the following work and will be compensated at the Net Cost thereof, as defined below:

- Repair, replace existing damaged underground utilities not shown on the Detail Design Drawings.
- Locate and uncover buried manholes, handholes, electrical boxes, or electrical cans and raise to final grade.
- Furnish and install Maintenance of Traffic and work area protection devices not shown on the Detail Design Drawings.
- Salvage and deliver to the Authority additional items not shown on the Detail Design Drawings.
- Construction schedule changes to accommodate facility operations requirements
- Perform work required to support additional requirements from Federal, State and local authorities.
- Changes to security requirements
- Implement structural changes to the toll plaza canopies.
- Repairs to concrete roadbed.
- Replace UPS batteries as required.

"Net Cost" shall be computed in the same manner as is Compensation for Extra Work, including any percentage additional to cost, as set forth in 1.2.4 Compensation for Extra Work following.

Performance of such Net Cost Work shall be as directed by the Engineer and shall be subject to all provisions of the Change Order relating to Performance of Extra Work. Compensation for said Net Cost Work shall not be charged against the total amount of compensation authorized for Extra Work.

1.2.4 Compensation for Extra Work

The Engineer shall have authority to agree in writing with the Contractor on behalf of the Authority upon lump sum or other compensation for Extra Work in lieu of the compensation for which provision is hereinafter made in this numbered clause.

If such agreement on compensation is not made, and Extra Work to be performed, the Contractor's compensation shall be increased by the following amounts and such amounts only:

A. For Extra Work consisting of refuse container services, an amount equal to the actual net cost in money of the labor and materials required for the provision of such services, plus seven per cent (7%) of such net cost.

B. For Extra Work consisting of performance of construction work at the construction site, an amount determined as follows:

   1. In the case of Extra Work performed by the Contractor personally, an amount equal to the actual net cost in money of the labor and materials required for such Extra Work, plus twenty per cent (20%) of such net cost, plus such rental for equipment (other than small tools) required for such Extra Work as the Engineer deems reasonable.

2. In the case of Extra Work performed by a subcontractor, an amount equal to the actual net cost in money of the labor and materials required for such Extra Work, plus twenty per cent (20%) of such net cost plus such rental for equipment (other than small tools) required for such Extra Work as the Engineer deems reasonable, plus seven per cent (7%) of the sum of the foregoing cost, percentage of cost, and rental.

As used in this numbered clause (and in this clause only):

"Refuse Container Services" means the delivery, removal and emptying of refuse containers as required during the performance of Extra Work subject to approval by the Engineer.

"Labor" means foremen, surveyors, laborers, mechanics and other employees below the rank of superintendent, exclusive of timekeepers, directly employed at the construction site, whether employed by the Contractor or by the subcontractors, subject to the Engineer's authority to determine what employees of any category are "required for Extra Work" and as to the portion of their time allotted to Extra Work; and "cost of labor" means the wages actually paid to and received by such employees; however, all wages actually paid that are in excess of the prevailing wages in the performance of Extra Work shall be subject, on each occasion, to the initial and continuing approval of the Engineer in advance of the performance of such Extra Work; plus a proper proportion of (a) vacation allowances and union dues and assessments which the employer actually pays pursuant to contractual obligation upon the basis of such wages, and (b) taxes actually paid by the employer pursuant to law upon the basis of such wages. At the Contractor's option, the amount of ten per cent (10%) will be applied to all wages actually paid to cover all labor costs including (a) and (b) above, but excluding paid holidays. The Contractor shall notify the Engineer whether or not the ten per cent (10%) option will be chosen prior to the initial performance of any Extra Work or Net Cost Work, if applicable. Such selection shall also apply to all subcontractors and shall remain in effect for the duration of the Change Order. "Employees" as used above mean only the employees of one employer.

For whichever option is selected, in accordance with the Contract clause entitled "Prevailing Wage (Davis-Bacon Act)", the Contractor and all subcontractors shall maintain complete and detailed payroll records, and such records shall be made available for inspection by the Authority.

"Materials" means temporary and consumable materials as well as permanent materials; and "cost of materials" means the price (including taxes actually paid by the Contractor pursuant to law upon the basis of such materials) for which such materials are sold for cash by the manufacturers or producers thereof, or by regular dealers therein, whether or not such materials are purchased directly from the manufacturer, producer or dealer (or if the Contractor is the manufacturer or producer thereof, the reasonable cost to the Contractor of the manufacture and production), plus the reasonable cost of delivering such materials to the construction site in the event that the price paid to the manufacturer, producer or dealer does not include delivery and in case of temporary materials, less their salvage value, if any.

"Work day" in reference to an item of equipment means a day other than a Saturday, Sunday or legal holiday except that if the particular item of equipment is actually utilized at the construction site by the Contractor or subcontractors under this or any other contract with the Authority on a Saturday, Sunday or legal holiday said day shall be deemed a work day.

The rental for equipment, whether owned by the Contractor or subcontractors or rented from others and notwithstanding the actual price of any rental or actual costs associated with such equipment, shall be computed by the Engineer on the basis of the following:

1. Hourly rental for those items of equipment listed in the "Rental Rate Blue Book" published by Machinery Information Division, K-III Directory Corporation, 1735 Technology Drive, Suite 410, San Jose, California 95110, (hereinafter called "the Blue Book"), shall be 100% of the applicable rates as listed in said book, reduced to an hourly basis (see formula below) except that such applicable rates shall be reduced by 50% for all hours of rental payable hereunder in excess of 8 hours each day. The edition of this publication to be used shall be the one in effect on the date of the actual rental of the equipment. The "Estimated Operating Cost per Hour" as set forth for such item of equipment in the Blue Book shall be added to the hourly rental for each hour that such equipment is actually engaged in performing Extra Work. No amount for operating cost will be allowed during periods when such equipment is not actually engaged in performing Extra Work (i.e., standby rental time). None of the provisions of the Blue Book shall be deemed referred to or included in this Change Order except as specifically set forth in this Section.
2. If no listing of rental rate and/or hourly operating cost for the item of equipment is in the Blue Book, the Engineer shall determine the reasonable rate of rental and/or hourly operating cost of the particular item of equipment by such other means as he finds appropriate.
3. In the event the Contractor is directed by the Engineer to immediately perform Extra Work within 24 hours of the direction to proceed, the Engineer shall determine the reasonable rate of rental and/all hourly operating cost of the items of equipment necessary to perform such Extra Work by such means as he finds appropriate. However, if the equipment is owned by the Contractor or owned by a subsidiary of the Contractor, the Blue Book rates will apply as set forth in this clause.

When utilizing the rental rates appearing in the Blue Book, the Engineer shall determine the applicable rate and the hourly rental determined therefrom by applying the following criteria:

1. The rate to be applied for an item of equipment used on a particular Extra Work order shall be the monthly rates from the foregoing publication.
2. The pro rata portion which one hour bears to the applicable rate shall be determined in accordance with the following formula:

Hourly rate based on monthly rental.	1/176 of monthly rental from Blue Book

3. The rental rate shall be multiplied by the applicable regional adjustment factor shown for such item of equipment in the Blue Book. The adjustment factor shall not apply to the hourly operating cost.
4. If the Engineer should determine that the nature or size of the equipment used by the Contractor in connection with Extra Work is larger or more elaborate, as the case may be, than the size or nature of the minimum equipment determined by the Engineer to be suitable for the Extra Work, the reasonable rental will not be based upon the equipment used by the Contractor but will be

based on the smallest or least elaborate equipment determined by the Engineer to have been suitable for the performance of the Extra Work.

In the case of equipment utilized only for Extra Work: (a) in addition to amounts determined as provided in subparagraphs A and B above, there will be added to the rental as computed above the taxes on the rental actually paid by the Contractor or subcontractor and the reasonable cost of transporting such equipment to and from the construction site, including applicable tolls, and (b) notwithstanding the number of hours during which such equipment is utilized, the minimum rental therefor will be for a period of eight hours.

In computing the Contractor's compensation insofar as it is based upon Extra Work, and notwithstanding any provision to the contrary appearing in the Blue Book, no consideration shall be given to any items of cost or expense not expressly set forth above, it being expressly agreed that the costs and percentage additions hereinbefore provided cover items of cost and expense to the Contractor of any type whatsoever, including administration, overhead, taxes (other than those enumerated above), clean-up, consumables including gas and oil, drafting (including printing or other reproduction), coordination, field measurements, maintenance, repairs, insurance, profit to the Contractor and small tools.

Whenever any Extra Work is performed (whether by the Contractor directly or through a subcontractor), the Contractor shall, at the end of each day, submit to the Engineer (a) daily time slips in such form as set forth below, showing the name and number of each workman employed on such Work and the number of hours which he is employed thereon, (b) a memorandum showing the wages to be paid to each workman, and unless the Contractor has notified the Engineer that he has chosen the ten per cent (10%) option set forth above, the state and federal taxes based on such wages, and vacation allowances and union dues and assessments which the employer actually pays pursuant to contractual obligation upon the basis of such wages, (c) a memorandum showing the amount and character of the materials furnished for such Work, from whom they were purchased and the amount to be paid therefor, and (d) a memorandum of equipment used in the performance of such Work, listing the actual hours of operation for each piece of equipment, together with the rental and operating cost claimed therefor. Template forms for the daily time slips will be provided to the Contractor prior to the commencement of Work. The Contractor shall complete the forms on 8½” x 14” ledger paper, individually and sequentially numbered, for all Work performed by the Contractor and any subcontractors. Submit the completed form with the Contractor’s original signature to the Engineer each day for verification by the Engineer. Upon verification, the Engineer will sign the form and provide the Contractor with a copy of the signed form. A duplicate copy of the signed form shall be submitted to the Engineer with the Contractor’s billing documentation and accompanied by such memoranda as described in (b), (c) and (d) above.

Such memoranda and time slips are for the purpose of enabling the Engineer to determine the amounts to be paid by the Authority under this numbered clause; and accordingly, they shall constitute a condition precedent to such payment and the failure of the Contractor or his subcontractors to furnish them with respect to any Work shall constitute a conclusive and binding determination on his part that such Work is not Extra Work and shall constitute a waiver by the Contractor of claims for payment for such Work. The Contractor's compensation for Extra Work shall be subject to audit review by the Authority. The Engineer will notify the Contractor that an audit review will be conducted no later than 90 days from the date of such notification. The Engineer will also provide the Contractor with an estimated duration of the

audit. During the audit review, the Contractor shall provide records to substantiate the memorandum and time slips submitted to the Engineer. Failure to provide such Contractor or subcontractor records may result in a reduction or total denial of material, equipment and labor costs for Extra Work. Upon completion of the audit review, the Contractor will be provided with the audit findings of the Authority. If the Contractor disagrees in whole or in part with the audit findings, the Contractor shall notify the Authority of such disagreement in writing within 30 days of receipt of said audit findings or the Authority will deem the audit findings to be final and acceptable to the Contractor. In the event that the Engineer and the Contractor shall agree in writing upon a lump sum or other compensation for Extra Work in lieu of compensation as provided in the second paragraph of this clause, the daily time slips and memoranda required by this paragraph shall not be required subsequent to the date on which such agreement has been reached.

1.2.5 Compensation for Emergency Delays

If the Contractor is specifically directed by the Engineer to suspend his operations as stipulated in the Section of Division 1 of the Specifications entitled "Conditions and Precautions" or if the Contractor is specifically directed not to start his operations at a time when operations are permitted to start as stipulated in such Section, and if solely because of such suspension or direction not to start any of the Contractor's or subcontractor's employees or equipment then engaged in or about to start such Work are necessarily kept idle at the construction site, during the hours when they would otherwise be engaged in the performance of the Work, then the Contractor's compensation shall be increased by an amount equal to the salaries and wages in amounts approved by the Engineer which the employer is required to pay and actually pays to such employees for the period or periods of such idleness, plus a proper proportion of (a) taxes actually paid by the employer pursuant to law upon the basis of such salaries and wages, and (b) vacation allowances and union dues and assessments which the employer actually pays pursuant to contractual obligations upon the basis of such salaries and wages, and in addition thereto such rental as the engineer deems reasonable for such equipment during the period or periods of such idleness. The rental for idle equipment shall be computed by the Engineer in accordance with the provisions of the Change Order entitled "Idle Salaried Men and Equipment".

In the event that the Contractor deems that any payment should be made pursuant to this numbered clause, he shall give prompt written notice to the Engineer stating the reasons why he believes such payments should be made and shall moreover, furnish to the Engineer at the end of each day, a memorandum showing the name, payroll title, salary rate and employer of each of the workingmen, and description, owner and claimed rental rate for each item of equipment claimed to have been kept idle. Said notice and memorandum are for the purpose of enabling the Engineer to verify the Contractor's claim at the time. Accordingly, notwithstanding any other provisions hereof, the failure of the Contractor to furnish such notice and memorandum shall constitute a conclusive binding determination on his part that he is not entitled to compensation as provided herein and shall constitute a waiver by the Contractor of all claims for such payment, such notice and memorandum being conditions precedent to payment under this numbered clause.

1.2.6 Idle Salaried Men and Equipment

If any salaried men or equipment of the Contractor or any subcontractor are necessarily kept continuously idle and wholly unoccupied at the construction site for a full day on each of two or more full days on

which they would be engaged in the performance of the Work but for causes due solely to acts or omissions of the Authority or the Engineer occurring after execution of this Change Order, and if such idleness is not due to any cause within the control of the Contractor or of any of his subcontractors or materialmen or his or their employees, then the Authority shall pay to the Contractor and the Contractor shall accept (in addition to any sums otherwise payable under this Contract, and in full satisfaction of and in liquidation of all claims for damages because of such act or omission of the Authority or the Engineer) an amount equal to that which the employer actually pays such salaried employees during such full days of idleness, plus a proper proportion of vacation allowances and union dues and assessments actually paid by the employer pursuant to contractual obligations on the basis of such salaries, and a proper proportion of the taxes actually paid by the employer pursuant to law upon the basis of such salaries and plus such rental for such idle equipment as the Engineer deems reasonable. The rental for idle equipment shall be computed by the Engineer in accordance with the provisions of the clause entitled "Compensation for Extra Work"; provided, however, that the seven per cent (7%) of the rental to be paid in accordance with said clause in the case of equipment utilized by subcontractors shall not be payable in connection with such idle equipment; and provided further that the provisions of subparagraph C of said clause shall not be applicable to such idle equipment.

The Contractor shall give written notice to the Engineer before the end of the second of the above mentioned 2 or more full days (whether or not the Authority is aware of the existence of any circumstances which might constitute a basis for payment under this numbered clause), specifically stating that salaried men or equipment have been kept idle under circumstances which might result in payment under this numbered clause; and he shall furnish with such notice, for all the days that have occurred, and shall in addition furnish at the end of each additional day of the above mentioned 2 or more full days, (a) a memorandum showing the name, payroll title, salary rate and employer of each of the salaried men claimed to have been kept idle at the construction site, and taxes based upon their salaries and the holiday and vacation allowances and union dues and assessments which the employer must actually pay pursuant to contractual obligations based on their salaries, and (b) a memorandum of the equipment claimed to be kept idle, together with the amount claimed as rental therefor. Said notice and memoranda are for the purpose of enabling the Engineer to verify the Contractor's claim at the time, and of enabling him to take such steps as may be necessary to remedy the conditions upon which the claim is based. The furnishing of such notice and memoranda shall be a condition precedent to payment under this numbered clause, so that the day on which notice is given shall be counted as not later than the second of the above mentioned 2 or more full days and no subsequent day shall be counted for which the above memoranda are not furnished at the end of such day.

1.2.7 Delays to Contractor

As between the Contractor and the Authority, the Contractor assumes the risk of all suspensions of or delays in performance of the Change Order, regardless of the length thereof, arising from all causes relating to this Change Order, except only to the extent, if any, that compensation or an extension of time may be due as expressly provided for elsewhere in this Change Order for such suspension or delays and except to the extent, if any, that compensation may be agreed to by the Engineer in writing pursuant to the clause hereof entitled "Compensation for Extra Work" for impact costs incurred by the Contractor in connection with the performance of Extra Work. Subject only to such exceptions, the Contractor shall

bear the burden of all costs, expenses and liabilities which he may incur in connection with such suspensions or delays, and all such suspensions, delays, costs, expenses and liabilities of any nature whatsoever, whether or not provided for in this Change Order, shall conclusively be deemed to have been within the contemplation of the parties. The Contractor shall not be responsible for delay which occurs for reasons beyond the reasonable control of the Contractor or subcontractors as determined by the Authority.

Notwithstanding any provisions of this Change Order, whether relating to time of performance or otherwise, the Authority makes no representation or guaranty as to when the construction site or any part thereof will be available for the performance of the Change Order or as to whether conditions at the construction site will be such as to permit the Change Order to be performed thereon without interruption or by any particular sequence or method or as to whether the performance of the Change Order can be completed by the time required under this Change Order or by any other time.

Wherever in connection with this Change Order it is required, expressly or otherwise, that the Authority shall perform any act relating to the Change Order, including making available or furnishing any real property, materials, or other things, no guaranty is made by the Authority as to the time of such performance and the delay of the Authority in fulfilling such requirement shall not result in liability of any kind on the part of the Authority except only to the extent, if any, that an extension of time or compensation may be due as expressly provided for elsewhere in this Change Order.

1.2.8 Prevailing Rate of Wage Certification

For Work performed under this Change Order, the Authority requires a certification in writing from the Contractor that he has paid and caused his subcontractors to pay at least the prevailing rate of wage and supplements required by clause 4, “Prevailing Wage (Davis Bacon Act)” of the Contract.

The Contractor and every subcontractor shall make and maintain weekly payroll records during the course of the Work and for the period set forth in the clause hereof entitled "Authority Access to Records" for all employees employed in the Work associated with this Change Order. Such records shall contain the name, address and last four digits of the social security number of each such employee (Contractors and subcontractors must maintain the full social security number of each employee and shall provide them upon request to the Port Authority Inspector General), the employee's correct payroll classification, rate of pay and supplements, daily and weekly number of hours worked, deductions made and actual wages and supplements paid. The Contractor shall submit these weekly payroll records to the Authority (on forms furnished by the Authority) as well as those of each of his subcontractors as the Authority may require with the Contractor's Payment Application, together with an affidavit by the Contractor and by each subcontractor to the effect that such payroll records are correct and complete, the wage and supplement rates contained therein are not less than those required by the provisions of this Change Order, and the classifications set forth for each employee conform with the work performed. Such copies and summaries and the original payroll records shall be available for inspection by the Authority (including its Inspector General), and the Contractor and its subcontractors shall permit designated representatives of the Authority to interview employees during working hours on the job site.

The Engineer may at any time request the Contractor to prepare a daily report on the Authority form entitled *Contractor Daily Sign-In Sheet*, copies of which can be obtained from the Engineer. The *Contractor Daily Sign-In Sheet* shall be completed as follows:

1) At the beginning of each workday, the Contractor shall:
   a) Fill in the top of the *Contractor Daily Sign-In Sheet*, including the location, date, contractor/subcontractor name and contract number;
   b) Ensure that each employee, including those of subcontractors, has printed and signed his or her name and indicated his or her work classifications, the last four digits of his or her social security number, and his or her starting time;
2) At the end of each workday, the Contractor shall:
   a) Ensure that each employee, including those of subcontractors, has signed out and indicated his or her ending time;
   b) Sign the Certification Statement at the bottom of the form to indicate that the information contained in the *Contractor Daily Sign-In Sheet* is true and accurate; and
   c) Submit the original completed form to the Engineer's representative.

In an area of his office at the Site of the Work which is accessible to his employees, the Contractor shall display such printed material as may be provided by the Engineer setting forth information for the employees of the Contractor and his subcontractors concerning the wage and supplemental benefit requirements set forth in this numbered clause. The Contractor shall also cause each of his subcontractors to display such material in a similarly accessible place in any office which the subcontractor maintains at the Site of the Work.

The Contractor's failure to comply with any provision of this numbered clause shall be deemed a substantial breach of this Contract.

1.2.9 Extensions of Time

Extensions of time, to the extent necessary, will be granted at the discretion of the Engineer after negotiations between the parties.

1.3 Changes to Contract

Delete Section 38 of the above referenced contract in its entirety and substitute therefor Section 1.3.1 below.

Delete Section 39 of the above referenced contract in its entirety and substitute therefor Section 1.3.2 below.

NOTE: For additional detail on compliance with Section 1.3.1 requirement, refer to Attachment 5 - Audit Department Controls Requirements Checklist.

1.3.1 Contract Review and Compliance Audits

The Contractor, and any subcontractors, shall provide prompt system access and reasonable assistance to the Authority's External and Internal Audit staff or its consultants in their performance of work under the Contract, including producing specific requested information and extraction of data and reports. The Contractor, and any subcontractors, shall promptly support requests related to audits

of the Contract, administrative functions and operations covered by this Contract. The Authority will require access to the Contractor's environment which supports the systems used to provide services required under the Contract on a periodic basis; the hours to be determined, at the convenience of the Authority.

The Authority reserves the right to use and load security and system software – in coordination with the Contractor - to evaluate the level of security and vulnerabilities in all systems which control, collect, dispense, contain, manage, administer, or monitor operations related to this Contract.

PA Internal Audit staff and their consultants/contractors performing Contract Review and Compliance audits shall be required to sign PA Non-Disclosure Agreement/Acknowledgments.

1.3.2 Authority Access to Records

The Authority shall have access during normal business hours to all records and documents of the Contractor relating to any amounts for which the Contractor has been compensated, or claims he should be compensated, by the Authority by payment determined on any basis other than by payment of a lump sum or unit price amount agreed upon in writing by the Contractor and the Authority; provided, however such access shall extend to certified payroll records as described in the clause entitled "Prevailing Rate of Wage Certification" regardless of the method by which the Contractor is compensated under this Change Order and above those included in the compensation set forth elsewhere herein. The most current three (3) years of original Change Order records and documents must be maintained; thereafter, digital copies of the Change Order records and documents are acceptable. All Contractor records shall be kept in the Port District (as defined in McKinney's Unconsolidated Laws §6403). The Contractor shall obtain for the Authority similar access to similar records and documents of subcontractors. Such access shall be given or obtained both before and within a period of three (3) years after Final Payment to the Contractor, provided, however, that if within the aforesaid three (3) year periods the Authority has notified the Contractor in writing of a pending claim by the Authority under or in connection with this Change Order to which any of the aforesaid records and documents of the Contractor or of his subcontractors relate either directly or indirectly, then the period of such right of access shall be extended to the expiration of six (6) years from the date of Final Payment with respect to the records and documents involved.

Upon request of the Authority, the Contractor shall furnish or provide access to the federal Form I-9 (Employment Eligibility Verification) for each individual performing Work under this Contract, including both citizens and non-citizens. The Contractor shall provide, at no cost to the Authority, access for and reasonable assistance to such auditors from the Authority or the Authority's external auditors that may, from time to time, be designated to audit detail records which support Contractor charges to the Authority. The Authority shall have access to the detail records that support Contractor charges to the Authority for up to three (3) years following the termination of the Contract.

No provision in this Contract giving the Authority a right of access to records and documents is intended to impair or affect any right of access to records and documents that the Authority would have in the absence of such provision.

PA Internal Audit staff and their consultants/contractors performing Contract Review and Compliance audits shall be required to sign PA Non-Disclosure Agreement/Acknowledgments.

1.4 Pass Thru Equipment

1.4.1 IBM, Lenovo and Cisco Procurements

Should the Port Authority require Xerox to purchase IBM, Lenovo, and Cisco equipment for the Lane and ECH upgrades under the agreements between those firms and the Authority, Xerox's liability shall be limited as Xerox will be procuring these items as a purchasing agent for the PANYNJ under the PANYNJ contracts. Under this scenario, Xerox will place the order with IBM, Lenovo, and Cisco under PANYNJ's contracts, and PANYNJ will pay Xerox invoice for said equipment on a pass-thru basis per the terms of the existing contract, which is Net -30 days. PANYNJ will accept title immediately from IBM, Lenovo, and Cisco under PANYNJ's contract terms and conditions with these vendors.

2 Hardware Requirements

All installed equipment furnished and installed under this Change Order shall utilize new, field-proven, commercial off-the-shelf (COTS) components and equipment. The Contractor shall furnish detailed documentation on the design, production and testing of any non-COTS units at the time of the Detailed Design Document submittal described in Section 5.1 below. To the maximum extent practical, equipment and components shall be widely available generic items. They shall be of a type, model, or family currently recommended for new installations by their manufacturers and in quantity production by manufacturers of such components. Multi-sourced components that provide the desired characteristics and performance shall be utilized whenever practicable.

All new components shall be suitable for installation and use in the existing Port Authority toll facility environment as defined below:

2.1 Non-environmentally Controlled Locations

All System components installed in all toll plaza booths, tunnels, mezzanines, and canopies: all basement areas of the toll plaza building, and all exterior locations exposed to weather shall meet the following performance requirements when operated inside their closed/locked enclosures:

- Temperature: Minus 25 to 140 degrees Fahrenheit
- Relative Humidity: 5 to 95 percent
- Salt Fog: Salt atmosphere with 5 percent salinity

2.2 Environmentally Controlled Interior Locations

All System components installed in air-conditioned areas of the toll plaza buildings other than toll plaza booths, tunnels, mezzanines, and canopies shall meet all performance requirements specified for the following ambient conditions when operated inside their closed/locked enclosures:

- Temperature - components installed in:
  - Heated areas shall meet performance requirements for temperatures between 32 and 120 degrees Fahrenheit
  - Unheated areas shall meet performance requirements for temperatures between zero and 120 degrees Fahrenheit
- Relative Humidity: 5 to 95 percent

The Contractor shall provide manufacturers' data sheets (hereafter Catalog Cuts) demonstrating each component's suitability at the time of the Detailed Design Document submittal.

3 System Requirements

The Contractor shall provide all necessary equipment, materials, personnel, vehicles, tools, services and support for the Work described in this section, including, but not limited to:

- Project management
- Software support for analysis
- Professional Engineering Services
- Removal and Disposal of Equipment
- Lane Decommissioning
- Testing, inspection, and demonstration
- Equipment installation services
- Software Quality Assurance
- Testing, Test Plans and results for all tests
- Commissioning
- Documentation (Including but not limited to: Detail Design Documentation, detail design and shop drawings, manuals, training materials and other documentation identified in Section 5 of this Change Order.)
- Spares as noted in Section 7 Maintenance and Spares.

3.1 Lane Controller Hardware and Equipment

Remove and replace existing Lane Controllers and Lane Equipment hardware including new computer hardware and modifications or replacements to the Lane Electronics Cabinets (hereafter LECs). Work shall include but not be limited to:

1. Remove and dispose of existing Lane Controller PC and peripherals.
2. Furnish and install Lane Controller computer.
3. Furnish and install Lane Controller Peripherals.
4. Modify, as necessary, mounting, electrical, and communications hardware to accept new Lane Controller PC and peripherals.
5. Furnish and Install replacement LEC and Automatic Vehicle Identification (AVI) enclosures at the Goethals Bridge only.
    a. Remove and dispose existing cabinets, conduits, junction boxes and furnish and install new components.
    b. Furnish and install new LEC cabinets as NEMA 4X, 304 SS enclosures with #4, non-directional finish per Technical Specification (TS) 05080, 2.01.
    c. Furnish and install new LEC back panel assemblies.
    d. Furnish and install new stainless steel AVI enclosure. Standard stainless steel material grade and finish offered by the AVI manufacturer is acceptable.
6. Integrate loops and treadles with existing and other new lane components provided herein.
7. Except for the Lanes identified in item 3.13.2 Relocation of Holland Tunnel Treadles below, provide a status report of all existing loops, treadles and cabling by performing a visual inspection, electrical test and auditing of data from the lanes prior to performing any Work.

The Contractor shall provide a Bill of Materials with pricing for Section 3.1 Lane Controller hardware and installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

3.2 Lane Controller Software

The existing Lane Controller operating system and software shall be modified to work with the new Lane Controller hardware. The existing Authority lane code shall be migrated to the current version of Red Hat Linux Enterprise operating system that shall be installed on each new Lane Controller. The code shall be modified as described below to interface to the new lane devices, address existing performance issues as applicable and implement lane business rule changes. Work shall include, but not be limited to:

1. Replace UnixWare Operating System with Red Hat Linux Enterprise Operating System on all Lane Controllers and integrate existing drivers, scripts, batch processes, and all utility software with Red Hat Linux Operating System as needed to support real time processes.
2. Implement software modifications needed to change from timer to event based logic, including:
    a. Modify the traditional lane software to generate E-ZPass or Flush (configurable) transactions for tag reads that remain in the queue for more than a configurable number of milliseconds when all 3 lane loops are low for more than a configurable number of milliseconds.
    b. Modify the traditional lane software to generate a Flush transaction for vehicles that remain in the queue for more than a configurable number of milliseconds when all 3 lane loops are low for more than a configurable number of milliseconds.
3. Migrate existing Smart Serial I/O (SSIO) real time software to the new Phoenix DIO Controller.
4. Modify the Lane software, configuration setup, network, and VES trigger point setup.
5. Modify existing Lane code for VES triggering and frame capture.
6. Modify process for VES image transfer.
7. Modify process for VES image association.
8. Perform requirements analysis to identify specific scenarios and sequences for the changes to each lane configuration including, but not limited to:
    a. Mapping of TOM Overhead Laser Scanner (OLS) classifications to the new SICK OLS
        i. Mapping new scanner data to existing Authority vehicle classes
        ii. Correlate degraded mode rules between TOMS provided classes and SICK provided geometric attributes (L/W/H, number of units)
        iii. Combine treadle data with SICK for proper classification
    b. Design of online failure detection, diagnostics, Maintenance Operations Manager (MOM) alarms and alarm priorities
    c. Identification of event scenarios and potential vehicle processing anomalies.
9. Implement necessary changes and enhancements to the software based on above analysis.
10. Modify the Lane Controller software to remove the TOMS data from speed processing and incorporate the Exit and VES loop data for speed reporting. **NOTE:** There are no performance requirements for speed detection.
11. Migrate the OLS software and interface to the Lane Controller software.
12. Develop and test the interface for LMS 511 to the new Lane Controller.

The modified lane software shall implement a method of guaranteed message transmission compatible with the new ECH platform in Section 3.11.

To summarize, the Contractor shall determine, through joint discovery with the Authority, changes to Lane Business Rules to be implemented in software that encompass :

1. Correlation of classifications (TOMS to SICK to PANYNJ classification)
2. Alarms (SICK, Phoenix DIO Controller, VES, Redundant Controllers)
3. Failover processing (automated or manual)
4. Support for Video Toll transactions
5. A new "Dedicated/AET" mode in which all transactions not associated with a valid E-ZPass tag shall be "Video Toll" transactions for both conventional and ORT lanes. There shall be no AET (i.e., Video Toll) requirements for staffed mode (i.e., lanes accepting both cash and E-ZPass).
6. Remote command changes
7. Lane mode processing and maintenance utilities
8. Potential driver feedback sign modifications to support AET modes
9. Configurable messages for the new LMS (see also Section 3.8 below).
10. Toll rate processing changes to support video tolling.

NOTE: Any changes to or from the AET modes are via remote commands or lane utilities and no changes shall be made to key switch logic or hardware. Lanes shall be able to support a default mode of either Dedicated or Dedicated/AET and use of the key switch shall cause the lane to open in the configured default mode.

The Contractor shall provide a Bill of Materials with pricing for Section 3.2 Lane Controller software effort in Attachment 2 – Bill of Materials and Pricing Templates.

3.3 Violation Enforcement System

Remove and replace the existing violation cameras, illumination and associated cabling and conduit. The replacement shall be the JAI Pulnix All-In-One Violation Enforcement System (VES). The work to be completed includes:

1. Remove and dispose of the existing VES equipment and modify mounting and electrical hardware to accept new VES equipment.
2. Furnish and install a 5 foot stanchion/transformer base and VES camera so as to achieve optimal performance.
3. Furnish and install all cabling and conduit to connect VES cameras and lighting to applicable equipment in the LEC.
4. All conduits for the VES cameras shall be new. The existing concrete island shall be trenched for the new conduit and patched to match the existing toll island surface[1].

[1] The concrete pouring season is from April 15th to October 15th, except for concrete patching, which can be performed at anytime provided that the patching is performed within the manufacturer's specifications for the product being used.

5. Comply with Attachment 6 - Applicable Authority Technical Specifications including, but not limited, to:
    a. 02073 Cutting, Patching and Removal
    b. 03602 Grouting (Non-Metallic)
    c. 16115 Underground Conduit Systems

The Contractor shall provide a Bill of Materials with pricing for Section 3.3 VES hardware and the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

3.4 Overhead Laser Scanner

Remove and dispose of the existing TOMS Overhead Laser Scanner (OLS). Furnish and install a SICK LMS 511 OLS, which shall include but not be limited to all hardware and modifications required to integrate the new SICK OLS to the new Lane Controller.

1. Remove and dispose of the existing TOMS OLS equipment.
2. Modify as necessary the mounting and electrical hardware to install the new SICK OLS equipment.
3. Furnish and install the OLS hardware.
4. Furnish and install all cabling and conduit to connect the OLS to the applicable equipment in the LEC.
5. Install the OLS utilizing the existing TOM OLS mounting brackets. Adjust as needed for an optimal operation and performance.
6. If required, repair the canopy fascia as required and approved by the Engineer based on the approved method, materials and finishes submitted in Shop Drawings and Samples. Provide special colors as selected by the Engineer.

The Contractor shall provide a Bill of Materials with pricing for Section 3.4 OLS hardware and the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

3.5 Network

Provide new network switches for connectivity between the Plaza Network Rack and the Lane Equipment Cabinets to increase the available bandwidth from 10Mbps to 1 Gbps. Attachment 3 – Network Diagrams provides additional high-level details on system connectivity for each facility.

The Contractor shall comply with requirements of Technical Specifications 16126 Fiber Optic Cable and 16127 Control/Signal Transmission Media. Work to be performed shall include, but not be limited to:

1. Remove and dispose of the existing network equipment.
2. Modify mounting, electrical, and communication hardware to accept new network equipment.
3. Furnish and install the network hardware including the components listed in Table 3-1 below.
4. Perform the following tasks:
    a. Remove and dispose of all existing ITCS network switches and repeaters at the locations and in the quantities noted under column heading “Existing Equipment To Be Removed and Disposed” in Table 3-1 below.

b. Furnish and install replacement Cisco 3850 fiber and copper Ethernet switches at the locations and quantities noted under column heading "Replacement Equipment" in Table 3-1 below.
c. Furnish and install all cabling and conduit to connect new network components to Lane Systems.
d. Furnish and install all connectors, fiber patch panels and replacement patch cables required to re-terminate all the existing multi-mode and single mode connections for this network.
e. Furnish and install a new Ethernet switch with fiber optic uplink capability in each Lane Electronics Cabinet and route to the new Cisco fiber switch using the existing network.
f. Furnish and install four (4) new single-mode fiber optic cables at each of the ITCS network connection points to PAWANET to provide redundant connectivity. The new single-mode fiber optic cables shall each contain a minimum of four (4) strands in a single sheath (i.e., 2 active strands for ITCS + spares) and shall be terminated at both ends with appropriate connectors to the new Cisco Catalyst 3850 and the redundant PAWANET Ethernet switches at each location. The other two (2) single-mode fiber optic cables shall be pulled as dark fiber along the same routes and left unterminated with a 10' coil at each end for future use. The locations that require redundant single-mode fiber connectivity to PAWANET include:
    i. The George Washington Bridge Lower Level, Holland Tunnel, Lincoln Tunnel, Goethals Bridge and Outerbridge Crossing ITCS network racks
    ii. The ITCS network equipment at both the primary and backup ECH locations at TeleCenter and PATC respectively.

The Contractor shall perform the physical connection for these new cables to the new ITCS Ethernet switches and TSD shall perform the physical connection for these new cables to the respective PAWANET Ethernet switches.

5. Install switches and cabling in the same cabinet as the existing equipment.
    a. Fiber optic cable terminations and installation shall be performed by a licensed electrician qualified to perform fiber optic network cabling installation as described in Section 1.05-E of Technical Specification 16126 Fiber Optic Cable.
6. Test all network connections end to end.
    a. Fiber optic testing shall be performed by a licensed electrician trained and qualified to perform Optical Time Domain Reflectometer (OTDR) testing to the requirements of 3.05-C, items 2 through 5 of Technical Specification 16126 Fiber Optic Cable. The Contractor shall supply a copy of training credentials and prior experience for the person performing the tests.
7. The Contractor shall provide a list of equipment requiring new IP addresses to the Authority for assignment

Location	Existing Equipment To Be Removed and Disposed		Replacement Equipment	
	DEC 90FL	DEC 90T	Cisco Switch 24 Ports Fiber	Cisco 3850 24 Ports Copper
HT	3	1	1	1
LT	4	1	1	1
GB	3	1	1	1
OBX	2	1	1	1
GWBPIP	0	0	0	1
GWB Upper	0	0	0	1
GWB Lower	4	1	3	1
Training	0	1	0	1
PATC	0	1	0	2
TeleCenter	0	1	0	2
Total	**14**	**8**	**7**	**12**

Table 3-1: ITCS Network Equipment to be Replaced

The Contractor shall provide a Bill of Materials with pricing for Section 3.5 Network hardware, materials and the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

3.6 Outerbridge Crossing (OBX) Open Road Tolling (ORT)

Provide a complete replacement of hardware and related components for the ORT Lanes at the OBX to implement a new ORT solution with redundant HOT standby zone controllers, automatic failover capabilities and new VES subsystem capabilities. This work shall include but not be limited to:

1. Remove and dispose of existing ORT equipment and modify as necessary hardware mounting and electrical terminations to accept new ORT equipment.
    a. The existing Idris System, including loops, detectors and associated equipment shall be reused.
2. Furnish and install new ORT hardware.
3. Furnish and install all cabling, conduit and labor to connect the VES to applicable equipment in the Zone Controller and LEC.

The Contractor shall provide a Bill of Materials with pricing for Section 3.6 OBX ORT hardware and the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

3.7 Close-up Lane Observation Camera Equipment

Furnish and install a new in-lane video camera in all lanes to view and monitor traffic in the toll lanes. The work shall include but not be limited to:

1. Furnish and install the required hardware.
2. Install cameras on the VES stanchions discussed in Section 3.3.2 above.

3. Furnish and install all cabling, conduit to route video equipment feeds to Authority designated DVR/NVRs.

The Contractor shall provide a Bill of Materials with pricing for Section 3.7 Close-up Lane Observation Camera equipment and the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

3.8 Lane Mode Sign

The Contractor shall furnish and install new Lane Mode Sign (LMS) to replace existing signs at the locations and in the quantities listed in Table 3-2 below. After removing the existing LMS signs, the Contractors shall attach new LMS signs to the existing canopy mounting and electrical infrastructure in accordance with approved Shop Drawings. The new LMS signs shall be centered over the lane.

OBX	GB	GWBP	GWBL	GWBU	HT	LT
5 *Excludes the Express Lane*	8	7	11 *Includes Lane 66*	12	9	13 *Excludes the Express Bus Lane (XBL)*

Table 3-2: LMS Sign Location and Quantities

The new LMS signs shall employ a full-color LED matrix large enough to display two lines of 12” text and be able to display fully variable text and graphics on either line or both. The page to page change rate shall not exceed 3.5 seconds. The sign shall have a brightness of at least 9,000 Candelas/m2 and be equipped with a light sensor-controlled dimmer circuit to adjust the luminance level automatically. The message shall be viewable at horizontal angle of 70 degrees and a vertical angle of 30 degrees.

Table 3-3 following shows the LMS messages that are to be furnished and installed under this Change Order for all signs except Lane 66 which shall display message C1 only and, for which, the Contractor may provide an alternative configurable message solution that does not necessarily require a Lane Controller.

Message No.	VMS Header	VMS Detail
A1	E-ZPass *White logo on Pantone 259 background or equivalent*	ONLY (flashing)
A3		BUSES ONLY
A4		TRUCKS ONLY
A5		NO TRUCKS
A6		NO CARS
A7		5 MPH
A8		25 MPH
A9		Future AET 1
A10		Future AET 2
B1	CASH *White text on Pantone 342C background or equivalent*	E-ZPASS
B2		ONLY (flashing)
C1	-BLANK-	LANE CLOSED
C5		-BLANK-
C6		ALL OTHERS

Table 3-3: Lane Mode Sign Message Library

The work shall include, but is not limited to:

1. Removal and disposal of existing LMS equipment.
2. Modify as necessary the existing LMS sign canopy structure to accept the new LMS sign.
3. Furnish and install the new LMS signs.
4. Furnish and install all cabling and conduit to connect the LMS to associated equipment in the LEC.

NOTES:

1) To support the use of the Cars Only restriction as All Others, modify all ITCS screens and reports where "Cars Only" is shown to instead indicate "All Others".
2) The Authority has discussed the 120^0 F upper limit on the operating temperature of the proposed LMS sign with the manufacturer and accepts a waiver from the 140^0 F requirement in Section 2.1 above.
3) Existing Canopy Lights, Driver Feedback Signs and Static Signs (in 25MPH E-ZPass lanes) shall remain.

The Contractor shall provide a Bill of Materials with pricing for Section 3.8 LMS hardware and the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

3.9 Replacement ITCS Supervisor and Deposit Workstations and Interface

Furnish and install ITCS Deposit and Supervisor Workstations and interfaces as required to integrate with the existing ITCS and in conformance to Section 6.3.5 Standard Workstation Hardware Configurations in

Attachment 8 – Technology Services Department (TSD) Standards & Guidelines for Port Authority Technology. The work shall include but not be limited to:

1. Remove and dispose of existing Deposit and Supervisor Workstations and associated equipment.
2. Furnish and install Supervisor and Deposit Workstations, Monitors and Deposit printers in the quantities listed in Table 3-4 below.
3. Integrate the existing Proximity Card Readers to the Deposit Workstations.
4. Disable all excess CD drives and USB ports on ITCS Deposit and Supervisor Workstations.

Description	Qty
Plaza Supervisor Stations	16
Plaza Supervisor Monitors	16
Receipt Printer	30
Drop Terminals & Monitors	30
Printer paper (50 rolls per case)	8
Terminal Emulator	46

Table 3-4: Workstation and Printer Replacements

The Contractor shall provide a Bill of Materials with pricing for Section 3.9 Replacement ITCS Supervisor and Deposit Workstations with the associated installation effort in Attachment 2 – Bill of Materials and Pricing Templates.

NOTE: The Authority acknowledges that the Vector function that allows the Toll Supervisor to monitor key touches on the Toll Collector touch screens will not be available under this Change Order due to the fact that this function is not compatible with the legacy touch screen devices being retained.

3.10 ECH/CSC Interface (CSC CO #103)

The Contractor shall furnish and install all necessary materials to implement the interface defined in CO#103 with all applicable systems in this Change Order. The work shall include, but not be limited to:

1. Change in number of violation images and image resolution.
2. Calculation of tolls due by ITCS.

   NOTE: The Authority acknowledges that the lane controller will not be able to distinguish between vehicles associated with registered video toll accounts and unregistered video toll accounts, if applicable. Accordingly, video toll transactions at the lane will only use a single set of toll rates for the appropriate vehicle classification in AET mode.

3. Modifications of file specifications for files exchanged between the CSC and the ITCS.
4. Accept Egregious Violator File by sending required acknowledgement file with no further action.
5. Revise and submit updated design, ICDs and any other relevant documentation reflecting the changes above.
6. Utilization of file name extensions for ITCS that are unique and distinct from those in CO#103 so as not to conflict with Replacement Toll Collection System (RTCS) filename extensions.

7. Storage of new CO#103 reconciliation codes in the ECH database for querying purposes.
8. Change transaction mapping so that REJTRANS and REJVIDEO both reconcile back with a type REJECTED.

3.11 ECH Re-platform and Upgrade

The Contractor shall furnish and install Xerox Vector 4G Toll Host software on new IBM servers to replace the existing production and backup ECH hardware and software at the TeleCenter and Port Authority Technical Center (PATC), respectively.

The new ECH software shall be provided through a modified version of the latest Vector software and shall include all of the current functionality provided by the new Vector software and the existing ECH functionality, PowerBuilder software, interfaces, internal and external reports currently available to ITCS users. The new Vector software shall be configured to fully accommodate the Authority's Plazas, Lanes and existing configurations.

NOTE: No Automatic License Plate Recognition (ALPR) shall be provided for the ECH with this Change Order.

Functional requirements for this Work are contained in this section and in the following documents:

- Attachment 1 - CSC CO #103
- Attachment 4 - Xerox Response to Authority Questions on ECH Upgrade and ECH to VECTOR Transaction Detail Mapping
- Attachment 9 – ECH to VECTOR Transition Plan
- Attachment 10 – Revenue Accounting Reconciliation and Toll Collector Audit Processes
- Attachment 11 – ITRACS Algorithm Calculations

Clarifications and changes jointly developed during requirement review and discovery meetings at the time of Project Kickoff and thereafter, shall be incorporated into Detail Design Documentation by the Contractor.

The Contractor shall provide a Bill of Materials with pricing for all hardware, software, development, installation and engineering support scope items for Sections 3.10 and 3.11 and all its subsections in Attachment 2 – Bill of Materials and Pricing Templates.

3.11.1 General Hardware & Software Requirements for ECH Re-platform and Upgrade

All 3rd Party hardware and software shall be provided with five (5) years of 24 X 7 manufacturer support that can be extended for an additional two (2) years for a total of seven (7) years.

The storage solution to be installed as part of the ECH Re-platform and Upgrade shall be sized to meet or exceed the initial storage requirements defined in Section 3.11.8 below. In addition, it shall be capable of being upgraded to support storage and on-line retrieval requirements of a full AET implementation at all Authority facilities with nothing more than the addition of cabinets, manufacturer's software and hard drives.

3.11.2 Transition Plan & Data Migration

The Contractor's Transition Plan shall provide for data migration from the existing ECH database to the new ECH database. As part of the design process, the Contractor shall meet with the Authority to review the data mapping requirement. The Contractor shall update Attachment 9 – ECH to VECTOR Transition Plan with a description of the process steps for moving, validating and cutover to the new database developed during those design meetings.

Approval by the TB&T Project Manager is required prior to performing any data migration work.

3.11.3 Revenue Audit Function

The Audit function in Vector shall be modified to accommodate the Authority's processes and flows for Toll Collector auditing as described in Attachment 10 – Revenue Accounting Reconciliation and Toll Collector Audit Processes and including the incorporation of ITRACS algorithms included in Attachment 11 – ITRACS Algorithm Calculations.

The Contractor shall supply optional pricing for Service Organization Compliance (SOC) levels 1 and 2 in Attachment 2 – Bill of Materials and Pricing Templates.

3.11.4 Reports

The new Vector Host System shall provide the reports listed below [reference Xerox document "Port Authority of New York and New Jersey Response to Question – ECH Upgrade, v4.0" included as Attachment 4].

Standard VECTOR 4G Reports

1. **Collector Reports**
   - 1.1. HOST0002A Segment of Duty.
   - 1.2. HOST0053U Collector TOD excluding E-Z Pass without Adjustments
   - 1.3. HOST0053A Collector TOD excluding E-Z Pass with Adjustments
   - 1.4. HOST0052 Employee TOD History
   - 1.5. HOST0004C Attendant Performance Standard Class Mismatch
   - 1.6. HOST0004D Attendant Performance Standard- Daily
   - 1.7. HOST0004M Attendant Performance Standard- Monthly
   - 1.8. HOST0067 Attendant Scheduling
2. **Revenue Reports**
   - 2.1. HOST0015 Deposits by Bank Deposit Date
   - 2.2. HOST0035- Plaza Deposit Record by Bank Revenue Date
   - 2.3. HOST0049 Plaza Deposit Record by TCS Revenue Date
   - 2.4. HOST0014 Deposits by Bank Revenue Date
   - 2.5. HOST0034 - Central Cash Accounting Plaza Return
   - 2.6. HOST0013 Revenue
   - 2.7. HOST0017 - No Funds
   - 2.8. HOST0070A TOD for E-ZPass with Adjustments

2.9. HOST0070U TOD for E-ZPass without Adjustments
2.10. HOST0069A ACM TOD with Adjustments
2.11 HOST0069U ACM TOD without Adjustments

3. E-ZPass Reports

3.1. HOST0061 E-ZPass Reconciliation Summary
3.2. HOST0062 ORT Reconciliation Summary
3.3. HOST0057 Home/Away E-ZPass Transaction
3.4. HOST0022 E-ZPass File Transfer
3.5. HOST0068 Transponder File Transmission

4. Audit Reports

4.1. HOST0042- Final Audit
4.2. HOST0047- Adjustment Summary
4.3. HOST0001- Initial Audit
4.4. HOST0030 Bank Adjustment
4.5. HOST0020 Bag Discrepancy Audit
4.6. HOST0048 ACM Bag Assignments Message Log
4.7. HOST0031 Bank Deposit Piece Count
4.8. HOST0019 Moneybag Manifest
4.9. HOST0026 Employee List by Plaza
4.10.HOST0064 Axle Dollar Variance
4.11.HOST0065 Retail Sales Detail
4.12.HOST0066 Retail Sales by Plaza

5. Traffic Reports

5.1. HOST0039 Daily Traffic Overview
5.2. HOST0060 Hourly Traffic by Lane
5.3. HOST0009 Traffic by Lane
5.4. HOST0058 Hourly Method of Payment

6. Traffic and Revenue

6.1. HOST0036 Traffic and Revenue Summary
6.2. HOST0010 Ranking of Traffic
6.3. HOST0032 Integrity - Lane vs. Host - Lane Only
6.4. HOST0033 Ranking Revenue

7. Daily Plaza Reports

7.1. HOST0005A Plaza Events
7.2. HOST0046 Transaction Detail

8. Excel Reports

8.1. HOST0031X Bank Deposit Piece Count
8.2. HOST0057x E-ZPass Home and Away
8.3. HOST0046x Transaction Detail
8.4. HOST0039x Daily Traffic Overview
8.5. HOST0036x Traffic and Revenue

8.6. HOST0058x Hourly Method of Payment
8.7. HOST0060x Hourly Traffic By Lane
8.8. HOST0032x Integrity

ITCS PowerBuilder Reports

9. Facility Traffic

9.1. Revenue
9.2. Class
9.3. Lane
9.4 Lane Mode

10. Transaction

10.1. All Details
10.2. Single Detail
10.3. Lane Mismatch
10.4. Detail with Summary

11. Reconciliation Toll Collector

11.1. Tour of Duty
11.2. Cash Discrepancy
11.3. Performance
11.4. Mismatch with Images
11.5. Tour Summary
11.6. Tour of Duty – Management
11.7. Tour of Duty – Detail
11.8. Tour of Duty – Detail – Collector
11.9. Unregistered Transaction Analyst
11.10. Transaction Type
11.11. Unusual Activity
11.12. Transaction Rates
11.13. Violation Details

12. TB&T Traffic

12.1. Calendar Detail
12.2. Record Traffic Detail
12.3. Traffic Forecast
12.4. Monthly Events Detail
12.5. Incomplete Traffic Detail
12.6. Weekly Traffic
12.7. Monthly Traffic

13. Miscellaneous

13.1. Data Transfer
13.2 Lane Messages
13.3. Toll Lane Availability

13.4. Lane Check
13.5. Bad ID Authorization
13.6. Tours for Toll Collectors

14. Manual Logon Activity with Toll Collector Info

14.1. Unusual Activity New

15. Security Reports

15.1. Employees
15.2. Modules
15.3. Groups
15.4. Toll Schedules

16. Validation

16.1. Plazas
16.2. Lanes
16.3. Plan Types
16.4. Exceptions
16.5. Revenue Types
16.6. Toll Classes
16.7. Error Codes
16.8. Message Thresholds
16.9. Terminal Definitions
16.10. Agencies
16.11. IAG Class
16.12. Violations Codes

17. Engineering Reports

17.1. Reconciled Rejected Violations Report
17.2. Rejected Violation Review
17.3. Uncollectable Violation Report with Review
17.4. Rejected Violations by Status – Statistics
17.5. Lane Hardware Errors
17.6. Query By Example

18. System Administration

18.1. Security
18.2. Employees
18.3. Modules
18.4. Groups
18.5. Toll Schedules
18.6. Validations

ITCS Batch Reports

CHECK_TAG_FILE
CHECK_VIOL_REJ

CHECK_CROSS_LANE
CHECK_RECON
CHECK_SPEED
CHECK_AXLES
CHECK_FLUSH
CHECK_UNREG
CHECK_VIOL
CHECK_DROPPED_AXLES
CHECK_VIOL_REJ_DETAIL
CHECK_AVI_PERF
CHECK_AXLES_AM
MONTHLY_VIOL_REJ_DAMAGES

3.11.5 Video Tolling Transaction

The Contractor shall modify ECH software to support:

1. A new Video Toll Transaction revenue type
2. Incorporate Dedicated/AET lane mode into Plaza Supervisor control and displays
3. Update ECH Reports to incorporate lane video tolling transactions

3.11.6 Image Review Process

The Contractor shall provide an image review process that provides the same capabilities and functionality as currently exists for Authority users.

3.11.7 Abusing Tags Management

The new ECH shall provide screens and reports to allow authorized staff to:

1. Maintain the abusing tags list used by the System to adjust charged class
2. Maintain the exception tags list used by the LOAD_MISMATCHERS batch job/report.

The LOAD_MISMATCHERS and MISMATCHER_DETAILS jobs shall be modified to use the same abusing tags list as used by the system to adjust charged class.

The system shall track the difference in toll between the original calculated toll and the recalculated toll based on the application of the abusing tags logic and shall provide reports to monitor this toll differential and its effectiveness.

3.11.8 ECH Storage Requirements

Furnish and install a new IBM-based image and database server with storage array to handle the following storage requirements:

1. 13 months of on-line storage for VES images with increased resolution as noted in Table 3-5 below.
2. Increase the current capability for 13 months of rolling transaction details storage to seven (7) years of transaction details storage.

NOTE: The combined VES images for front and rear for one vehicle, when compressed are approximately 1.25MB in size. Estimated network bandwidth requirements for the VES are based on five (5) images for conventional lanes and four (4) images for OBX ORT Lanes.

Data Type	Number of Months	Estimated Number of Transactions
Violations/Video Tolls	12	3,000,000
ETC Mismatches	3	750,000
Collector Mismatches	12	410,000
BB Video Tolls (current Cash transactions)	12	405,000
GWBP Overnight Video Toll Increase (est.)	12	31,000
GWBL Overnight Video Toll Increase (est.)	12	141,000
Total Image Sets		**4,737,000**
Total Storage Capacity Required		**6.22TB** *(Based on 4.737M image sets X 1.25MB per image set + 5% OH)*

Table 3-5: ECH VES Image Storage Requirements

The Contractor shall furnish and install all materials needed to expand the storage array as noted above. Work shall include, but not be limited to:

1. Furnish and install all hardware including new Red Hat Linux based server(s), storage arrays and tape backup units needed to expand the current storage capacity in this Change Order.
2. Migrate 13 months of the VES data from the existing image storage system to the new image storage system.
3. Verify proper migration of the image data and report the results to the Authority.
4. Update file transfer software to comply with CO#103 requirements.

As part of the Detail Design, the Contractor shall define and document a solution for the storage and transfer of all required files to/from the legacy ECH, the new ECH and the VECTOR CSC/Back Office systems during and after the transition such that transfers are executed at regular intervals using Secure File Transfer (SFTP) .

3.11.9 Off-line Storage

Offline storage retention requirements for the ECH shall remain the same as required in the Contract. The existing ECH database backup functionality shall be retained until the system is decommissioned. New data backup capability is required for the ECH to protect image data stored on the server.

3.12 Training

The Contractor shall conduct four (4) types of training programs under this Change Order, as follows:

1. Toll Collector and Toll Supervisor Training incorporating any screen or process changes associated with the new devices to be installed under 3.9 above [hereafter Course 1].
2. A comprehensive course on hardware and software architecture, operations and maintenance of the new Vector ECH system [hereafter Course 2].
3. A comprehensive course on system reports [hereafter Course 3].
4. A comprehensive course on Revenue Accounting features of the new system [hereafter Course 4].

Course 1 shall be delivered by the Contractor to the Authority's trainers (approximately 2 to 5 people) at the Port Authority Technical Center as a Train the Trainer program. Authority trainers will subsequently train tolls staff.

Course 2 for 12 Authority staff, shall be delivered by the Contractor at an Authority facility To Be Determined.

Course 3 shall be presented to multiple groups of up to 10 Authority staff (maximum of 60 Authority staff in total) at an Authority facility To Be Determined.

Course 4 for 12 Authority staff, shall be delivered by the Contractor at an Authority facility To Be Determined.

Prior to the actual training for each course, the Contractor shall conduct a pilot session for each course to elicit Authority comments and feedback on training materials and class content. Scheduling for the pilot session shall be coordinated early enough in the program such that the Contractor has adequate time to make the necessary modifications to course content and materials for the remaining courses.

The Contractor shall provide a Bill of Materials with pricing for all training scope items under Section 3.12 and all its subsections in Attachment 2 – Bill of Materials and Pricing Templates including optional pricing for one (1) additional training session for each course as an ad hoc session on an independent schedule.

3.12.1 Training Manuals and Materials

The Contractor shall provide all course materials, presentation materials, handouts and student manuals for all courses including electronic copies in Word and PowerPoint, as well as two (2) copy-ready sets of the final version for all courses - one (1) in color and one (1) in black & white.

3.13 Lane Installation

As noted throughout this section, the Contractor is required to provide equipment with turnkey installation and test at each location. In addition, the Contractor shall include the following special installation services in 3.13.1 and 3.13.2 below:

3.13.1 Decommissioning of Lane 66 ITCS Equipment at GWB Lower Level

The Contractor shall decommission lane 66 ITCS equipment at the GWB Lower Level. The task shall include but not be limited to:

- Disconnecting the Lane Controller from the canopy traffic light and restore manual canopy traffic light control.
- Powering down the Lane Controller and removing the Lane Controller from the Host Table.
- AVI antenna and cabling will remain connected and the AVI Reader shall be set in "guard mode".

NOTE: As noted in Section 3.8 above, the Contractor shall replace the existing Vultron LMS with a new LMS sign with the ability to display a configurable message set to C1: LANE CLOSED.

3.13.2 Relocation of Holland Tunnel Treadles

The Contractor shall modify ITCS lane equipment locations at the Holland Tunnel to eliminate existing inconsistencies in lane geometry at Lanes 3, 4, 5, 6, and 7. The following Scope of Work shall be completed, at a minimum, to modify the treadle locations in these lanes:

1. Remove the existing loops, treadle and treadle frame.
2. Furnish and install a new treadle frame, of the same type removed, to a location as noted in approved Detail Design and/or Shop Drawings.
3. Connect the new frame to the existing treadle drain and existing conduit infrastructure.
4. Furnish, install and terminate a new treadle, of the same type removed in the newly installed treadle frame.
5. Cut, install, and terminate new loops in compliance with revised lane geometry.
6. Patch and repair roadway and island to match existing conditions. All concrete repairs shall comply with Attachment 6 - Applicable Authority Technical Specifications including, but not limited, to:
    a. 02073 Cutting, Patching and Removal
    b. 03602 Grouting (Non-Metallic)
    c. 15410 Plumbing Piping and Appurtenances
    d. 15430 Plumbing Specialties

The Contractor shall observe the Authority's concrete pouring season from April 15th to October 15th, as well as, manufacturer recommendations for concrete patching, which can be performed at anytime provided that the patching is performed within the manufacturer's specifications for the product being used.

The Contractor shall provide pricing for a turnkey installation effort at each location in Attachment 2 – Bill of Materials and Pricing Templates.

4 Schedule and Management

4.1 Kickoff Meeting

The Contractor will schedule a round of Kickoff & Initial Discovery Meetings with the Authority within 10 business days of execution of the Change Order. Topics to be discussed during this round of meetings include but are not limited to the following:

- Introduction of project team
  - Organizational charts for the Xerox ITCS implementation and maintenance team
  - Staffing list with titles and contact information – please indicate full-time or part-time (i.e., shared with other projects) status
  - Staffing list with role and contact information – please indicated full-time or part-time status (i.e., shared with other projects).
- Project communications
  - Use of Milestone Review templates for technical clarifications or Requests for Information (RFI)
  - Document reviews
  - Format for Monthly Management Report
- System Design Review Meeting organization and scheduling (sample topics below / Contractor to propose alternate groupings)
  - Requirements Review items identified in Section 3.2, bullet #8 above.
  - Lane SW Design
  - ECH SW Design
  - Integration of ITRACS
  - Training
  - Transition
  - Schedule
    - Site Surveys
    - Updates and Tracking
    - Planning for FAT

4.2 System Design Review Meetings

The Contractor shall schedule and conduct System Design Review Meetings during the system design period for the purpose of clarifying design requirements as applicable and refining proposed design solutions to Change Order requirements. The System Design Review Meetings will include Contractor project and design staff along with appropriate TB&T staff and will be held at an Authority location. The Contractor shall prepare and distribute an agenda for each meeting and minutes of the previous meeting to all participants expected to attend the meetings five (5) days prior to the scheduled meeting. Topics to be discussed include, but are not limited to:

- Review, amendment and acceptance of minutes from prior meetings

- Analyze work accomplished since previous meetings, including: design status, RFIs, problems arising from proposed changes, and other circumstances which might affect progress of the work
- System design clarifications and proposed solutions as identified by the Contractor
- Schedule review.

The design refinements achieved and agreements reached during the System Design Review Meetings shall be incorporated into the applicable Detailed Design Documents as defined in Section 5.1.

4.3 Project Schedule

Within 30 calendar days of execution of the Change Order, provide a Baseline Project schedule in the latest version of Primavera P6 scheduling software. The schedule shall detail all proposed activities with predecessor and successor links except the Change Order Start and Change Order Completion milestones. Other schedule requirements are detailed in Section 33 of Attachment 7 - Division 1 General Provisions.

4.4 Project Monthly Progress Report

The Contractor shall provide monthly progress reports that include:

- Project Schedule updates
- Action Item Log identifying open issues identified in correspondence, Design Review and other meetings. Each action item in the log shall contain:
    - Item Number
    - Description
    - Requesting Party
    - Assigned Party
    - Status (open / closed / in progress / deferred / etc.);
    - Date Opened
    - Date Closed
    - Progress Notes.

The report shall detail the previous month's progress, issues that have been encountered and need resolution, and the planned work for the upcoming month.

5 Documentation

All documentation required under this Change Order shall be provided by the Contractor for the Authority's review and approval prior to implementation or start of field work, as appropriate. The Contractor shall update those documents in accordance with the Authority's comments and instructions, and according to the project schedule accepted by the Authority.

In addition, the Contractor shall update all Detail Design Documents and any other documents where changes occurred and were approved by the Authority in conjunction with the System Design Review process in 4.2 above and in accordance with the actual installation.

The Contractor shall deliver the updated documents according to the Project Schedule agreed upon by both parties in Section 4.3 above.

5.1 Detailed Design Documents (DDD)

The Contractor shall update the following original ITCS Detail Design Documents, which shall include but is not limited to complete functional line and block diagrams, catalog cuts, and product literature as well as comprehensive and detailed technical information describing the hardware, software, and communications:

- Computer HW Documentation
- Equipment Support Document
- Software Design Document
- System Documentation

The Contractor shall include the ECH/CSC Interface Design and Interface Control Document (ICD) as a new document section or volume.

Ten (10) hard copies of the DDD shall be delivered to the Authority along with one (1) electronic copy in Microsoft Word (original with Track Changes on) and one (1) electronic copy as a PDF of the print copy.

5.2 Implementation Plan

The Contractor shall provide an Implementation Plan, for review by the Authority as per the schedule. The Implementation Plan shall provide detailed instructions to field personnel on the sequence and method by which each removal, construction, installation, and testing task is to be performed. The Contractor shall adhere to the hours of work and staging as designated in Sections 11and 12 below.

A Site Safety Program compliant to Section 17 - Safety Provisions of the Division 1 General Provisions shall be included in the Implementation Plan.

5.2.1 Work Sequence

The Implementation Plan shall include but not be limited to a detailed work sequence for all removal, construction, installation, testing, training, and transition tasks, and their relationships to one another, for all System components shown below or in the most efficient order considered by the Contractor:

1. Network
2. Lane level
3. Plaza level
4. ECH level (primary and backup)
5. Training Academy

All ECH, Networking, Plaza, toll booth, toll island, and toll lane modifications and dependencies shall be called out in this work sequence.

5.2.2 Checklists for Completeness of On-site Work

The Implementation Plan shall include but not be limited to checklists for completeness of all on-site work. These checklists shall include but not be limited to items required for the installation crew to complete modifications, installation, transition, removal, and disposal work tasks.

A copy of the respective checklist shall be attested to by the Contractor and provided to the Authority after the completion of lane installation.

Each checklist shall include but not be limited to:

- A complete listing of all affected System (hardware and software) switch settings
- A complete listing of any other hardware and software configuration parameters
- Software installation, configuration, and initialization instructions.

5.3 Detail Design Drawings, Shop Drawings, Catalog Cuts and Samples

The Contractor shall comply with design submittal requirements defined in Section 1.1 above and listed in Section 8 Detail Design Drawings, Shop Drawings, Catalog Cuts and Samples of Attachment 7 - Division 1 General Provisions which the Contractor shall refer to in its entirety and shall include:

1. Inspection and structural analysis of the existing OLS mounts, mounting HW and modifications required to install new OLS equipment.
2. Inspection and structural analysis of the existing LMS mounts, mounting HW and modifications required to install new LMS equipment.
3. A description of their methodology for repair of canopy fascia when required, including material specifications, fastening methods, finish material product data, and special colors, as required, to match existing.
4. A description of means & methods

5.3.1 Submittal Schedule

The Contractor shall submit a general “Submittal Schedule” for the Engineer’s review and approval listing the planned transmittal date and estimated number in each specification section category of Shop

Drawings, Catalog Cuts, pages of calculations and samples within 30 calendar days after execution of the Change Order. A more detailed schedule shall be submitted no less than 30 calendar days prior to the actual date of any submittal.

The Contractor shall submit Detailed Design and Shop Drawings, signed and sealed by a Professional Engineer, for the architectural, plumbing, civil, electrical, structural, maintenance of traffic and environmental requirements of the site design for replacement equipment as per the schedule.

5.3.2 Submittal Format

The format for Shop Drawings prepared by the Contractor shall be as noted in Division 1, Section 8 requirements except that, in addition, the Contractor shall provide seven (7) PDF files containing the respective location Detail Design and Shop drawings that can be printed on 11 in. x 17 in. paper; i.e., a separate PDF file for each location for the initial submittal..

5.4 Manuals

The Contractor shall include the submittal schedule for manuals in the Project Schedule.

5.4.1 System Administration Manual

The Contractor shall update the existing or create a new ITCS System Administrator Manual, which shall include but is not limited to comprehensive and detailed technical information describing the hardware, software, and communications changes to the ITCS. The information provided in the updates shall be consistent with the original intended purpose of the document. The Contractor shall also provide new ECH manuals covering the new Vector software and hardware.

5.4.2 Operations Manual

The Contractor shall update the existing or create a new ITCS Operations Manual, which shall include but is not limited to information required by Authority personnel in day-to-day operations including descriptions of the various system components and processes for which it identifies specific incidents that can occur together with the required responses/solutions. The information provided in the updates shall be consistent with the original document.

5.4.3 Maintenance and Service Manual

The Contractor shall update the existing or create a new ITCS Maintenance and Service Manual, which shall include but is not limited to comprehensive and detailed technical information describing the hardware, software, and communications changes to the ITCS. The information provided in the updates shall be consistent with the original document.

5.4.4 Toll Collector Operating Manual

The Contractor shall update the existing or create a new ITCS Toll Collector Operating Manual, which shall include but is not limited to comprehensive and detailed technical information describing the hardware, software, and communications changes to the ITCS. The information provided in the updates shall be consistent with the original intended purpose of the document.

5.4.5 Toll Supervisor's Operating Manual

The Contractor shall update the existing or create a new ITCS Toll Supervisor Manual, which shall include but is not limited to comprehensive and detailed technical information describing the hardware, software, and communications changes to the ITCS. The information provided in the updates shall be consistent with the original intended purpose of the document.

5.4.6 ECH Re-platform Training Manuals

The Contractor shall provide a complete set of Training Manuals covering the depth and breadth of the new Vector software, hardware, external programs, batch processes, interfaces, reports and any new or refreshed functionality provided as part of the re-platform effort. Training Manuals shall include, but are not limited to, comprehensive and detailed technical information describing the hardware, software, and communications changes to the ITCS. The information provided in the updates shall be consistent with the original intended purpose of the document.

5.5 Disaster Recovery Plan

The Contractor is responsible for submitting a Disaster Recovery plan that addresses recovery operations for both the existing or "legacy" ITCS systems and new ITCS systems in this Change Order. The Disaster Recovery Plan, Revision 3.0, dated October 2013 is currently under review by the Authority for the current ITCS system. The Contractor shall update the Revision 3.0 document to reflect the system modifications implemented in this Change Order and to ensure compliance with TSD standards including the following updates, at a minimum:

1. Address existing Authority comments provided for the 3.0 document.
2. Develop Disaster Severity Definitions to define the level of potential disaster based on impact to critical functions.
3. Identification and addition of disaster cases and recovery procedures that address the interim situation when a legacy ECH and a new ECH are operating in tandem.
4. Identification and addition of disaster cases and recovery procedures that address the final situation when the ITCS Change Order is completed and the identified legacy equipment has been decommissioned.
5. Establish disaster recovery preparatory procedures to incorporate CSC personnel and reflect all new ITCS devices.
6. Include lists, Bills of Material and/or other technical documents in the Disaster Recovery Plan that identify:
    - System Components- a copy of all essential office equipment and records shall be stored off-site. Specify any special computer hardware, software, databases, networks or other technology.
    - Hardware
        - Hardware inventory for system in operation
        - Desktop Workstations (In Office)

        - Desktop Workstation location
        - Desktop Workstations (Offsite including at home users)
        - Laptops
    - Software
        - Software inventory of the system in operation
        - Systems, Applications and Network Software
        - Communications
        - Operations
    - Off-Site Inventory.
    - Supplemental Hardware/Software Inventory.

7. Define Disaster Recovery Plan update procedures and responsibilities

5.6 Documentation Review and Approval Cycle

The Authority will review and comment on each document and drawing submitted by the Contractor. The Authority will make every effort to complete its review within the following timeframes:

- Review cycles for engineering submittals (i.e., design drawings, shop drawings, catalog cuts and calculations, Implementation Plan) are as specified in Division 1 Guidelines, Section 8 [table reproduced below for reference].

No. of Drawings Submitted Within 5 Business Days for Each Discipline(*)	No. of Business Days for Engineer to Review Detail Design and Shop Drawings
Up to 50	10
51 to 75	15
More than 75	20
* Disciplines shall be defined as follows: Structural, Architectural, Civil, Geotechnical, Mechanical, Electrical, Traffic and Environmental.	

- Review cycles for TB&T submittals - all other documents

No. of Changed or New Pages in a Single Document	No. of Business Days for Review
Up to 50	15
51 to 100	20
100 > n < 250	25
> 250	30
+ 10 business days for 2 documents submitted within 5 consecutive days + 20 business days for 3 documents submitted within 5 consecutive days + 30 business days for 4 documents submitted within 5 consecutive days	

The Contractor shall incorporate all Authority comments received on all documents and drawings. The Contractor shall resubmit all such documents or drawings for one (1) additional review and comment cycle by the Authority.

6 Testing

The Contractor shall conduct the tests described in this section to verify functionality and to demonstrate to the Authority the readiness of ITCS for production. There are three Authority witnessed tests: The Factory Acceptance Test (FAT), On-site First Installation Test (OFIT), and Field Check Out Test (FCOT) to be conducted, reported upon and approved by the Authority.

The Authority will, at its own expense, provide personnel and consultants to witness FAT, OFIT and FCOT testing.

The sequence of events and deliverables are presented below. The Contractor shall deliver the updated documents according to the Project Schedule agreed upon by both parties in Section 4.2.

FAT:

1. The Contractor prepares the Factory Acceptance Test (FAT) Plan and submits it to the Authority for approval as scheduled.
2. The Authority will review the FAT and approve or return with comments, if not approved. The Contractor shall resubmit the FAT with the Authority comments incorporated for additional reviews.
3. Upon approval, the Contractor shall perform the FAT and provide a Report explaining the results, identifying open issues, and providing an action plan for resolution of open issues as required.
4. The Authority will review and return the report with comments within the timeframes listed in 5.6 above, as appropriate, and provide approval of the action plan or comments for changes if needed. The Authority will limit its review and comment cycle to a maximum of two (2) rounds.
5. Upon approval from the Authority, the Contractor shall implement their action plan to resolve open issues and provide a final report to the Authority.
6. Once reviewed by the Authority, if no further issues remain, and the Authority approves the FAT Plan, the Contractor may proceed with installation of the first lane and the ECH in accordance with the approved schedule.

OFIT:

1. The Contractor prepares the On-Site First Installation Test (OFIT) Plan to the Authority for approval as scheduled.
2. The Authority will review the OFIT and approve or return with comments, if not approved. The Contractor shall resubmit the OFIT with the Authority comments incorporated for additional review. The Authority shall limit its review and comment cycles to a maximum of two (2) rounds.
3. Upon approval, the Contractor shall install the required equipment in the first lane and perform the OFIT. After completing the OFIT, the Contractor shall provide a Report explaining the results, identifying open issues, and providing an action plan for resolution of open issues as required.
4. The Authority will review and return the report with comments as necessary and provide approval of the action plan or comments for changes if needed. The Authority will limit to one its review and comment cycle.

5. Upon approval from the Authority, the Contractor shall implement their action plan to resolve open issues and provide a final report to the Authority.
6. Once reviewed by the Authority, if no further issues remain, and the Authority provides approval, the Contractor may proceed with installation of the subsequent Staffed/Dedicated lanes.

FCOT:

1. The Contractor shall provide a Field Checkout Test (FCOT) Plan specific to the lane type, to the Authority for approval as scheduled.
2. The Authority will review the FCOT Plan and approve or return with comments, if not approved. The Authority shall limit its review and comment cycles to a maximum of two (2) rounds.
3. Upon approval, and as lanes are installed, the Contractor shall perform the approved FCOT for each approved lane type without further submittals and provide a report explaining the results, identifying open issues, and providing an action plan for resolution of open issues as required.
4. The Authority will review and return the report with comments as necessary and provide approval of the action plan or comments for changes if needed. The Authority will limit to one its review and comment cycle.
5. Upon approval from the Authority, the Contractor shall implement their action plan to resolve open issues and provide a final report to the Authority.
6. Once reviewed by the Authority, if no further issues remain, and the Authority provides approval, the Contractor may place the lane into production and proceed with installation of subsequent lanes.

6.1 Factory Acceptance Test

A FAT shall be performed to demonstrate the functionality, to the Authority, of all proposed modifications required by this SOW including the ECH/CSC interface. For all Lane changes, the FAT shall be performed at the Contractor's facility in Crofton MD. For the ECH, the Contractor shall provide a suitable facility capable of accommodating the required tests. The test shall include every functional item in this SOW as well as regression testing for the ITCS functions.

The Contractor shall provide a FAT Plan describing their approach to testing. For the lane and plaza changes, at least one unit of every hardware and software component provided in this SOW shall be fully integrated with ITCS and demonstrated. All new and modified ECH functionality shall be demonstrated to show successful operation of the ECH on its new platform. The Contractor may use existing Contract spare parts inventory that will not be replaced as part of this Change Order such as Manual Lane Terminals (MLT), receipt printers, proximity card readers, etc. to perform the FAT. The Contractor may also purchase such parts for the FAT and return the same in good working order to spares inventory after the test. All other components provided for the FAT shall be new and unused. Upon completion of the FAT, those components will be un-installed from the Crofton, MD test site and the ECH test site, and installed at the Authority's facilities.

The Contractor shall provide any vehicles and drivers necessary to simulate Authority traffic conditions.

The Contractor shall demonstrate that the hardware and software is fully integrated and satisfies all of the requirements of this SOW. Testing shall demonstrate end to end connectivity and full functionality of all components.

The Contractor shall design and conduct a representative stress test for FAT that simulates heavy traffic in conjunction with system access and reporting requests from 25 simultaneous users.

6.2 On-Site First Installation Test (OFIT)

6.2.1 Lane OFIT

An OFIT shall be performed at an Authority selected conventional lane and witnessed by the Authority. The OFIT is intended to verify that the individual lanes are ready to be placed into service with live traffic.

The OFIT shall be a pre-approved subset of the FAT to determine that changes made to ITCS are production ready. Once the changes have been installed and determined by the Contractor to be ready for test, the lane shall remain closed for OFIT and test vehicles shall be used to execute the scripted tests.

Upon completion, an OFIT Report shall be submitted to the Authority, open issues shall be resolved and with the approval of the Authority, the lane shall be opened to live traffic. The OFIT shall be performed once for a fully equipped conventional Staffed/Dedicated Lane.

Once the OFIT is approved by the Authority in the designated conventional lane, the remaining conventional lanes may be installed and commissioned with a Field Checkout Test as approved by the Authority and as described below.

6.2.2 ECH OFIT

A derivative of the FAT shall be performed as the OFIT test for the primary and backup ECH to demonstrate all hardware, networking, software, interfaces and backup are ready for live operation.

A test of manual failover for the ECH shall be performed after both ECH platforms have successfully completed their individual FCOT.

Upon completion, an OFIT Report shall be submitted to the Authority, open issues shall be resolved and with the approval of the Authority, the ECH will be authorized to support lanes opening to live traffic..

6.3 Field Checkout Test (FCOT)

The FCOT is an Authority witnessed commissioning test. Two (2) FCOT types are required with this Change Order, as follows:

6.3.1 Conventional Lane FCOT

For conventional lanes, the FCOT is derived from the OFIT and represents the key tests, as approved by the Authority, needed to prove the lane's readiness for production.

6.3.2 OBX Express Lane FCOT

For the OBX Express Lanes, the FCOT is derived from the FAT and, likewise, represents the key tests, as approved by the Authority, needed to provide the lane's readiness for production.

When completed for each lane, the FCOT Report shall be submitted to the Authority for approval. Any issues on the Report shall be resolved by the Contractor and re-submitted for approval prior to placing the lane into revenue service.

7 Maintenance and Spares

The Contractor shall provide a one-year Warranty on all parts, including software, installed under this Change Order except as specified for the ECH in 3.11.1.

The Contractor shall integrate all newly installed components into the existing Contract, and shall be responsible for preventive, corrective, and emergency maintenance of all installed equipment through December 31, 2015 with no modification to the Contract term or price. The Authority will address additional extensions for ITCS maintenance in a separate process.

The Contractor shall be responsible for maintenance of newly installed ITCS network switches and related network equipment. The Authority will maintain PAWANET switches and network equipment.

Spare parts shall be included for the newly installed equipment for the first year of operation. The Bill of Materials will include a separate listing for the quantities of spares specified.

The Authority has an existing inventory of 39 XAI treadle cards which it will continue to make available to Xerox at no cost for use in the lanes.

8 Maintenance of Traffic

The Contractor shall comply with Section 37, Division 1 Maintenance of Traffic and Work Area Protection specifications in Attachment 7 - Division 1 General Provisions and 24 Attachment 12 – MOT Reference Drawings

9 Milestone Payments

Table 9-1 following provides a schedule of Milestone Payments.

Item	Description	% of TCV	Cumulative Total
1	Approval of Project Schedule	5%	5%
2	Approval of Detail Design Documentation	5%	10%
3	Completion of Factory Acceptance Test (FAT)	10%	20%
4	Installation and commissioning of First Site	5%	25%
5	Commissioning per lane (67 lanes)	1.0% per lane or 67%	92%
6	Project Acceptance	8%	100%

Table 9-1: Milestone Payment Schedule

10 Assumptions By Contractor

The following assumptions made by the Contractor in prior correspondence with the Authority, are acceptable to the Authority.

1. There are no special noise abatement treatments required in the performance of this SOW.
2. The scope assumes that the new LMS sign will be installed and tested within the same timeframes as the other modifications in the scope of work.
3. Per agreement between the Authority and the Contractor, the SLA and associated liquidated damages for allowable image rejection rates will be reduced for each toll facility during the 90 day period following conversion to the new toll equipment at that facility. After the 90 day conversion period expires, the SLA for each facility will be modified to be more stringent reflecting the improved image reject performance to be delivered with the upgraded equipment. The revised SLA values for image reject performance are shown in Section 1.2.1 above.
4. All requirements of CO #103 are necessary as a complement to this Change Order. However, all references to Central Toll Host (CTH) in CO #103 shall be replaced by Electronic Toll Host (ECH).
5. No performance or payment bond is included for this scope of work.
6. No asbestos or lead abatement work is included.
7. Contaminated soil testing, excavation, and disposals are excluded.
8. No permits or fees are included.
9. No Division of Community Affairs (DCA) permits or inspections for the State of New Jersey are included.
10. The Contractor grants the Authority a continued perpetual license to existing software and modifications made under this Change Order.
11. Pricing for this Change Order reflects tax exemption terms and conditions identified in the Contract.
12. Title to equipment delivered under this Change Order transfers to the Authority in accordance with terms and conditions of the Contract.

11 Hours of Work

1. Subject to all requirements stated elsewhere herein, the Work shall be performed only during the following restricted hours of Work.
2. Unless otherwise stated herein, Work may be performed in the lanes closed and taken out of service only when a Construction Engineer is on site during the hours 7:00 AM to 3:00 PM and 10:00 PM to 6:00 AM the following morning, Monday through Friday unless otherwise directed by the Engineer.

   The Authority understands that the Contractor may desire additional hours of work for special circumstances and will endeavor to review and accommodate, to the best of its ability, requests for extended Construction Engineering support with 48-hour written notice to the Engineer.
3. Unless otherwise stated herein, Work may be performed at the Telecenter and Port Authority Technical Center Monday thru Friday from the hours of 8:15 AM to 4:15 PM.
4. Unless otherwise stated herein, work to be performed outside of the toll lanes may be performed Monday through Friday between the hours of 7:00 AM. to 3:00 PM daily.
5. Work requiring the closure of an adjacent lane (i.e., a 2nd lane when one lane in the plaza is out of service or a 3rd lane when two lanes in the plaza are out of service) shall only be conducted between the hours 11:00 p.m. to 5:00 a.m. the following morning, Monday through Friday.
6. The Contractor shall submit to the Authority, at least three (3) weeks in advance, its schedule hours of Work for the next two (2) weeks (e.g., Look-Ahead Plan). The scheduled hours of work shall include any lane closures required during that period.
7. Notwithstanding anything to the contrary above, for the duration of this Change Order, no closure of any traffic/toll lanes is permitted during the following periods:

   a. <u>All Plazas</u>
      i. Memorial Day weekend (5:00 AM Friday through 5:00 AM Tuesday).
      ii. Independence Day weekend (5:00 AM Friday through 5:00 AM Tuesday if the holiday falls on a Saturday, Sunday or Monday; 5:00 AM Thursday through 5:00 AM Monday if the holiday falls on a Friday; and 5:00 AM the day before to 5:00 AM the day after if the holiday falls during the week).
      iii. Labor Day weekend (5:00 AM Friday through 5:00 AM Tuesday).
      iv. Mother's Day and Father's Day weekends (5:00 AM Friday through 5:00 AM Monday).
      v. Thanksgiving weekend (5:00 AM Friday through 5:00 AM Monday after the holiday).
      vi. Christmas through New Year (5:00 AM December 23 through 5:00 AM January 2).
      vii. Easter weekend (5:00 AM Friday through 5:00 AM Monday).
      viii. From 5:00 AM the day before to 5:00 AM the day after the start of Rosh Hashanah, Yom Kippur, Passover and Hanukkah.
      ix. Columbus Day weekend (5:00 AM Friday through 5:00 AM Tuesday).
      x. From 5:00 AM the day before to 5:00 AM the day after Veteran's Day.

   b. <u>Additionally</u>, at the Lincoln Tunnel:
      i. Lincoln Tunnel Fun Run Weekend (5:00 AM Friday through 5:00 AM Monday).
      ii. MS Bike Tour Weekend (5:00 AM Friday through 5:00 AM Monday).

8. The Outerbridge Crossing has peak traffic volumes from Memorial Day thru Labor Day. No work shall be performed at the Outerbridge Crossing from 5:00 AM before Memorial Day to 5:00 PM the Tuesday after Labor Day.
9. Do not perform Work at the construction site outside of the times allowed above or on Federal Legal holidays or a holiday of the State(s) in which the Work is being performed, unless otherwise permitted by the Engineer.

12 Staging

The Contractor shall submit to the Engineer for approval, its proposed staging schedule based on the following requirements.

1. Toll Lane Construction Staging Restrictions

   The construction staging of the facilities shall have the following restrictions:

   a. In general, the Contractor shall be permitted to perform the Work of the Change Order at a maximum of two toll plazas at a time with the following exceptions:
      i. Toll lanes shall not be taken out of service at the George Washington Bridge Upper Level, Lower Level or PIP plazas simultaneously.
      ii. Toll lanes shall not be taken out of service at the Goethals Bridge and Outerbridge Crossing simultaneously.

   b. Construction at the Lincoln Tunnel XBL shall only be performed from 10:00 PM to 5:30 AM with the lane open to vehicular traffic by 5:00 AM daily; i.e., the Lincoln Tunnel XBL Lane system shall remain functional throughout construction during operational hours.

   c. As each lane is taken out of service, according to the staging plan below, it shall remain out of service until work is completed and the Contractor returns the lane to service.

   d. The Authority will allow the Contractor to close an adjacent lane as specified in Section 11 Hours of Work above.

2. Plaza Construction Staging

   a. Goethals Bridge (SIB)
      i. Toll Lane 16
      ii. Toll Lanes 14 & 6
      iii. Toll Lanes 12 & 8
      iv. Toll Lane 10
      v. Toll Lanes 2 & 4

   b. Outerbridge Crossing (SIB)
      i. Toll Lane 16
      ii. Toll Lanes 12 & 14
      iii. Toll Lanes 8 &10
      iv. Toll Lanes 2 & 4

   c. George Washington Bridge Upper Level
      i. Toll Lanes 24 & 18
      ii. Toll Lanes 22 & 16
      iii. Toll Lanes 20 & 14

iv. Toll Lanes 12 & 10
v. Toll Lanes 8 & 6
vi. Toll Lanes 4 & 2

d. George Washington Bridge Lower Level

i. Toll Lanes 74 & 72
ii. Toll Lanes 70 & 68
iii. Toll Lanes 64 & 54
iv. Toll Lanes 62 & 58
v. Toll Lanes 60 & 56

e. George Washington Bridge PIP approach

i. Toll Lane 42
ii. Toll Lanes 46 & 38
iii. Toll Lanes 44 & 40
iv. Toll Lanes 36 & 34

f. Lincoln Tunnel

i. Toll Lanes 3 & 23
ii. Toll Lanes 4 & 12
iii. Toll Lanes 5 & 11
iv. Toll Lanes 6 & 10
v. Toll Lanes 9 & 7
vi. Toll Lanes 8
vii. Toll Lanes 1, 2 & XBL

NOTE: XBL cannot be closed throughout 2014 or until the completion of Westbound Helix construction, whichever comes last.

g. Holland Tunnel

i. Toll Lanes 1 & 6
ii. Toll Lanes 2 & 5
iii. Toll Lanes 3 & 7
iv. Toll Lanes 4 & 8
v. Toll Lanes 9

NOTE: Notwithstanding the information provided in Sections 11 and 12 above, <u>all</u> work hours are subject to change based on the operational needs of the facility and must be coordinated in advance during the Construction period.

-THIS PAGE INTENTIONALLY LEFT BLANK-

24 Attachment 12 – MOT Reference Drawings

-THIS PAGE INTENTIONALLY LEFT BLANK-

EXHIBIT A - Revised July 17, 2014

Revised Cost Proposal Sheets (including ORT lanes and spares)

Itemized Preventive and Remedial Maintenance and Repairs

Tunnel, Holland Tunnel and Training Academy

ITCS item	(A) Monthly Maintenance and Remedial Repair Cost per Item of Equipment	(B)[5] Number of Items of Equipment at all Facilities	(C) Estimated Total Monthly Maintenance and Remedial Repair Cost per Item of Equipment
AVI Antenna[1] (Mark IV Service & Spare Parts)	$ 41.84	73	$ 3,054
AVI Reader[1](Mark IV Service & Spare Parts)	$ 469.83	13	$ 6,108
AVI UPS[1](Mark IV Service & Spare Parts)	$ 352.38	13	$ 4,581
Booth Equipment[2]	$ 447.56	58	$ 25,959
ETC Canopy Traffic Light	$ 44.26	69	$ 3,054
Communications[3]	$ 458.09	Quantity N/A	$ 458
Deposit workstation equipment	$ 47.72	24	$ 1,145
Driver Feedback Sign and Traffic Light	$ 98.67	58	$ 5,723
Lane Controller	$ 376.37	71	$ 26,722
Lane Mode Sign	$ 398.34	69	$ 27,486
Loops	$ 153.32	209	$ 32,043
ORT Lane Electronic Components	$ 152.70	2	$ 305
ORT Loops (2 axle, 6 Main)	$ 23.47	8	$ 188
ORT Light Sensors	$ 99.25	2	$ 199
Overhead Vehicle Profiler	$ 287.69	69	$ 19,851
Plaza Supervisor workstation	$ 45.81	10	$ 458
Treadle[4]	$ 97.37	69	$ 6,719
UPS-Lane Controller	$ 236.57	71	$ 16,796
VES Equipment (including lights)	$ 659.13	139	$ 91,619
VES Equipment (including lights) -ORT	$ 610.79	10	$ 6,108
Video Monitoring & VCR	$ 75.20	8	$ 602
VES VIC Computers -- ORT	$ -	3	$ -
Training Academy:			
Booth Equipment	$ 248.13	8	$ 1,985
Deposit workstation	$ 38.17	2	$ 76
Plaza Workstation	$ 38.17	4	$ 153

Total Estimated Monthly Maintenance Cost at River Crossings or TB&T

$ $ 281,390

(Sum of column [C])

1. Mark IV diagnostic and service replacement
2. Includes ETC override switches located in separate enclosures attached to the lane controller cabinets at GWB.
3. PAWNET connection at each Plaza and related ITCS network equipment and connection.
4. Includes maintenance of treadle drains

Note: All prices will be inclusive of parts and replacement costs if required, and personnel costs. Also, all prices will cover components and subcomponents related to ITCS

EXHIBIT B

Cost Proposal Sheets
Computerized Maintenance Management System
River Crossings or TB&T

Software	**Cost per Authority Licensed User**	**Required Number of Authority Licensed Users**	**Monthly Total**
Software Licenses (per user)	$ 1,009.66	**3**	$ 3,028.99
Other		**3**	
Other:		**3**	
Other:		**3**	
Other:		**3**	
Other:		**3**	
Other:		**3**	
Total Monthly Price for Computerized Maintenance Management System at all River Crossings or TB&T (sum of column "Monthly Total")			**$ 3028.99**

EXHIBIT C - Revised July 17, 2014

Cost Proposal Sheets – System Administration Services and Hardware/Software Support River Crossings or TB&T

I. Total Monthly Price for System Administration at all River Crossings or TB&T	**$**	$ 38,556.72
II. Total Estimated Monthly cost for ACS Proprietary Software Support for the ECH	**$**	$ 11,967.80
III. Total Estimated Monthly cost for N/A	**$**	$ -
IV. Total Estimated Monthly cost for Oracle Software Support	**$**	$ 4,933.29
V. Total Estimated Annual cost for COTS Software Support (non-Oracle)	**$**	$ 2,782.00
Total Monthly Price for System Administration and Harware and Software Support at all River Crossings or TB&T	**$**	$ 58,239.81

(Sum of I through V above)

Notes:

1. For the purpose of this proposal, the yearly cost for H/S support will calculated as a monthly charge.

EXHIBIT D - Revised Revised July 17, 2014

Cost Proposal Sheets - System Administration Services and Hardware/Software Support Aviation

I. Total Monthly Price for System Administration for the ACH	**$**	$ 10,996.76
II. Total Estimated Monthly cost for ACS Proprietary Software Support for the ACH	**$**	$ 1,440.78
III. Total Estimated Monthly cost for Actuate Hardware/Software Support	**$**	$ 2,906.77
Total Monthly Price for System Administration, Hardware and Software Support for Aviation	**$**	$ 15,344.31 (Sum of I through III above)

Notes:

1. For the purpose of this proposal, the yearly cost for H/S support will calculated as a monthly charge.

EXHIBIT E

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services and Additional Repairs due to negligence not River Crossings or TB&T
Note: This information must be provided.

System Administration Personnel Title Function	**Estimated Number of Hours per Month**	**All Inclusive Hourly Rate****	**Total Estimated Monthly Additional System Administration Services**
Data Base Administrator Regualr Hourly Rate*	10	$ 120.50	$ 1,205.04
Data Base Administrator Overtime Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 120.50	$ 602.52
System Administrator Regular Hourly Rate*	10	$ 96.84	$ 968.35
System Administrator Overtime Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Premium Overtime Hourly Rate*	5	$ 96.84	$ 484.18

Total Estimated Monthly Additional System Administration **$** $ 4,346.77

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

Maintenance and Repair Personnel	**Estimated Number of Hours per Month**	**All Inclusive Hourly Rate****	**Total Estimated Monthly AdditionalRepairs due to negligence not the faultof the Contractor**
Laborers Regular Hourly Rate*	15	$ 97.43	$ 1,461.47
Laborers Overtime Regular Hourly Rate*	10	$ 137.35	$ 1,373.53
Laborers Premium Hourly Rate*	5	$ 177.27	$ 886.37
Elecricians Regular Hourly Rate*	15	$ 146.78	$ 2,201.74
Electrian Overtime Hourly Rate*	10	$ 211.39	$ 2,113.85
Electrians Premium Overtime Hourly Rate*	5	$ 276.00	$ 1,380.00
Mechanics Regular Hourly	15	$ 115.84	$ 1,737.56
Mechanics Overtime Hourly Rate*	10	$ 164.96	$ 1,649.62
Mechanic Premium Overtime Hourly Rate*	5	$ 214.09	$ 1,070.43

Total Estimated Monthly Additional Repairs due to negligence not the fault of the contractor **$** $ 13,874 56

* Refer to Section entitled "Definitions" for definitions of "Regular Working Hours", Overtime Working Hours" and "Premium Overtime Working Hours"

**Wage rates shall be all-inclusive including overhead, taxes, including tolls, travel time, cost of vehicle use and profit.

List additional personnel if appropriate to the submitted Proposal.

The above additional maintenance and repair personnel rates shall be for loss or damage caused by willful of negligent acts by third persons not the fault of the Contractor or for Extra Work if ordered by the Authority.

EXHIBIT F

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services
Aviation (for ACH)

his information must be provided.

System Administration Personnel Title Function	**Estimated Number of Hours per Month**	**All Inclusive Hourly Rate****	**Total Estimated Monthly Additional System Administration Services**
Data Base Administrator Regualr Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Overtime Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 120.50	$ 602.52
System Administrator Regular Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Overtime Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Premium Overtime Hourly Rate*	5	$ 96.84	$ 484.18

Total Estimated Monthly Additional System Administration Personnel Aviation **$** $ 3,260.08

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours"

**Wage rates shall be all-inclusive including overhead, taxes, including tolls, travel time, cost of vehicle use and profit.

List additional personnel if appropriate to the submitted Proposal.

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

EXHIBIT G - Revised July 17, 2014

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services and Additional Repairs for Non-River Crossings or TB&T
Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regualr Hourly Rate*	10	$ 120.50	$ 1,205.04
Data Base Administrator Overtime Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 120.50	$ 602.52
System Administrator Regular Hourly Rate*	10	$ 96.84	$ 968.35
System Administrator Overtime Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Premium Overtime Hourly Rate*	5	$ 96.84	$ 484.18

Total Estimated Monthly Additional System Administration **$** $ 4,346.77

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

Maintenance and Repair Personnel	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Repairs and maintenance for non-emergency extra work
Laborers Regular Hourly Rate*	15	$ 97.43	$ 1,461.47
Laborers Overtime Regular Hourly Rate*	10	$ 137.35	$ 1,373.53
Laborers Premium Hourly Rate*	5	$ 177.27	$ 886.37
Elecricians Regular Hourly Rate*	15	$ 146.78	$ 2,201.74
Electrian Overtime Hourly Rate*	10	$ 211.39	$ 2,113.85
Electrians Premium Overtime Hourly Rate*	5	$ 276.00	$ 1,380.00
Mechanics Regular Hourly Rate*	15	$ 115.84	$ 1,737.56
Mechanics Overtime Hourly Rate*	10	$ 164.96	$ 1,649.62
Mechanic Premium Overtime Hourly Rate*	5	$ 214.09	$ 1,070.43

Total Estimated Monthly Repairs and Maintenance for non-emerg **$** $ 13,874.56

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours"

**Wage rates shall be all-inclusive subject, but not limited to, overhead, taxes, including tolls, travel time, cost of vehicle use and profit. The rates set forth above shall not be subject to mark up as set forth in Section 13. Compensation for Extra Work of Part II - General Contract Provisions.

List additional personnel if appropriate to the submitted Proposal.

The above additional maintenance and repair personnel rates shall be for loss or damage caused by willful of

EXHIBIT H- Revised July 17, 2014

Cost Proposal Sheets

Skills & Hourly Rates/Additional System Administration Services for Non-Emergency Extra Work

Aviation (for ACH)

Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regular Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Overtime Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 120.50	$ 602.52
System Administrator Regular Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Overtime Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Premium Overtime Hourly Rate*	5	$ 96.84	$ 484.18

Total Estimated Monthly Additional System Administration Personnel Aviation for Non-emergency Extra Work $ 3,260.08

* Refer to Section entitled "Definitions" for definitions of "Regular Working Hours", Overtime Working Hours" and "Premium Overtime Working Hours"

**Wage rates shall be all-inclusive subject, but not limited to, overhead, taxes, including tolls, travel time, cost of vehicle use and profit. The rates set forth above shall not be subject to mark up as set forth in Section 13. Compensation for Extra Work of Part II - General Contract Provisions.

List additional personnel if appropriate to the submitted Proposal.

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

EXHIBIT I - Revised July 17, 2014

Cost Proposal Sheets - Price Summary Sheet

Item	Category of Work	Estimated Price
1.	**From Exhibit "A"** Estimated Monthly Preventative and Remedial Maintenance and Repairs at all River Crossings or TB&T.	$ 281,390.22
2.	**From Exhibit "B"** Estimated Monthly Computerize Maintenance Management System at River Crossings or TB&T.	$ 3,028.99
3.	**From Exhibit "C"** Estimated Monthly System Administration Services and Harware/Software Support at River Crossings or TB&T.	$ 58,239.81
4.	**From Exhibit "D"** Estimated Monthly System Administration Services and Hardware/Software Support (for ACH) at Aviation.	$ 15,344.31
5.	**From Exhibit "E"** Estimated Monthly Extra Services for System Administration Personnel and Maintenance and Repair Personnel- River Crossings or TB&T.	$ 18,221.34
6.	**From Exhibit "F"** Estimated Monthly Extra Services, System Administration Personnel (for ACH) - Aviation	$ 3,260.08
7	**From Exhibit "G"** Estimated Monthly Non-Emergency Extra Work Services for System Administration Personnel and Maintenance and Repair Personnel- River Crossings or TB&T.	$ 18,221.34
8	**From Exhibit "H"** Estimated Monthly Non-Emergency Extra Work Services, System Administration Personnel (for ACH) - Aviation	$ 3,260.08

I. River Crossings or TB&T:

TOTAL ESTIMATED CONTRACT EXTENSION PRICE: River Crossings or TB&T

A. $ 4,549,220.27

(Multiply Total Estimated Price of Items 1, 2, 3, 5 and 7 by 12 months; from 1/1/17-12/31/17)

B. $ 18,221.34

(Insert the one-time charge from Item 7)

II. Aviation:

TOTAL ESTIMATED CONTRACT EXTENSION PRICE: Aviation

$ 262,373.66

(Multiply Total Estimated Price of Item 4, 6 and 8 by 12 months, from 1/1/17-12/31/17)

TOTAL EST. CONTRACT PRICE FOR ONE YEAR

$ 4,829,815.26

(Sum of I.A., I.B., and II above)

~~IBM quotes for ECH upgrade:~~	Qty
~~1) x3650 M4 - Annual Essential Support 24x7 4 Hour Response~~	0
~~2) V5000 Control and Expansion Shelves (Primary Location)~~	0
~~a) IBM System Storage Storwize V5000 Software Maintenance~~	
~~b) IBM v5000 Hardware Maintenance~~	
~~3) V5000 Control and Expansion Shelves (DR Location)~~	0
~~a) IBM System Storage Storwize V5000 Software Maintenance~~	
~~b) IBM v5000 Hardware Maintenance~~	

Software maintenenace included in pricing:	Qty
1) WebSphere Base license - Application Server - Annual Maintenance	2
2) Oracle EE (CPU license) - Annual Maintenance - primary / secondary	12
3) Oracle ADG (CPU License) - Annual Maintenance	12
4) Oracle PART (CPU License) - Annual Maintenance	12
5) Crystall Reports - Annual Maintenance	4
6) Linux Enterprise Server - Redhat - Annual License	5

THE PORT AUTHORITY OF NY & NJ

December 29, 2010

VIA EMAIL: Charlie.Mitchell@acs-inc.com

ACS State & Local Solutions, Inc.
12410 Milestone Center Drive
Germantown, MD 20876
Attn: Charles Mitchell

RE: Contract for Integrated Toll Collection System (ITCS) In-Lane Maintenance and System Administration Services and E-ZPass Plus System Administration Services: Contract #4600006009 / Purchase Order #4500043187: 120-day option and Contract Extension

Dear Mr. Mitchell:

In accordance with the Section entitled "Duration" (Part II, Section 2, page 3) of the subject Contract, the Port Authority of New York and New Jersey (the "Authority") hereby extends the referenced Contract for the additional one hundred twenty (120)-day period subsequent to the expiration of the second exercised option period, subject to the same terms and conditions of the Contract as in the preceding option period. The 120-day period shall commence on October 1, 2011 and expire on January 28, 2012.

Furthermore, the Authority hereby accepts the attached proposal from ACS State & Local Solutions ("ACS") to extend the Contract from January 29, 2012 to December 31, 2014. ACS shall provide the subject services for this extension period under the same terms and conditions of the Contract, with pricing in accordance with the attached proposal.

The Authority shall have the right at its sole option to extend this Contract for an additional year (from January 1, 2015 to December 31, 2015) subject to the same terms and conditions of the Contract.

The Authority's exercise of the 120-day option and its acceptance of ACS's proposal is conditioned upon ACS' continuance of the Monitoring Agreement and protocol put in place at the time the contract was awarded.

If a future review by our Audit Department indicates a modification to the price adjustment that may be afforded under the aforementioned "Escalation" clause of the Contract, it will be done accordingly and Contract compensation will be retroactively adjusted. Nothing herein shall be construed as a waiver by the Port Authority of any of its rights or remedies under the Contract, or as the exercise by the Port Authority of any extension rights thereunder.

Please submit the updated Certificate of Insurance to the attention of the General Manager, Risk Management, The Port Authority of New York and New Jersey, 225 Park Avenue South, 12th Floor,

One Madison Avenue, 7th Floor
New York, NY 10010
T: 212 435 7000

New York, NY 10003. This Certificate must be annotated with CITS tracking number: CITS #2216N.

Your facility contact is Charles Fausti, who can be reached at (212) 435-4951. If you have questions regarding this extension, please contact James Summerville, Sr. Contracts Specialist, at 212-435-3954 or jsummerville@panynj.gov.

Very truly yours,

Lillian Valenti
Director, Procurement Department

ACS
A xerox Company

Charlie Mitchell
Account Executive
Transportation Solutions Group

ACS, A Xerox Company
12410 Milestone Center Drive
Germantown, MD 20876

Charlie.Mitchell@acs-inc.com
Tel 914.388.7168

September 22. 2010

James Summerville
Senior Buyer
Port Authority of NY and NJ
One Madison Avenue
New York City, New York 10010

Subject: Maintenance Contract Change Order

Dear Mr. Summerville:

This letter is in response to your September 20, 2010 e-mail requesting clarification of our price quote.

Our price for Item III of Exhibit D already included the cost for Sun Microsystems. We are providing a revision with to Exhibit D with the Item III description reading: "Total Estimated Monthly cost for Actuate and Sun Microsystems Hardware/Software Support." as you requested.

We confirm that the price for all OBX ORT lane closures, which are contractually required for preventive and corrective maintenance, is included in our price proposal. We also confirm that all OBX ORT lane closures are being performed in accordance with the revised MOT plan, as provided by the Port Authority to ACS in April 2010.

Please contact me at (914) 388-7168 with any further questions.

Sincerely,

ACS State and Local Solutions, Inc.

By: Charlie Mitchell

Charlie Mitchell

CC:
Charlie Fausti, PANYNJ, Senior Program Manager, E-ZPass Projects
Jerry Ingersoll, PANYNJ, E-ZPass Maintenance Manager

EXHIBIT A - Revised Sept 18, 2010

Revised Cost Proposal Sheets (including ORT lanes and spares)

Itemized Preventive and Remedial Maintenance and Repairs

Tunnel, Holland Tunnel and Training Academy

ITCS item	(A) Monthly Maintenance and Remedial Repair Cost per Item of Equipment	(B)[5] Number of Items of Equipment at all Facilities	(C) Estimated Total Monthly Maintenance and Remedial Repair Cost per Item of Equipment
AVI Antenna[1] (Mark IV Service & Spare Parts)	$ 38.25	73	$ 2,792.03
AVI Reader[1](Mark IV Service & Spare Parts)	$ 429.54	13	$ 5,584.06
AVI UPS[1](Mark IV Service & Spare Parts)	$ 322.16	13	$ 4,188.05
Booth Equipment[2]	$ 409.18	58	$ 23,732.27
ETC Canopy Traffic Light	$ 40.46	69	$ 2,792.03
Communications[3]	$ 418.80	Quantity N/A	$ 418.80
Deposit workstation equipment	$ 43.63	24	$ 1,047.01
Driver Feedback Sign and Traffic Light	$ 90.21	58	$ 5,232.27
Lane Controller	$ 344.09	71	$ 24,430.28
Lane Mode Sign	$ 364.18	69	$ 25,128.29
Loops	$ 140.27	209	$ 29,316.33
ORT Lane Electronic Components	$ 139.60	2	$ 279.20
ORT Loops (2 axle, 6 Main)	$ 21.46	8	$ 171.71
ORT Light Sensors	$ 90.74	2	$ 181.48
Overhead Vehicle Profiler	$ 263.02	69	$ 18,148.21
Plaza Supervisor workstation	$ 41.88	10	$ 418.80
Treadle[4]	$ 89.02	69	$ 6,142.47
UPS-Lane Controller	$ 216.28	71	$ 15,356.18
VES Equipment (including lights)	$ 602.60	139	$ 83,760.96
VES Equipment (including lights) -ORT	$ 558.41	10	$ 5,584.06
Video Monitoring & VCR	$ 68.75	8	$ 550.03
VES VIC Computers -- ORT	$ 93.07	3	$ 279.20
Training Academy:			
Booth Equipment	$ 226.85	8	$ 1,814.82
Deposit workstation	$ 34.90	2	$ 69.80
Plaza Workstation	$ 34.90	4	$ 139.60

Total Estimated Monthly Maintenance Cost at River Crossings or TB&T

$ 257,557.96

(Sum of column [C])

1. Mark IV diagnostic and service replacement
2. Includes ETC override switches located in separate enclosures attached to the lane controller cabinets at GWB.
3. PAWNET connection at each Plaza and related ITCS network equipment and connection.
4. Includes maintenance of treadle drains

Note: All prices will be inclusive of parts and replacement costs if required, and personnel costs. Also, all prices will cover components and subcomponents related to ITCS

EXHIBIT B - Revised Sept 18, 2010

Cost Proposal Sheets
Computerized Maintenance Management System
River Crossings or TB&T

Software	Cost per Authority Licensed User	Required Number of Authority Licensed Users	Monthly Total
Software Licenses (per user)	$ 967.07	3	$ 2,901.21
Other		3	
Other:		3	
Other:		3	
Other:		3	
Other:		3	
Other:		3	

Total Monthly Price for Computerized Maintenance Management System at all River Crossings or TB&T (sum of column "Monthly Total") **$ $ 2,901.21**

EXHIBIT C - Revised Sept 18, 2010

Cost Proposal Sheets – System Administration Services and Hardware/Software Support River Crossings or TB&T

I. Total Monthly Price for System Administration at all River Crossings or TB&T	$	29774.65
II. Total Estimated Monthly cost for ACS Proprietary Software Support for the ECH	$	5520.00
III. Total Estimated Monthly cost for HP/Compaq Hardware/Software Support	$	8054.60
IV. Total Estimated Monthly cost for Oracle RDB Software Support	$	506.00
V. Total Estimated Monthly cost for BEA MessageQ Software Support	$	506.00
Total Monthly Price for System Administration and Hardware and Software Support at all River Crossings or TB&T	$	44361.25 (Sum of I through V above)

Notes:

1. For the purpose of this proposal, the yearly cost for H/S support will calculated as a monthly charge.

EXHIBIT D - Revised Sept 22, 2010

Cost Proposal Sheets - System Administration Services and Hardware/Software Support Aviation

I. Total Monthly Price for System Administration for the ACH	**$**	10,532.85
II. Total Estimated Monthly cost for ACS Proprietary Software Support for the ACH	**$**	1,380.00
III. Total Estimated Monthly cost for Actuate and Sun Microsystems Hardware/Software Support	**$**	2,784.15
Total Monthly Price for System Administration, Hardware and Software Support for Aviation	**$**	14,697.00 (Sum of I through III above)

Notes:

1. For the purpose of this proposal, the yearly cost for H/S support will calculated as a monthly charge.

EXHIBIT G - Revised Sept 18, 2010

Cost Proposal Sheets

Skills & Hourly Rates/Additional System Administration Services and Additional Repairs due to negligence not River Crossings or TB&T

Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regular Hourly Rate*	10	$ 115.42	$ 1,154.23
Data Base Administrator Overtime Hourly Rate*	5	$ 115.42	$ 577.12
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 115.42	$ 577.12
System Administrator Regular Hourly Rate*	10	$ 92.75	$ 927.50
System Administrator Overtime Hourly Rate*	5	$ 92.75	$ 463.75
System Administrator Premium Overtime Hourly Rate*	5	$ 92.75	$ 463.75

Total Estimated Monthly Additional System Administration $ 4,163.47

The above rates by the Contractor shall be for additional System Administration Services as ordered by the Authority.

Maintenance and Repair Personnel	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional Repairs due to negligence not the fault of the Contractor
Laborers Regular Hourly Rate*	15	$ 85.86	$ 1,287.90
Laborers Overtime Regular Hourly Rate*	10	$ 121.04	$ 1,210.41
Laborers Premium Hourly Rate*	5	$ 156.22	$ 781.11
Electrician Regular Hourly Rate*	15	$ 129.35	$ 1,940.28
Electrician Overtime Hourly	10	$ 186.28	$ 1,862.84
Electricians Premium Overtime Hourly Rate*	5	$ 243.22	$ 1,216.09
Mechanics Regular Hourly Rate*	15	$ 102.08	$ 1,531.17
Mechanics Overtime Hourly Rate*	10	$ 145.37	$ 1,453.68
Mechanic Premium Overtime Hourly Rate*	5	$ 188.66	$ 943.29

Total Estimated Monthly Additional Repairs due to negligen $ 12,226.78

* Refer to Section entitled "Definitions" for definitions of "Regular Working Hours", Overtime Working Hours" and "Premium Overtime Working Hours"

**Wage rates shall be all-inclusive including overhead, taxes, including tolls, travel time, cost of vehicle use and profit.

List additional personnel if appropriate to the submitted Proposal.

The above additional maintenance and repair personnel rates shall be for loss or damage caused by willful of negligent acts by third persons not the fault of the Contractor or for Extra Work if ordered by the Authority.

EXHIBIT H - Revised Sept 18, 2010

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services
Aviation (for ACH)

'his information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regular Hourly Rate*	5	$ 115.42	$ 577.12
Data Base Administrator Overtime Hourly Rate*	5	$ 115.42	$ 577.12
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 115.42	$ 577.12
System Administrator Regular Hourly Rate*	5	$ 92.75	$ 463.75
System Administrator Overtime Hourly Rate*	5	$ 92.75	$ 463.75
System Administrator Premium Overtime Hourly Rate*	5	$ 92.75	$ 463.75

Total Estimated Monthly Additional System $ 3122.601

* Refer to Section entitled "Definitions" for definitions of "Regular Working Hours", Overtime Working Hours" and "Premium Overtime Working Hours"

**Wage rates shall be all-inclusive including overhead, taxes, including tolls, travel time, cost of vehicle use and profit.

List additional personnel if appropriate to the submitted Proposal.

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

EXHIBIT K - Revised Sept 18, 2010

Cost Proposal Sheets

Skills & Hourly Rates/Additional System Administration Services and Additional Repairs for Non-Emergency River Crossings or TB&T

Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regular Hourly Rate*	10	$ 115.42	$ 1,154.23
Data Base Administrator Overtime Hourly Rate*	5	$ 115.42	$ 577.12
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 115.42	$ 577.12
System Administrator Regular Hourly Rate*	10	$ 92.75	$ 927.50
System Administrator Overtime Hourly Rate*	5	$ 92.75	$ 463.75
System Administrator Premium Overtime Hourly Rate*	5	$ 92.75	$ 463.75

Total Estimated Monthly Additional System Administration $ 4163.468

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

Maintenance and Repair Personnel	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Repairs and maintenance for non-emergency extra work
Laborers Regular Hourly Rate*	15	$ 85.86	$ 1,287.90
Laborers Overtime Regular Hourly Rate*	10	$ 121.04	$ 1,210.41
Laborers Premium Hourly Rate*	5	$ 156.22	$ 781.11
Electrician Regular Hourly Rate*	15	$ 129.35	$ 1,940.28

Electrician Overtime Hourly Rate*	10	$ 186.28	$ 1,862.84
Electricians Premium Overtime Hourly Rate*	5	$ 243.22	$ 1,216.09
Mechanics Regular Hourly Rate*	15	$ 102.08	$ 1,531.17
Mechanics Overtime Hourly Rate*	10	$ 145.37	$ 1,453.68
Mechanic Premium Overtime Hourly Rate*	5	$ 188.66	$ 943.29

Total Estimated Monthly Repairs and Maintenance for non-emergen $ 12226.782

* Refer to Section entitled "Definitions" for definitions of "Regular Working Hours", Overtime Working Hours" and "Premium Overtime Working Hours"

**Wage rates shall be all-inclusive subject, but not limited to, overhead, taxes, including tolls, travel time, cost of vehicle use and profit. The rates set forth above shall not be subject to mark up as set forth in Section 13. Compensation for Extra Work of Part II - General Contract Provisions.

List additional personnel if appropriate to the submitted Proposal.

The above additional maintenance and repair personnel rates shall be for loss or damage caused by willful of negligent acts by third persons not the fault of the Contractor or for Extra Work if ordered by the Authority.

EXHIBIT L- Revised Sept 18, 2011

Cost Proposal Sheets

Skills & Hourly Rates/Additional System Administration Services for Non-Emergency Extra Work

Aviation (for ACH & TCH)

Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regular Hourly Rate*	5	$ 115.42	$ 577.12
Data Base Administrator Overtime Hourly Rate*	5	$ 115.42	$ 577.12
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 115.42	$ 577.12
System Administrator Regular Hourly Rate*	5	$ 92.75	$ 463.75
System Administrator Overtime Hourly Rate*	5	$ 92.75	$ 463.75
System Administrator Premium Overtime Hourly Rate*	5	$ 92.75	$ 463.75

Total Estimated Monthly Additional System Administration Personnel Aviation for Non-emergency Extra Work $ 3122.601

* Refer to Section entitled "Definitions" for definitions of "Regular Working Hours", Overtime Working Hours" and "Premium Overtime Working Hours"

**Wage rates shall be all-inclusive subject, but not limited to, overhead, taxes, including tolls, travel time, cost of vehicle use and profit. The rates set forth above shall not be subject to mark up as set forth in Section 13. Compensation for Extra Work of Part II - General Contract Provisions.

List additional personnel if appropriate to the submitted Proposal.
The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

EXHIBIT M - Revised Sept 18, 2010

Cost Proposal Sheets - Price Summary Sheet

Item	Category of Work	Estimated Price
1.	**From Exhibit "A"** Estimated Monthly Preventative and Remedial Maintenance and Repairs at all River Crossings or TB&T.	$ 257,557.96
2.	**From Exhibit "B"** Estimated Monthly Computerize Maintenance Management System at River Crossings or TB&T.	$ 2,901.21
3.	**From Exhibit "C"** Estimated Monthly System Administration Services and Hardware/Software Support at River Crossings or TB&T.	$ 44,361.25
4.	**From Exhibit "D"** Estimated Monthly System Administration Services and Hardware/Software Support (for ACH) at Aviation.	$ 14,697.00
5.	**From Exhibit "G"** Estimated Monthly Extra Services for System Administration Personnel and Maintenance and Repair Personnel- River Crossings or TB&T.	$ 16,390.25
6.	**From Exhibit "H"** Estimated Monthly Extra Services, System Administration Personnel (for ACH) - Aviation	$ 3,122.60
7	**From Exhibit "K"** Estimated Monthly Non-Emergency Extra Work Services for System Administration Personnel and Maintenance and Repair Personnel- River Crossings or TB&T.	$ 16,390.25
8	**From Exhibit "L"** Estimated Monthly Non-Emergency Extra Work Services, System Administration Personnel (for ACH & TCH) - Aviation	$ 3,122.60

I. River Crossings or TB&T:

TOTAL ESTIMATED CONTRACT EXTENSION PRICE: River Crossings or TB&T

A. $ $ 11,816,032.24

(Multiply Total Estimated Price of Items 1, 2, 3, 5 and 7 by 35 months; from ~~2/1/12~~ 1/29/12-12/31/14)

B. $ $ 16,390.25

(Insert the one-time charge from Item 7)

II. Aviation:

TOTAL ESTIMATED CONTRACT EXTENSION PRICE: Aviation

$ $ 732,977.07

(Multiply Total Estimated Price of Item 4, 6 and 8 by 35 months; from ~~2/1/12~~ 1/29/12-12/31/14)

TOTAL EST. CONTRACT PRICE

$ $ 12,549,009.31

(Sum of I.A., I.B., and II above)

THE PORT AUTHORITY OF NY & NJ

October 4, 2005

DHL
ACS State & Local Solutions, Inc.
Mr. Michael. P. Huerta
Senior Vice President and Managing Director
1800 M Street, N.W.
Washington, DC 20036
Attn: J. Lockwood

Re: Contract for Integrated Toll Collection System (ITCS) In-Iane Maintenance and System Administration Services and E-ZPass Plus System Administration Services - Purchase Order No. 4500043187

Dear Mr. Huerta:

The Port Authority of New York and New Jersey ("the Authority") hereby accepts the proposal of ACS State & Local Solutions, Inc. ("ACS State & Local Solutions"), for a contract (the "Contract") for Integrated Toll Collection System (ITCS) In-Iane Maintenance and System Administration Services and E-ZPass Plus System Administration Services, commencing on October 1, 2005 and, unless sooner terminated, expiring on September 30, 2009 with the Authority having the right to extend the Contract for up to two additional one-year periods.

ACS State and Local Solutions shall submit to the Authority the following by no later than October 14, 2005: the list Open Road Tolling (ORT) spare parts in inventory as of October 1, 2005; and the initial inventory of ITCSspare parts in conformance with Contract MF-274.038M.

The Contract between the parties shall consist of the following Items 1 through 12; in case of conflict between any of the Items, the order of precedence shall be as numbered below:

1. This Letter of Acceptance.

2. The revised General Contract Provisions dated October 4,2005, attached hereto.

3. The revised Scope of Work dated October 4, 2005, including the revised Attachment I "Port Authority Operating and Maintenance (O & M) Standards dated August 10, 2005 and revised Attachment M "Mark IV Irrevocable Offer" dated July 25, 2005, attached hereto.

One Madison Avenue,7th fl
New York, NY 10010
T: 2124357000

4. The revised Cost Proposal Sheets dated September 29,2005, attached hereto.

5. ACS State and Local Solutions' email (Responses to Remaining Contract Issues) dated September 23, 2005 and ACS State and Local Solutions' Letter (Follow-up to Request for Clarifications and Best and Final Offer) dated July 8, 2005, the foregoing listed in order of precedence. The Authority has selected Alternative #1, for fixed monthly pricing.

6. ACS State and Local Solutions' Letter (Response to Follow-up Request for Clarifications and Best and Final Offer) dated June 30, 2005.

7. The Authority's Follow-up Request for Clarifications and Best and Final Offer dated June 27, 2005.

8. ACS State and Local Solutions' BAFO Letter (Response to Request for Clarifications and Best and Final Offer) dated June 15,2005.

9. The Authority's Request for Clarifications and Best and Final Offer dated June 9, 2005.

10. ACS State and Local Solutions' Proposal Presentation dated June 7, 2005, including "Answers to Questions Regarding RFP No. 0000007516."

11. ACS State and Local Solutions' Proposal (RFP Response) dated May 17, 2005.

12. The Authority's Request for Proposals for the Integrated Toll Collection System (ITCS) In-lane Maintenance and System Administration Services and E-ZPass Plus System Administration Services issued March 2005, as amended by Addendum No. 1 dated May 3,2005; Addendum No.2 dated May 4,2005; and Addendum No.3 dated May 10, 2005.

If you are in agreement with the above, please indicate such agreement by signing both copies of this letter at the lower left and returning both signed copies to the attention of Ms. Patricia Cose, Procurement Department, at the above address. One fully executed original of this letter will be returned to you following execution by the Port Authority. If you have any questions, Ms. Cose can be reached at (212) 435-3917.

THE PORT AUTHORITY OF NY & NJ

Sincerely,

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

By _____
Acting Director ofProcurement

Date: 10/11/05

AGREED:

ACS STATE AND LOCAL SOLUTIONS, INC.

By: _____
Michael P. Huerta

Title: Senior Vice President

Date: October 13, 2005

PART II - GENERAL CONTRACT PROVISIONS

1. General Agreement

A. The undersigned (hereinafter referred to as the "Contractor" or "you") agrees to provide, and The Port Authority of New York and New Jersey (hereinafter referred to as the "Authority") agrees to purchase system administration including software and hardware support management for the ITCS System, which processes all Tunnels, Bridges and Terminals Department (TB&T) toll transactions, both manual and electronic, and Aviation E-ZPass Plus system which processes all parking transactions, and maintenance services for the ITCS in-lane equipment; all as more fully set forth in the Scope of Work attached hereto and made a part hereof. The Contractor shall also furnish management maintenance support of the operating systems, databases and all software including proprietary software. The Scope of Work requires the doing of all things necessary or proper for or incidental to the requirements as set forth in the Scope of Work. All things not expressly mentioned in the Scope of Work but involved in carrying out their intent are required by the Scope of Work and the Contractor shall perform the same as though they were specifically mentioned, described and delineated. Notwithstanding the above, the Port Authority will provide any network services and reserves the right to furnish the hardware needed for the system.

B. The Contractor agrees to provide, and the Port Authority of New York and New Jersey agrees to purchase Preventive and Remedial Maintenance and Repair services including replacement of parts, and deployment of lane controller software upgrades, reinstallation of lane software or changes to in-lane equipment settings resulting from changes to the ECH for the Integrated Toll Collection System's in-lane related equipment; all as more fully set forth in the Scope of Work attached hereto and made a part hereof. All things not expressly mentioned in the Scope of Work but involved in carrying out their intent are required and the Contractor shall perform the same as though they were specifically mentioned, described and delineated.

The estimated monthly price for Preventive and Remedial Maintenance and Repair services from Exhibit A, River Crossings or TB&T: $184,593.00

The total monthly price for Preventative and Remedial Maintenance and Repair services from Exhibit A, River Crossings or TB&T shall be reduced based on the removal of required coverage of three geographic regions: (Staten Island Bridges (one region), George Washington Bridge (one region) and Holland and Lincoln tunnels (one region). The following monthly cost reduction shall be applicable from the total for Column C:

Removal of required coverage in 1 region: 15% monthly cost reduction

Removal of required coverage in 2 regions: 30% monthly cost reduction

Removal of required coverage in 3 regions: 100% monthly cost reduction

C. The Contractor agrees to provide, and the Port Authority of New York and New Jersey agrees to purchase at the sole option of the Port Authority, upgrading of equipment; all as more fully set forth in the Cost Proposal Sheets attached hereto and made apart hereof at the unit prices set therein.

The estimated price for the upgrading of equipment from Exhibits E and F are

Aviation	N/A
River Crossings or TB&T	N/A

D. The Contractor agrees to perform, and the Port Authority of New York and New Jersey agrees to purchase System Administration Services, including all software and hardware maintenance management support for the ACH and ECH; all as more fully set forth in the Scope of Work attached hereto and made a part hereof. The Scope of Work requires all things not expressly mentioned in the Scope of Work but involved in carrying out their intent and the Contractor shall perform the same as though they were specifically mentioned, described or delineated.

The total monthly price for System Administration Services From Exhibits C and Dare

Aviation (for ACH)	$ 15,630.00
Aviation (for TCH)	$ 14,347.00
TB&T (for ECH)	$ 39,525.00

E. The Contractor agrees to provide, and the Port Authority of New York and New Jersey agrees to purchase at the sole option of the Port Authority, additional maintenance and repair services for loss or damage caused by willful or negligent acts of third persons not the fault of the Contractor or for Extra Work ordered by the Authority and for additional System Administration Services ordered as Extra Work; all as more fully set forth in the Cost Proposal Sheets attached hereto and made apart hereof at the unit prices set forthwith.

The estimated prices for the additional preventative and remedial maintenance and system administration services from Exhibit G are

River Crossings or TB&T (additional maintenance/repair due to negligence acts or Extra Work)	$ 11,534.67

River Crossings or TB&T (additional system administration services) $ 3,927.72

The estimated price for the additional system administration services from Exhibit His

Aviation (ACH & TCH) $ 3,927.72

F. The Contractor agrees to provide, and the Port Authority of New York and New Jersey agrees to purchase a Computerized Maintenance Management System for use in tracking Preventive and Remedial Maintenance and Repair services for the Integrated Toll Collection System; all as more fully set forth in the Scope of Work attached hereto and made a part hereof. All things not expressly mentioned in the Scope of Work but involved in carrying out their intent are required and the Contractor shall perform the same as though they were specifically mentioned, described and delineated.

The total monthly price for the Computerized Maintenance Management System from Exhibit B

River Crossings or TB&T $ 2,901.00

G. Subject only to the provisions of the clause here in entitled "Extra Work" in (Section 12 of this Part II), the Contractor's sole compensation in full consideration for the supply of all the post implementation hardware and software components shall be at the unit prices identified in the Contractor's response to the RFP. The services hereunder shall be at the unit prices and shall be deemed to include all expenses incurred by the Contractor to supply the services. There shall be no separate reimbursement for expenses. The Scope of Work requires the doing of all things necessary or proper for or incidental to the requirements as set forth in the Scope of Work. The Scope of Work requires all things not expressly mentioned in the Scope of Work but involved in carrying out their intent and the Contractor shall perform the same as though they were specifically mentioned, described or delineated.

2. Duration

This Contract shall take effect on October 1, 2005 (herein referred to as the "Effective Date") and shall continue in effect for a four (4) year period (the "Initial Term").

The Authority shall have the right at its sole option to extend this Contract for up to two (2) additional one (1) year periods ("Option Periods") from the expiration of the Initial Term upon the same terms and conditions subject to the following: not later than ninety (90) days prior to the expiration of expiration of the Initial Term or any Option Period exercised, the Authority will send a notice of intention to extend the term of this Contract, as aforesaid, and

the term of the Contract shall thereupon be extended for the applicable extension period subject only to the adjustment of scope and charges as herein provided.

The Authority shall have the absolute and unilateral right to extend this Contract for an additional one hundred twenty (120) day period subsequent to the expiration of the Initial Term or the expiration of any Option Period exercised, if any, subject to the same terms and conditions of the Contract as in the preceding contract period. The charges quoted by the Contractor that are in effect during the last year of the Initial Term or the last exercised Option Period shall remain in effect during this extension period without escalation. The Authority will advise the Contractor in writing at least thirty (30) days prior of its intent to exercise this Contract extension.

Please note: During the term of this Contract, the Authority is planning to replace the current Integrated Toll Collection System (ITCS). The Authority may exercise its right to terminate this Contract during the Initial Term or any exercised option period or extension period in accordance with Part II, Section 17, Termination of Agreement.

3. Escalation

The prices and hourly rates payable after the second year of the Initial Term shall be adjusted utilizing the Consumer Price Index - All Urban Consumers; Series Id: CUUSA101SAOL2; Not Seasonally Adjusted; New York-Northern New Jersey-Long Island, NY-NJ-CT-PA area; all items less shelter; 1982-1984=100, published by the Bureau of Labor Statistics of the United States Department of Labor (hereinafter called the "Price Index"). Adjustments shall be computed as follows:

a) For the third year of the Initial Term, the Price Index shall be determined for the months of March 2006 and March 2007. The Unit Prices payable in the first two years of the Initial Term of the Contract shall each be multiplied by a fraction, ~the numerator of which is the Price Index for March 2007 and the denominator of which is the Price Index for March 2006. The resulting products shall be the Unit Prices payable in the third year of the Initial Term.

b) For the fourth year of the Initial Term, the Price Index shall be determined for the months of March 2007 and March 2008. The Unit Prices payable in the third year of the base period shall each be multiplied by a fraction, the numerator of which is the Price Index for March 2008 and the denominator of which is the Price Index for March 2007. The resulting products shall be the Unit Prices payable in the fourth year of the Initial Term.

c) For the first option period, the Price Index shall be determined for the months of March 2008 and March 2009. The Unit Prices payable in the Contract's fourth year shall each be multiplied by a fraction, the numerator of which is the Price Index for March 2009 and the denominator of which is the Price Index for March 2008. The resulting products shall be the Unit Prices payable in the first option period.

d) For the second option period, the Price Index shall be determined for the months of March 2009 and March 2010. The Unit Prices payable in the Contract's fifth year shall each be multiplied by a fraction, the numerator of which is the Price Index for

March 2010 and the denominator of which is the Price Index for March 2009. The resulting products shall be the Unit Prices payable in the second option period.

In the event that the Index is not available for any specified months as hereinabove set forth within the time set forth for payment, such index for the latest month then published shall be used to constitute the Index. In the event of the change of basis or the discontinuance of the publication by the United States Department of Labor of the Index, such other appropriate index shall be substituted as may be agreed to by the parties hereto as properly reflecting changes in the value of the current United States money in a manner similar to that established in the said Index used in the latest adjustment. In the event of the failure of the parties to so agree, the Authority may select and use such index as it deems appropriate.

4. PrevailingWage (Davis-BaconAct)

The Contractor shall pay of provide (and shall cause all subcontractors to payor provide) to his or their workmen and laborers (who are employed by him or them to work on an hourly or daily basis at any trade or occupation at or about the Site of the Work) at least the prevailing rate of wage and supplements for others engaged in the same trade of occupation in the locality in which the Work is being performed as determined by the Authority.

For the purposes of this Contract, The Authority has determined that the prevailing rates of wage and supplements are those established by the Secretary of Labor of the United States pursuant to the Davis-Bacon Act (40 U.S.C.A. 276a) for the locality in which the Work is to be performed. The applicable rates shall be those which are in effect on the date of Contract execution.

The provisions of this numbered clause are inserted in this Contract for the benefit of such workmen and laborers as well as for the benefit of the Authority; and if the Contractor or any subcontractor shall payor provide any such workman or laborer less than the rates of wages and supplements above described, such workman or laborer shall have a direct right of action against the Contractor or such subcontractor for the difference between the wages and supplements actually paid or provided and those to which he/she is entitled under this clause, if Such workman or laborer is employed by any subcontractor whose subcontract does not contain a provision substantially similar to the provisions of this clause (requiring the payment or provision of at least the above minimum and providing for a cause of action in the event of the subcontractors failure to payor provide such wages and supplements) such workman or laborer shall have a direct right of action against the Contractor. The Authority shall not be a necessary party to any action brought by any workman or laborer to obtain a money judgment against the Contractor or any subcontractor pursuant to this numbered clause.

Nothing herein contained shall be construed to prevent the Contractor or any subcontractor from paying higher rates or providing higher supplements that the minimum hereinbefore prescribed.

5. Definitions

The term "days" or "calendar days" in reference to a period of time shall mean consecutive calendar days, Saturdays, Sundays and holidays, included. The term "week", unless otherwise specified, shall mean seven (7) consecutive calendar days, Saturdays, Sundays, and holidays included.

The term "month", unless otherwise specified, shall mean a calendar month.

"Work" shall mean all structures, equipment, plant, labor, materials (including materials and equipment, if any, furnished by the Authority) and other facilities, and all other things necessary or proper for, or incidental to the activities at the Site of the Work.

The term "Site of the Work", "Facility" or words of similar import shall mean:

River Crossings
Bayonne Bridge
Holland Tunnel
Lincoln Tunnel
George Washington Bridge (three plazas)
Goethals Bridge
Outerbridge Crossing

Aviation Facilities
John F. Kennedy International Airport
LaGuardia Airport
Newark Liberty International Airport

Other Facilities
The Port Authority Technical Center (PATC)
- Training Academy
- Network Operations Control Center (NOCC)

Port Authority TeleCenter

"Director" shall mean the Director of Tunnels, Bridges, and Terminals Department and/or the Director of Aviation for the purpose of this Contract, acting personally or through one of his/her authorized representatives for the purpose of this Contract.

"Contract Manager" shall mean the person designated by the Director to manage all aspects of this Contract or his/her successor in duties for the purpose of this Contract, acting personally or through his/her duly authorized representative.

"Facility Manager" shall mean the General Manager of each of the "Work Sites" listed above or his/ her successor in duties for the purpose of this Contract, acting personally or through his/her duly authorized representative.

No persons other than those specifically identified above shall be deemed a representative of the Director or of the Contract Manager except to the extent specifically authorized in an express written notice to the Contractor signed by the Director or the Contract Manager, as the case may be. Further, no person shall be deemed a successor in duties of the Director

unless the Contractor is so notified in writing signed by the Authority's Director ofthe Purchasing Department. No person shall be deemed a successor in duties of the Contract Manager unless the Contractor is so notified in writing signed by the Director.

"Subcontractor" shall mean anyone who performs Work (other than or in addition to the furnishing of materials, plant or equipment) at or about the Site of the Work directly or indirectly for or on behalf of the Contractor (and whether or not in privity of Contract with the Contractor), but shall not include any person who furnished merely his/her own personal labor or his/her own personal services. "SubContractor", however, shall exclude the Contractor or any subsidiary or parent of the Contractor or any person, firm or corporation which has a substantial interest in the Contractor or in which the Contractor or the parent or the subsidiary of the Contractor, or an officer or principal of the Contractor or of the parent or the subsidiary of the Contractor has a substantial interest, provided, however, that for the purpose of the clause hereof entitled "Assignments and SubContracts" the exclusion in this paragraph shall not apply to anyone but the Contractor.

The term "maintenance" or words of similar import, as used herein, shall mean the aggregate of the following: preventative maintenance, periodic inspection, testing and remedial repairs of the systems as specified herein. Such maintenance shall include the furnishing and replacing of any parts or items of equipment that may be required to keep all the system components in working order, 24 hours a day 7-days a week. However, such maintenance shall not include the furnishing and replacing of any parts of items of equipment that may be required as the result of damage caused by accident, abuse or negligence not attributable to employees of the Contractor as is demonstrated to the satisfaction of the Manager.

"Materialmen" shall mean anyone who furnishes materials, plant or equipment (including temporary or consumable materials) to the Contractor or any subcontractor for use at or about the work site in the performance of Work.

The term "Authority" refers to the Port Authority of New York and New Jersey.
"Notice" shall mean a written notice.

Reference to Work or its performance, "directed", "required", "permitted", "ordered", "designated", "prescribed", and words of similar import shall mean directed, required, permitted, ordered, designated, or prescribed but the Manager; and "approved", "acceptable", "satisfactory" and words of similar import shall mean approved by or acceptable or satisfactory to the Manager; and "necessary", "reasonable", "proper", "correct" and words of similar import shall mean necessary, reasonable, proper, or correct in the judgments of the Manager.

"Priority Service Calls" - see Part V, Attachment C - "Priority Service Calls."

"First in, First out (FIFO)" - A queuing principle in which entities in a queue leave the queue in the same order in which they arrive.

"Burn-in" - To test for defects by operating a component, equipment or software for a continuous period of time.

"Peak Operational Periods" - see Part III, Scope of Work, Primary Response Period.

"Integrated Toll Collection System" or "ITCS" shall mean both the electronic toll collection system and the manual toll collection system.

"In-Lane Equipment" shall mean any ITCS related equipment located at a toll plaza at one of the River Crossings.

"ACS" shall refer to Affiliated Computer Services, State and Local Solutions, Inc..

Holidays: The following legal holidays will be observed at Port Authority offices and facilities:

New Year's Day	Columbus Day
Martin Luther King, Jr. Day	Veteran's Day
Presidents Day	Thanksgiving Day
Memorial Day	Day After Thanksgiving
Independence Day	Christmas Day
Labor Day	

As used herein, the terms "Port Authority" or "Authority" shall mean the Port Authority of New York and New Jersey.

"Regular Working Hours" - as used herein shall mean 6:30 A.M. to 4:30 P.M., Monday through Friday, excluding legal holidays observed at the Site of the Work as defined above.

"Overtime Working Hours" - as used herein shall mean hours other than regular working hours and eight (8) hours on Saturday

"Premium Overtime Working Hours" - as used herein shall mean hours in excess of eight (8) hours on Saturday and all day Sunday and holidays observed at the Site of Work as defined in the clause of the Contract entitled "Holidays

6. General Provisions

A. No certificate, payment, (final or otherwise), acceptance of any work nor any other act or omission of the Authority shall operate to release the Contractor from any obligations under or upon this agreement, or to stop the Authority from showing at any time, that such certificate, payment, acceptance, act or omission was incorrect or to preclude the Authority from recovering any monies paid in excess of that lawfully due, whether under mistake of law or fact or to prevent the recovery of any damages sustained by the Authority.

B. The Contractor shall not issue or permit to be issued, any press release, advertisement, or literature of any kind which refers to the Authority or to the fact that services have been, are being or will be performed in connection with this Agreement unless you first obtain the written approval of the Director. Such approval may be withheld if for any reason the Authority believes that the publication of such information would be harmful to the public interest or is in any way undesirable.

C. Under no circumstances shall Contractor or any subcontractors communicate in any way with any department, board, agency, commission, or other organization or any person whether governmental or private in connection with the services to be performed hereunder except upon prior written approval and instructions of the Director, provided, however, that data from manufacturers and suppliers of materials, devices and equipment shall be obtained by the Contractor when it finds such data necessary unless otherwise instructed by the Authority.

D. Any services performed for the benefit of the Authority at any time by the Contractor or on the Contractor's behalf, even if expressly and duly authorized by the Authority, shall be deemed to be rendered under and subject to this Agreement (unless referable to another expressly written, duly executed agreement by the same parties), whether such additional services are performed prior to, during or subsequent to the services described herein, and no rights or obligations shall arise out of such additional services except as provided under this Agreement.

E. The Contractor shall observe and obey (and compel its officers, employees, guests, invitees, and those doing business with it, to observe and obey) the rules and regulations of the Port Authority now in effect, and such further rules and regulations which may from time to time during the effective period of this Contract, be promulgated by the Port Authority for reasons of safety, health, preservation of property, or maintenance of a good and orderly appearance of the Facilities, or for the safe and efficient operation of the Facilities. The Port Authority agrees that, except in cases of emergency, it shall give notice to the Contractor of every rule and regulation hereafter adopted by it.

F. This Contract does not constitute the Contractor as an agent or representative of the Port Authority for any purpose whatsoever. The Contractor shall perform all services hereunder as an independent Contractor and the Contractor, its officers, and employees shall not be deemed to be agents, servants, or employees of the Port Authority.

7. **Intellectual Property**

A. Except as provided below: as between the Port Authority and the Contractor all User Guides, Training Manuals and tutorials, Quick Reference Cards, procedures, documentation, estimates, reports, records, data, charts, documents, models, designs, renderings, drawings, specifications, photographs, computations, computer tapes or discs, and other documentation of any type whatsoever, whether in the form of writing, figures or delineations, which are prepared or compiled in connection with this Agreement, shall become the exclusive property of the Authority, and the Authority shall have the exclusive right to use or permit the use of them and any ideas or methods represented by them for any purpose and at any time without other compensation than that specifically provided for herein. With regard to training manuals the Authority shall expressly have the right to use, alter and reproduce including electronically, said manuals for its internal business purposes. The Contractor hereby warrants and represents that the Authority will have at all times the ownership and rights provided for in the immediately preceding sentence free and

clear of all claims of third persons whether presently existing or arising in the future and whether presently known to either of the parties to this Agreement or not. Any information given to the Port Authority before, with or after submission of the Agreement on Terms of Discussion, either orally or in writing, is not given in confidence and may be used, or disclosed to others, for any purpose at any time without obligation or compensation and without liability of any kind whatsoever except as otherwise set forth in the "Agreement On Terms Of Discussion."

B. All pre-existing information or documentation including computer programs or code including source code, of the Contractor, utilized by the Contractor hereunder in the performance of his services hereunder shall be deemed licensed to the Authority for the duration and purposes of this agreement, but shall remain the property of the Contractor.

C. Third party software not specially prepared for the purpose of this agreement but utilized by the Contractor hereunder in the performance of his services hereunder shall be licensed to the Contractor for the duration and purposes of this Agreement as long as the Work performed hereunder is performed by the Contractor, provided, however, that should Contractor not perform the Work hereunder for any reason whatsoever, then the Contractor shall transfer its license in the third-party software to the Authority, assuming third party license allows for assignment.

D. The right of the Authority as well as the Contractor to use any copyrightable matter, trade secrets or other proprietary matters, shall be obtained by the Contractor without separate or additional compensation whether the same is copyrighted before, during or after the performance of the Work. Subject to approval of the Authority, the Contractor may provide a substitute of such proprietary matter to ensure continuity of performance under this Agreement.

E. Any modifications made by the Contractor to the Electronic Central Host computer program or code, including source code, shall become the property of the Authority with all rights therein. Any modifications to the Airport Central Host computer program or code, including source code, shall be deemed licensed to the Authority in perpetuity and subject to the terms of the escrow agreement under Contract MFA-Design and Implementation of Airport Central Host for E-ZPass Plus Parking System at J.F.K. International, Newark International and LaGuardia International. Modifications to the Computerized Maintenance Management shall be subject to the terms of the attached Software License and Agreement included herein as Attachment J.

8. Indemnity in Regard to Infringement Matter Within Software License

The. Contractor shall indemnify the Authority against and save it harmless from all loss and expense incurred in the defense, settlement or satisfaction of any claims in the nature of patent, copyright, or other proprietary rights infringement arising out of or in connection with the Authority's use, in accordance with the preceding clause, of such patentable subject matter or patented material, compositions of matter, manufactures, apparatus, appliances, processes of manufacture or types of construction, or copyrighted matter or other matter protected as intellectual property. If requested by the Authority

and if notified promptly in writing of any such claims, the Contractor shall conduct all negotiations with respect to and defend such claim without expense to the Authority. If the Authority be enjoined from using any of the facilities which form the subject matter of this Contract; and as to which the Contractor is to indemnify the Authority against proprietary rights claims, the Authority may, at its option and without thereby limiting any other right it may have hereunder or at law or in equity, require the Contractor to supply, temporarily or permanently, facilities not subject to such injunction and not infringing any proprietary rights and if the Contractor shall fail to do so, the Contractor shall, at its expense, remove all such facilities and refund the cost thereof to the Authority and otherwise equitably adjust compensation and take such steps as may be necessary to ensure compliance by the Authority with such injunction, to the satisfaction of the Authority.

The Contractor shall promptly and fully inform the Director of any claims or disputes for infringement or otherwise, whether existing or potential, of which it has knowledge relating to any Intellectual Property used, developed or licensed in connection with the performance of the Work or otherwise in connection with this Contract.

9. Propriety Rights in Subject Matter Not Within Software License and Agreement

If in accordance with this Contract the Contractor furnishes research, development or consultative services in connection with the performance of the Work and if in the course of such research, development, or consultation patentable or copyrightable subject matter or trade secrets or other proprietary matter is produced by the Contractor, its officers, agents, employees, subcontractors, or suppliers, not custom software and not within the scope of the attached Software License and Agreement, if required by this Contract (see Attachment J), the Authority shall have, without cost or expense to it, an irrevocable, non-exclusive, royalty-free license to make, have made, and use, either itself or by anyone on its behalf, such subject matter in connection with any activity now or hereafter engaged in or permitted by the Authority. Promptly upon request by the Authority, the Contractor shall furnish or obtain from the appropriate person a form of license satisfactory to the Authority, but it is expressly understood and agreed that as between the Contractor and the Authority the license herein provided for shall nevertheless arise for the benefit of the Authority immediately upon the production of said subject matter and shall not await formal exemplification in a written license agreement as provided for above. Such license may be transferred by the Authority to its successors, immediate or otherwise, in the operations of or ownership of any facility now or hereafter operated by the Authority or the Authority but such license shall not be otherwise transferable.

The right of the Authority as well as the Contractor to use all patented material, compositions of matter, manufactures, apparatus, appliances, processes of manufacture or types of construction as well as any copyrightable matter, trade secrets or other proprietary matters, shall be obtained by the Contractor without separate or additional compensation whether the same is patented before, during or after the performance of the Work.

10. Liquidated Damages

A. Damages for Incomplete Performance and/or Delay

The Contractor shall complete performance of all work in connection with this Contract in accordance with the Scope of Work.

The Contractor shall not commence the performance of any work on Authority premises until the Contractor has received notice from the Authority that the insurance provided by him in accordance with the clause hereof entitled "Insurance to be Provided by the Contractor" is satisfactory, as evidenced by the certificate to be furnished under said clause. The time for completion shall not be extended on account of the time required to furnish the documents referred to above, but the Authority shall give notice to the Contractor within five (5) days after receipt of the Certificate of Insurance as to whether or not such insurance is satisfactory.

The Contractor's obligations for the performance of all Servicesat the servicelevels specified herein and completion of all work within the time or times provided for in this Contract are of the essence of this Contract.

Inasmuch as the damage and loss to the Authority that will result from delay in completing the Contractor's performance within the times required or from the Contractor'sfailureto performat the levelsherein stipulated will include items of loss whose amount will be incapable or very difficult to accurately estimate, the damages to the Authority for each calendar day by which the Contractor does not complete his performance within the times herein stipulated, shall be liquidated in the sum of the following amount, Saturdays, Sundays and holidays included:

The Authority may consider continued failure to meet performance under this Contract at the levels stipulated as a material breach of this Contract. Inasmuch as the damage and loss to the Authority which will result will include items of loss whose amount will be incapable or very difficult to accurately estimate, the damages to the Authority for non-performance will be liquidated as follows:

SERVICE	SERVICE LEVEL	~ LIQUIDATED DAMAGES FOR NON-PERFORMANCE
Uptime Availability respective of both the ACH, ECH and TCH host services measured monthly	99.9%	5% deduction on the total monthly payment for system administration services if the availability falls below 99.9%
Resolution of workstation service calls measured monthly	No Plaza Supervisor* workstation problem resolution to exceed four (4) hour. No Non-Plaza Supervisor* workstation problem resolution to exceed two (2) days.	$250 per hour for each hour per each workstation service call in excess of the required four (4) hours resolution. $100 per day for each hour per each workstation service call in excess of the required two (2) day resolution.
Corrective maintenance service call response for repair of restoration of system	Failure to respond to service calls within the specified times (see Part III, Section 2, K for response time requirements)	Corrective fees as set forth in Part III, Section 2, J and K
System Administration service calls	Failure to respond to service calls within the specified time	$100 per hour for each hour which response time exceeds the specified maximum (see Part III, Section 3, B and C for response time requirements)

* See Part III Section 3, J for definition.

Credits for damages shall be applied to the preVIOUSmonthly inVoice for system administration services.

Additional liquidated damages for non-performance for is described fully in Part III, Sections J and K.

Computation of on-line availability and resolution of calls refers specifically to work covered in this Contract which is the Contractor's responsibilities.

The Contractor shall not be charged with delay, or assessed Liquidated Damages for delay or failure, which occurs for reasons beyond the reasonable control of the Contractor or subcontractors as determined by the Port Authority.

11. Support Services Payments

On or prior to the fifth (5th) day of each calendar month during the term of this Contract including the calendar month immediately following the expiration or termination of this Contract, the Contractor shall submit monthly invoices for the performance of services in the prior month. Except for services set forth in Exhibits A through D, invoices shall be accompanied by a complete itemization thereof and such records and other information that the Director shall require. The Contractor's invoices for payment shall bear the Contractor's Federal Identification Number. The Contractor shall submit all invoices to the following:

The Port Authority of New York & New Jersey

Aviation
Elsie Poisson, Aviation Parking Technical Administrator
225 Park Avenue South, 9th FIr.
New York, New York 10010

TB&T
Barbara Abal, Supervisor, Toll System
One Madison Avenue, 5th FIr.
New York, New York 10010

The Port Authority shall, at the receipt of Contractor invoice and upon certification to the Port Authority and the Contractor by the Director (after receipt from the Contractor of such additional information as the Director may require), pay to the Contractor by check payments within 30 days after certification of the Contractor's invoices by the Director.

12. Extra Work

Except as specifically hereinafter provided in this numbered clause, the Contractor shall immediately make such changes in or additions to the products and services hereunder and supply such additional service as the Authority may direct ("Extra Work"). If such changes or additions are without fault on his part, or on the part of others performing on behalf of the Contractor whether or not in privity of contract with the Contractor, and if solely as a result thereof, the Contractor incurs additional costs in the performance of his obligations hereunder, the Contractor may request compensation for such changes or additions in addition to the compensation provided for elsewhere herein. Agreement by the Port Authority, if such is forthcoming, shall be in writing. The execution of the aforementioned written agreement shall be a condition precedent to payment of any additional compensation for changes or additions. Accordingly, if the Authority directs the Contractor to make any change in or addition to products or services which entitle him to compensation in addition to that provided for elsewhere herein, he shall not

proceed with such changes or additions prior to execution of the aforementioned written agreement except as set forth in paragraph 13.

If, as a result of any changes in or additions to the products or services the Authority directs the Contractor to make, the costs of performance of his obligations hereunder are decreased, the parties shall agree to make such adjustments by way of reduction in the compensation provided for elsewhere herein as they may deem equitable and reasonable and, in making such adjustments, no allowance shall be made for anticipated profits.

The Director shall have the authority to order Extra Work up to an amount equal to six percent (6%) of the total estimated Contract price unless the Contractor is advised of a greater authorization in a letter signed by the Authority's Director of Procurement. Nothing herein shall be construed as a presentation that any changes or additions will be ordered.

13. Compensation For Extra Work

The Director and the Contractor may agree, in writing, on lump sum or other compensation for Extra Work. In the event that no such agreement is reached compensation shall be increased by the sum of the following amounts and such amounts only:

A. the actual net cost in money of the labor (including premiums for workers' compensation insurance, taxes, vacation allowances and union dues and assessments required to be paid by the employer on the basis of such labor costs) and material required for such extra work,

B. ten percent (10%) of the amount under (a) above,

C. in addition to the foregoing, if the extra work is performed by a subcontractor, five percent (5%) of the amounts under (a) and (b) above. No extra work shall be performed by a subcontractor without the prior written approval of the Director.

14. Extra Work Procedures

Whenever any Extra Work is performed by the Contractor on a basis other than on a lump sum basis, the Contractor shall, as a condition precedent to payment for such work, furnish to the Director or his authorized representative at the end of each day daily time slips showing (a) the name and employee number of each person employed thereon, and the number of hours in each day during which they performed Extra Work; and (b) a brief description of the nature of the work performed and a list of material and equipment used. Item (b) shall be supplemented by the Contractor at a later date with a statement indicating from whom materials were purchased and the amount paid therefor. Such daily time slips are for the purpose of enabling the Director or his authorized representatives to determine the accuracy of the amounts claimed by the Contractor.

15. Performance of Extra **Work**

The provisions of this Contract relating generally to the Work shall apply without exception to any Extra Work required and to the performance thereof. Moreover, the provisions of the Contract relating generally to the Work and its performance shall also apply to any Extra Work required and to the performance thereof, except to the extent that a written order in connection with any particular item of Extra Work may expressly provide otherwise.

16. Final Payment

After satisfactory completion of all services required hereunder, and upon receipt from the Contractor of such information as may be required, the Director shall certify in writing to the Contractor the total compensation earned by the Contractor.

If so required, the Contractor shall thereupon furnish to the Authority a detailed sworn statement of all claims, just and unjust, of subcontractors, materialmen and other third persons then outstanding which he has reason to believe may thereafter be made on account of the services provided under this Agreement.

Within thirty days (30) after issuance of such certificate of total compensation earned (or within thirty days (30) after receipt of the documents provided for in the immediately preceding paragraph, if required and if such date is later), the Port Authority shall pay to the Contractor by check the amount stated in said certificate, less all other payments and advances whatsoever to or for the account of the Contractor. All prior estimates and payments shall be subject to correction in this payment, which is throughout this Agreement called the Final Payment.

The acceptance by the Contractor, or by anyone claiming by or through him, of the Final Payment shall be and shall operate as a release to the Authority of all claims and of all liability to the Contractor for all things done or furnished in connection with this contract and for every act and neglect of the Authority and others relating to or arising out of the this contract, including claims arising out of breach of the contract and claims based on claims of third persons.

The Contractor's agreement as provided in the immediately preceding paragraph shall be deemed to be based upon the consideration forming part of this Contract as a whole and not to be gratuitous; but in any event even if deemed gratuitous and without consideration, such agreement as provided in the immediately preceding paragraph shall nevertheless be effective. Such release shall include all claims, whether or not in litigation and even though still under consideration by the Authority. Such release shall be effective notwithstanding any purported reservation of right by the Contractor to preserve such claim. The acceptance of any check designated as "Final Payment" or bearing any similar designation shall be conclusively presumed to demonstrate the intent of the Contractor that such payment was intended to be accepted as final, with the consequences provided in this numbered clause, notwithstanding any purported reservation of rights.

The Contractor agrees that he shall not be entitled to, and hereby waives any right he might otherwise have to, and shall not seek any judgment whether under this Contract or otherwise for any such Final Payment or for an amount equivalent thereto or based thereon, or for any part thereof, if such judgment would have the effect of varying, setting aside, disregarding or making inapplicable the terms of this numbered clause or have the effect in any way of entitling the Contractor to accept such Final Payment or an amount equivalent thereto or based thereon or any part thereof other than in the same fashion as a voluntary acceptance of a Final Payment subject to all the terms of this Contract including this numbered clause, unless and until the Contractor should obtain a judgment on any claim arising out of or in connection with this Contract (including a claim based on breach of contract) for an amount not included in said Final Payment. Interest on any late payment under this Contract shall be at 6% per annum.

Notwithstanding the above, in the event that the Contractor has advised and/or submitted a claim under this Contract, the Authority agrees to pay the final payment, less an amount mutually agreed to as a retention, pending resolution of the claim. In this event, the Contractor will preserve all its right and privileges under the contract, in equity and law until the matter is resolved.

17. Termination of Agreement

A. The Authority may at any time for cause terminate this Agreement or any portion of the Agreement as to any services not yet rendered upon thirty (30) days notice to the Contractor, subject to a thirty (30) day cure period in which the Contractor must correct the identified defect or demonstrate good faith effort to correct the defect.

B. The Authority may terminate the System Administration Services scope of this Agreement in its entirety or any portion thereof without cause upon thirty (30) days notice to the Contractor. If the Authority elects to terminate the ACH portion of the System Administration Services, the cost of the remaining services shall be adjusted as set forth in Exhibit C, Note 4. and Exhibit D, Note 4. If the Authority elects to terminate either or both of the ECH and TCH portions of the System Administration Services, all costs set forth in the associated Exhibit, Exhibits C and D respectively, shall not be applicable.

C. The Authority may terminate the ACS Proprietary Software Support Services scope of this Agreement upon thirty (30) days notice to the Contractor.

D. The Authority shall have the right to terminate the Maintenance of the Integrated Toll Collection System scope or any portion thereof without cause upon forty-five (45) days notice to the Contractor effective with the start of the third year of the Contract. If the Authority elects to terminate any portion of the Maintenance of the Integrated Toll Collection System scope, the cost of the remaining services shall be adjusted as set forth in Paragraph B of Section 1. General Agreement above.

Contractor shall have no right of termination as to any services under this Agreement without just cause. Termination by either party shall be by certified letter addressed to the other at its address herein after set forth. Should this Agreement be terminated by either party as above provided, you shall receive no compensation for any services not

yet performed, but if termination is without fault on your part, the Authority shall pay you as the full compensation to which you shall be entitled in connection with this Agreement for the services satisfactorily performed through the date of termination an amount which the Director determines represents the portion of the Lump Sum, Pre-paid Support Hours or Software Modification Price or compensation for Extra Work equivalent to the work satisfactorily performed less any payments previously advanced. No allowance shall be made for anticipated profits. If the Authority terminates this contract for its own convenience the Authority shall compensate the Contractor in the amount of its non-cancellable obligations.

18. Withholding of Payments

If (1) the Contractor fails to perform any of his obligations under this Contract or any other agreement between the Authority and the Contractor (including his obligation to the Authority to pay any claim lawfully made against him by any materialman, subcontractor or workman or other person which arises out of or in connection with the performance of this Contract or any other agreement with the Authority) or (2) any claim (just or unjust) which arises out of or in connection with this Contract or any other agreement between the Authority and the Contractor is made against the Authority or (3) any subcontractor under this Contract or any other agreement between the Authority and the Contractor fails to pay any claims lawfully made against him by any materialman, subcontractor, workman or other third person which arises out of on in connection with this Contract or any other agreement between the Authority and the Contractor or if in the opinion of the Authority any of the aforesaid contingencies is likely to arise, then the Authority shall have the right, in its discretion, to withhold out of any payment (final or otherwise and even though such payment has already been certified as due) such sums as the Authority may deem ample to protect it against delay or loss or to assure the payment of just claims of third persons, and to apply such sums in such manner as the Port Authority may deem proper to protect it against delay or loss or to satisfy such claims. All sums so applied shall be deducted from the Contractor's compensation. Omission by the Authority to withhold out of any payment, final or otherwise, a sum for any of the above contingencies, even though such contingency has occurred at the time of such payment, shall not be deemed to indicate that the Authority does not intend to exercise its right with respect to such contingency. Neither the above provisions for rights of the Authority to withhold and apply monies nor any exercise or attempted exercise of, or omission to exercise, such rights by the Authority shall create any obligation of any kind to such materialman, subcontractors, workman or other third persons.

Until actual payment to the Contractor, his/her right to any amount to be paid under this Contract (even though such amount has already been certified as due) shall be subordinate to the rights of the Authority under this clause.

Contractor shall not be liable for any failure or delay in performance of the obligations under this Agreement if performance is affected by reason of or as a result of fires, strikes, floods, water, wind, earthquakes, tornado, hurricane, lightning explosions, war, terrorist attacks, governmental regulations, court order or decrees, or other cause beyond the reasonable control of Contractor.

In the event payments are wrongfully withheld interest shall be paid in the amount of 6% per annum.

19. Contractor Personnel Standards of Performance

The Contractor shall furnish sufficiently trained management, supervisory, and operating personnel to perform the services required of the Contractor under this Contract. If, in the opinion of the Director, any of the Contractor's personnel are not satisfactory in the performance of services to be furnished hereunder, the Contractor shall remove such personnel and replace them with personnel satisfactory to the Director.

At the time the Contractor is carrying out its field operations there may be other persons working in the vicinity. The Contractor shall so conduct its operations as to work in harmony and not endanger, interfere with or delay the operations of others, all to the best interests of the Authority and others and as may be directed by the Director.

20. Harmony

A. The Contractor shall not employ any persons or use any labor, or use or have any equipment, or permit any condition to exist which shall or may cause or be conducive to any labor complaints, troubles, disputes or controversies at the Facility which interfere or are likely to interfere with the operation of the Port Authority or with the operations of lessees, licensees or other users of the Facility or with the operations of the Contractor under this Contract.

The Contractor shall immediately give notice to the Port Authority (to be followed by written notices and reports) of any and all impending or existing labor: complaints, troubles, disputes or controversies and the progress thereof. The Contractor shall use its best efforts to resolve any such complaint, trouble, dispute or controversy. If any type of strike, boycott, picketing, work stoppage, slowdown or other labor activity is directed against the Contractor at the Facility or against any operations of the Contractor under this Contract, whether or not caused by the employees of the Contractor, and if any of the foregoing, in the opinion of the Port Authority, results or is likely to result in any curtailment or diminution of the services to be performed hereunder or to interfere with or affect the operations of the Port Authority, or to interfere with or affect the operations of lessees, licensees, or other users of the Facility or in the event of any other cessation or stoppage of operations by the Contractor hereunder for any reason whatsoever, the Port Authority shall have the right at any time during the continuance thereof to suspend the operations of the Contractor under this Contract, and during the period of the suspension the Contractor shall not perform its services hereunder and the Port Authority shall have the right during said period to itself or by any third person or persons selected by it to perform said services of the Contractor using the equipment which is used by the Contractor in its operations hereunder as the Port Authority deems necessary and without cost to the Port Authority. During such time of suspension, the Contractor shall not be entitled to any compensation. Any flat fees, including management fees, shall be prorated. Prior to the exercise of such right by the Port Authority, it shall give the Contractor notice thereof, which notice may be oral. No exercise by the Port

Authority of the rights granted to it in the above subparagraph shall be or be deemed to be a waiver of any rights of termination or revocation contained in this Contract or a waiver of any rights or remedies which may be available to the Port Authority under this Contract or otherwise.

B. During the time that the Contractor is performing the contract, other persons may be engaged in other operations on or about the worksite including Facility operations, pedestrian, bus and vehicular traffic and other Contractors performing at the worksite, all of which shall remain uninterrupted.

The Contractor shall so plan and conduct his operations as to work in harmony with others engaged at the site and not to delay, endanger or interfere with the operation of others (whether or not specifically mentioned above), all to the best interests of the Port Authority and the public as may be directed by the Port Authority.

Contractor shall not be liable for any failure or delay in performance of the obligations under this Agreement if performance is affected by reason of or as a result of fires, strikes, floods, water, wind, earthquakes, tornado, hurricane, lightning explosions, war, terrorist attacks, governmental regulations, court order or decrees, or other cause beyond the reasonable control of Contractor.

21. Notification of Security Requirements

In case of conflict, the requirements set forth in the Proposal Submission Requirements shall take precedence over the security requirements in this section.

The Port Authority operates facilities and systems, at which terrorism or other criminal acts may have a significant impact on life safety and key infrastructures. The Authority reserves the right to impose multiple layers of security requirements on the performance of the Contract Work, including on the Contractor, its staff and subcontractors and their staffs depending upon the level of security required, as determined by the Authority. The Contractor shall and shall instruct its subcontractors to cooperate with Authority staff in adopting security requirements. These security requirements may include but may not be limited to the following:

i. Identity Checks and Background Screening

Contractor/subcontractor identity checks and background screening shall include but shall not be limited to: (1) inspection of not less than two forms of valid/current government issued identification (at least one having an official photograph) to verify staffs name and residence; (2) screening of federal, state, and/or local criminal justice agency information databases and files; (3) screening of any terrorist identification files; (4) multi-year check of personal, employment and/or credit history; (5) access identification to include some form of biometric security methodology such as fingerprint, facial or iris scanning.

The Contractor may be required to have its staff, and any subcontractor's staff, authorize the Authority or its designee to perform background checks. Such authorization shall be in a form acceptable to the Authority. If the Authority directs the Contractor to have identity checks and background screening performed by a particular firm designated by the Authority, the Authority will compensate the Contractor for the cost of such screening pursuant to the Extra Work provisions of the Contract.

ii. Issuance of Photo Identification cards:

If the Authority requires facility-specific identification cards for the Contractor's and subcontractors' staff, the Authority will supply one card per staff member of such identification cards at no cost to the Contractor. Copies of the identification card will be issued at a cost of $25.00 each.

iii. Access Control, Inspection, and Monitoring by Security Guards:

The Authority will provide for facility access control, inspection and monitoring by Authority retained security guards. Should the Authority require the Contractor to hire security guards for the purpose of facility access control and inspection in lieu of or in addition to the Authority retained facility security guards, the Contractor will be reimbursed for the cost of such security guards pursuant to the Extra Work provisions of the Contract. However, this provision shall not relieve the Contractor of its responsibility to secure its equipment and work at the facility at its own expense.

The Authority may impose, increase, and/or upgrade security requirements for the Contractor, subcontractors and their staffs during the term of this Contract to address changing security conditions and/or new governmental regulations.

22. Insurance Procured By The Contractor

The Contractor shall take out, maintain, and pay the premiums on Commercial General Liability Insurance, including but not limited to premises-operations and products-completed operations, broad form property damage and independent contractors coverage, with contractual liability covering the obligations assumed by the Contractor under this Contract and, if vehicles are to be used to carry out the performance of this Contract, then the Contractor shall also take out, maintain, and pay the premiums on Business Automobile Liability Insurance covering Contractor's owned, non-owned, and rented vehicles in the following limits:

Commercial General Liability Insurance - $ 1 million combined single limit per occurrence for bodily injury and property damage liability and $2 million general aggregate.

If applicable, Automobile Liability Insurance - $ 1 million combined single limit per accident for bodily injury and property damage liability

Excess Umbrella Liability in the amount of $1 million covering both Commercial General Liability and Automobile Liability, if applicable.

In addition, the Commercial General Liability and Automobile Liability policies shall name The Port Authority of New York and New Jersey as additional insured, including but not limited to premises-operations, products-completed operations, broad form property damage and independent contractor coverage on the Commercial General Liability Policy. Moreover, the Commercial General Liability Policy shall not contain any provisions for exclusions from liability other than provisions for exclusion from liability forming part of the standard, basic unamended and unendorsed Commercial General Liability Policy or its equivalent. The commercial general liability policy (ies) and certificate of insurance must include a cross-liability provision providing severability of interests so that coverage will respond as if separate policies were in force for each insured.

The certificate of insurance and policy (ies) must contain the following wording for the above liability coverage:

"The insurer shall not, without obtaining the express advance written permission from the General Counsel of the Port Authority, raise any defense involving in any way the jurisdiction of the Tribunal over the person of the Port Authority, the immunity of the Port Authority, its Commissioners, officers, agents or employees, the governmental nature of the Port Authority, or the provisions of any statutes respecting suits against the Port Authority. "

The Contractor shall also take out, maintain, and pay premiums on Workers' Compensation Insurance in accordance with the requirements of law in the state(s) where work will take place.

Each policy above shall contain a provision that the policy may not be canceled, terminated, or materially changed without thirty (30) days' prior written notice to the Port Authority of New York and New Jersey, General Manager, Risk Management, at the address below.

The Port Authority may at any time during the term of this agreement change or modify the limits and coverage of insurance subject to Contractor's review and approval.

Within five (5) days after the award of this agreement or contract, the Contractor must submit an original standard ACORD form certificate of insurance to the Port Authority of New York and New Jersey, General Manager, Risk Management, 225 Park Ave. South, 12th Floor, New York, NY 10003 (attention Agreement Certificate Review) and a copy of the certificate to the Facility Contract Administrator, at the location where the work will take place. This certificate of insurance MUST show evidence of the above insurance policy (ies), stating the agreement number. In the event of litigation, the Contractor insurance policies may be viewed at a local insurance carrier broker of the Contractor.

The General Manager, Risk Management must approve the certificate(s) of insurance, before any work can begin. To expedite the review of the certificate(s) of insurance, they may be faxed to the General Manager, Risk Management at (212) 435-5861. However, original certificates of insurance must be submitted in accordance with the aforementioned paragraph.

If at any time the above liability insurance should be canceled, terminated, or modified so that the insurance is not in effect as above required, then, if the Manager shall so direct, the Contractor shall suspend performance of the contract at the premises. If the contract is so suspended, no extension of time shall be due on account thereof. If the contract is not suspended (whether or not because of omission of the Manager to order suspension), then the Authority may, at its option, obtain insurance affording coverage equal to the above required, the cost of such insurance to be payable by the Contractor to the Authority.

Renewal policies shall be delivered to the Port Authority at least fifteen (15) days prior to the expiration date of each expiring policy. If at any time any of the certificates or policies shall become unsatisfactory to the Port Authority, the Contractor shall promptly obtain a new and satisfactory certificate and policy. Upon request of the General Manager, Risk Management, the Contractor shall furnish the Port Authority with a certified copy of each policy stated above. **(eITS # 2216N)**

23. Assignments and Subcontracts

Any assignment or other transfer by the Contractor of this Contract or any part hereof or of any of his rights hereunder or of any monies due or to become due hereunder and any delegation of any of his duties hereunder without the express written consent of the Director shall be void and of no effect as to the Authority, provided, however, that the Contractor may subcontract portions of the Work to such persons as the Director, may, from time to time, expressly approve in writing. For each individual, partnership or corporation proposed by the Contractor as a subcontractor, the Contractor shall submit to the Authority a certification or, if a certification cannot be made, a statement by such person, partnership or corporation to the same effect as the certification or statement required from the Contractor pursuant to the clauses of the "Integrity"~Section entitled "Certification of No Investigation Indictment, Conviction, Debarment Suspension, Disqualification and Disclosure of Other Information and "Non-Collusive Bidding and Code of Ethics Certification; Certification of No Solicitation Based on Commission, Percentage, Brokerage Contingent or Other Fee". All further subcontracting by any subcontractor shall also be subject to such approval of the Director.

No consent to any assignment or other transfer, and no approval of any subcontractor, shall under any circumstances operate to relieve the Contractor of any of his obligations; no subcontract, no approval of any subcontractor and no act or omission of the Authority or the Director shall create any rights in favor of such subcontractor and against the Authority; and as between the Authority and the Contractor, all assignees, subcontractors, and other transferees shall for all purposes be deemed to be agents of the Contractor. Moreover, all subcontractors and all approvals of subcontractors, regardless of their form, shall be deemed to be conditioned upon performance by the subcontractor in accordance

with this Contract; and if any subcontractor shall fail to perform the Contract to the satisfaction of the Director, the Director shall have the absolute right to rescind his approval forthwith and to require the performance of the Contract by the Contractor personally or through other approved subcontractors.

24. Certain Contractor's Warranties

The Contractor represents and warrants:

A. That he is financially responsible and experienced in, and competent to perform this Contract; that no representation, promise or statement, oral or in writing, has induced him to submit his Proposal, saving only those contained in the papers expressly made part of this Contract; that the facts stated or shown in any papers submitted or referred to in connection with his Proposal are true; and, if the Contractor be a corporation, that it is authorized to perform this Contract;

B. That he has carefully examined and analyzed the provisions and requirements of this Contract, that from his own investigations he has satisfied himself as to the nature of all things needed for the performance of this Contract, the general and local conditions and all other matters which in any way affect this Contract or its performance, and that the time available to him for such examination, analysis, inspection and investigations was adequate;

C. That the Contract is feasible of performance in accordance with all its provisions and requirements and that he can and will perform it in strict accordance with such provisions and requirements;

D. That no Commissioner, officer, agent or employee of the Authority is personally interested directly or indirectly in this Contract or the compensation to be paid hereunder;

E. That, except only for those representations, statements or promises expressly contained in this Contract, no representation, statement or promise, oral or in writing, of any kind whatsoever by the Authority, its Commissioners, officers: agents: employees or consultants has induced the Contractor to enter into this Contract or has been relied upon by the Contractor, including any with reference to: (1)the meaning, correctness, suitability or completeness of any provisions or requirements of this Contract; (2) the nature, existence or location of materials, structures, obstructions, utilities or conditions, which may be encountered at the installation sites; (3) the nature, quantity, quality or size of the materials, equipment, labor and other facilities needed for the performance of this Contract; (4) the general or local conditions which may in any way affect this Contract or its performance; (5) the price of the Contract; or (6) any other matters, whether similar to or different from those referred to in (1) through (5) immediately above, affecting or having any connection with this Contract, the bidding thereon, any discussions thereof, the performance thereof or those employed therein or connected or concerned therewith.

F. That, notwithstanding any requirements of this Contract, any inspection or approval of the Contractor's services by the Authority, or the existence of any patent or trade

name, the Contractor nevertheless warrants and represents that the services and any intellectual property supplied to the Authority hereunder shall be of the best quality and shall be fully fit for the purpose for which they are to be used. The Contractor unconditionally guarantees against defects or failures of any kind, including defects or failures in design, workmanship and materials, excepting solely defects or failures which the Contractor demonstrates to the satisfaction of the Authority have arisen solely from accident, abuse or fault of the Authority occurring after issuance of Final Payment hereunder and not due to fault on the Contractor's part. In the event of defects or failures in said services, or any part thereof, then upon receipt of notice thereof from the Authority, the Contractor shall correct such defects or failures as may be necessary or desirable, in the sole opinion of the Authority, to comply with the above guaranty.

Moreover, the Contractor accepts the conditions at the sites of work as they may eventually be found to exist and warrants and represents that he can and will perform the Contract under such conditions and that all materials, equipment, labor and other facilities required because of any unforeseen conditions (physical or otherwise) shall be wholly at his own cost and expense, anything in this Contract to the contrary notwithstanding.

Nothing in the Scope of Work or any other part of the Contract is intended as or shall constitute a representation by the Authority as to the feasibility of performance of this Contract or any part thereof. Moreover, the Authority does not warrant or represent either by issuance of the Scope of Work or by any provision of this Contract as to time for performance or completion or otherwise that the Contract may be performed or completed by the times required herein or by any other times.

The Contractor further represents and warrants that he was given ample opportunity and time and by means of this paragraph was requested by the Authority to review thoroughly all documents forming this Contract prior to execution of this~Contract in order that he might request inclusion in this Contract of any statement, representation, promise or provision which he desired or on which he wished to place reliance; that he did so review said documents; that either every such statement, representation, promise or provision has been included in this Contract or else, if omitted, that he expressly relinquishes the benefit of any such omitted statement, representation, promise or provision and is willing to perform this Contract without claiming reliance thereon or making any other claim on account of such omission.

The Contractor further recognizes that the provisions of this clause (though not only such provisions) are essential to the Authority's consent to enter into this Contract and that without such provisions; the Authority would not have entered into this Contract notwithstanding anything to the contrary in this Contract.

25. Rights and Remedies of The Authority

The Authority shall have the following rights in the event the Director shall deem the Contractor guilty of an uncured material breach of this contract, following written notice from the Authority setting out the specifics of the breach and setting out a reasonable time for Contractor to cure:

a) The right to take over and complete the Work at the reasonable expense of the Contractor, either directly or through other Contractors;
b) The right to cancel this Contract as to all of the Work yet to be performed;
c) The right to specific performance, an injunction or any other reasonable and appropriate equitable remedy;
d) The right to monetary damages.

For the purpose of this Contract, breach shall include but not be limited to the following, whether or not the time has yet arrived for performance of an obligation under this Contract: a statement by the Contractor to any representative of the Authority indicating that he cannot or will not perform anyone or more of his obligations under this Contract; any act or omission of the Contractor or any other occurrence which makes it improbable at the time that he will be able to perform anyone or more of his obligations under this Contract; any suspension of or failure to proceed with any part of the Work by the Contractor which makes it improbable at the time that he will be able to perform anyone or more of his obligations under this Contract; any false certification at any time by the Contractor as to any material item certified pursuant to the clauses hereof entitled "Certification of No Investigation (Criminal or Civil Anti-Trust), Indictment, Conviction, Debarment, Suspension, Disqualification and Disclosure of Other Required Information" and "Non-Collusive Bidding and Code of Ethics Certification; Certification of No Solicitation Based on Commission, Percentage, Brokerage, Contingent or Other Fee", or the willful or fraudulent submission of any signed statement pursuant to such clauses which is false in any material respect; or the Contractor's incomplete or inaccurate representation of its status with respect to the circumstances provided for in such clauses.

The enumeration in this numbered clause or elsewhere in this Contract of specific rights and remedies of The Authority shall not be deemed to limit any other rights or remedies which The Authority would have in the absence of such enumeration; and no exercise by The Authority of any right or remedy shall operate as a waiver of any other of its rights or remedies not inconsistent therewith or to stop it from exercising such other rights or remedies.

Neither the acceptance of the work or any part thereof, nor any payment therefor, nor any order or certificate issued under this Agreement or otherwise issued by the Authority, or any officer, agent or employee of the Authority, nor any permission or direction to continue with the performance or work, nor any performance by the Authority of any of the Contractor's duties or obligations, nor any aid provided to the Contractor by the Authority in his performance of such duties or obligations, nor any other thing done or omitted to be done by the Authority, its Commissioners, officers, agents or employees shall be deemed to be a waiver of any provision of this agreement or of any rights or remedies to which the Authority may be entitled because of any breach hereof, excepting only a resolution of its Commissioners, providing expressly for such waiver. No cancellation, rescission or annulment hereof, in whole or as to any part of the work, because of any breach hereof, shall be deemed a waiver of any money damages to which the Authority may be entitled because of such breach. Moreover, no waiver by the Authority of any breach of this Agreement shall be deemed to be a waiver of any other or any subsequent breach.

26. Rights and Remedies Of The Contractor

Inasmuch as the Contractor can be adequately compensated by money damages for any breach of this Contract which may be committed by the Authority, the Contractor expressly agrees that no default, act or omission of the Authority shall constitute a material breach of this Contract, entitling him to cancel or rescind it or (unless the Director shall so direct) to suspend or abandon performance.

27. Tax Exemptions, Duties and Imposts

Sales to the Authority, as the governmental instrumentality of the States of New York and New Jersey, are exempt from taxation, either state or municipal, in those two states, and also from Federal taxation, including excise taxes. Certificate of Registry for tax-free transactions under Chapter 32 of the Internal Revenue Code is No. 13-730079K. The Contractor should retain a copy of this Contract to substantiate the exempt sale. The Contractor shall pay all duties and imposts, if any, on the importation of any materials.

The Authority is an organization exempt from the New Jersey State Sales and Use Tax Act, and the New York State and New York City Sales and Compensating Use Tax Act. In view of the foregoing, the Contractor should not include in his prices any amounts for New Jersey, New York State or New York City sales and use taxes on materials supplies and services.

If (I) any claim is made against the Contractor by New Jersey, New York State or New York City for such sales or compensating use taxes, or (II) any claim is made against the Contractor by a materialmen or subcontractor on account of a claim against such materialman or subcontractor by either State or the City for such sales or compensating use taxes, then the Authority will reimburse the Contractor in an amount equal to the amount of such tax required to be paid in accordance with the requirements of law, provided that: ~~~ ~

A. the Contractor, or the Contractor and any such subcontractor, as the case may be, have complied with such rules and regulations as may have been promulgated relating to the claiming of the exemption from such taxes and have filed all forms and certificates required by the applicable laws, rules and regulations in connection therewith; and

B. the Authority is afforded the opportunity before any payment of tax is made, to contest said claim in the manner and to the extent that the Authority may choose and to settle or satisfy said claim, and such attorney as the Authority may designate is authorized to act for the purpose of contesting, settling and satisfying said claim; and

C. the Contractor, or the Contractor and any such subcontractor, as the case may be, shall give immediate notice to the Authority and its designated attorney in contesting said claim and furnish promptly to the Authority and said attorney all information and documents necessary to contest such claim which items shall be preserved for six (6) years after the date of Final Payment or longer if such a claim is pending or threatened at the end of such six (6) years.

If the Authority elects to contest any such claim, it will bear the expense of such contest.

28. Title to Equipment

Title to all equipment to be furnished hereunder by the Contractor shall be transferred to the Authority upon its delivery to the installation site.

The Contractor shall furnish such bills of sale and affidavits of title as the Authority shall reasonably request.

29. Notice Requirements

No claim against the Authority shall be made or asserted in any action or proceeding at law or in equity, and the Contractor shall not be entitled to allowance of such claim of which he knows or should know, unless the Contractor shall have complied with all requirements relating to the giving of written notice and of information with respect to such claim as provided in this clause. The failure of the Contractor to give such written notice and information as to any claim shall be conclusively deemed to be a waiver by the Contractor of such claim, such written notice and information being conditions precedent to such claim. As used herein "claim" shall include any claim arising out of this Agreement (including claims in the nature of breach of contract or fraud or misrepresentation before or subsequent to execution of this Agreement and claims of a type which are barred by the provisions of this Agreement) for damages, payment or compensation of any nature or for performance of any part of this Agreement.

The above requirement for written notice does not apply if Contractor is prevented from providing timely written notice due to causes beyond his control. Contractor shall not be liable for any failure or delay in performance of the obligations under this Agreement if performance is affected by reason of or as a result of fires, strikes, floods, water, wind, earthquakes, tornado, hurricane, lightning explosions, war, terrorist attacks, governmental regulations, court order or decrees, or other cause beyond the reasonable control of Contractor.

The requirements as to the giving of written notice and information with respect to claims shall be as follows:

A. In the case of any claims for which requirements are set forth elsewhere in this Agreement as to notice and information, such requirements shall apply.
B. In the case of all other types of claims, notice shall have been given to the Director, as soon as practicableafter occurrence of the act, omission, or other circumstances upon which the claim is or will be based, stating as fully as practicable at the time all information relating thereto. Such information shall be supplemented with any further information as soon as practicable after it becomes or should become known to the Contractor, including daily records showing all costs which the Contractor may be incurring or all other circumstances which will affect any claim to be made which records shall be submitted to the Authority.

The above requirements for notices and information are for the purpose of enabling the Authority to avoid waste of public funds by affording it promptly the opportunity to cancel or revise any order, change its plans, mitigate or remedy the effects of circumstances giving rise to a claim or take such other action as may seem desirable and to verify any claimed expense or circumstance as they occur and the requirements herein for such notice and information are essential to this Agreement and are in addition to any notice required by statue with respect to suits against the Authority.

The above referred to notices and information are required whether or not the Authority is aware of the existence of any circumstances which might constitute a basis for a claim and whether or not the Authority has indicated it will consider a claim.

Since merely oral notice or information may cause disputes as to the existence or substance thereof, and since notice, even if written, to other than the Authority representative above designated to receive it may not be sufficient to come to the attention of the representative of the Authority with the knowledge and responsibility of dealing with the situation, only notice and information complying with the express provisions of this clause shall be deemed to fulfill the Contractor's obligation under this Agreement.

30. Service OfNotices On The Contractor

Whenever provision is made in this Contract for the gIVIng of any notice to the Contractor, its deposit in any post office box, enclosed in a postpaid wrapper addressed to the Contractor at his/her office, or its delivery to his/her office, shall be sufficient service thereof as of the date of such deposit or delivery, except to the extent, if any, otherwise provided in the clause entitled "Submission to Jurisdiction". Until further notice to the Authority the Contractor's office will be that stated in his/her Proposal. Notices may also be served personally upon the Contractor; or if a corporation, upon any officer, director or managing or general agent; or if a partnership upon any partner.

31. No Third Party Rights

Nothing contained in this Agreement is intended for the benefit of third persons, except to the extent that the Agreement specifically provides otherwise by use of the words "benefit" or "direct right of action".

32. Indemnification

The Contractor shall indemnify and hold harmless the Authority, its Commissioners, officers, representatives and employees, from and against all claims and demands, just or unjust, of third persons to the extent arising out of or to the extent alleged to arise out of or in connection with the Contractor's negligent acts or omissions, and those of its officers, employees, agents and subcontractors, in the performance or non-performance of its services under this Contract, and for a all expenses incurred by the Authority in the defense, settlement or satisfaction thereof. If reasonably so directed, the Contractor shall at its own expense defend any suit based upon any such claim or demand, even if such suit, claim or demand is groundless, false or fraudulent, and in handling such shall not, without obtaining express advance permission from the

General Counsel of the Port Authority, raise any defense involving in any way the jurisdiction of the tribunal over the person of the Port Authority, the immunity of the Port Authority, its Commissioners, officers, agents or employees, the governmental nature of the Port Authority or the provision of any statutes respecting suits against the Port Authority.

33. Risks Assumed By The Contractor

The Contractor assumes the following risks, whether such risks arise from acts or omissions (negligent or not) of the Contractor, the Authority, or the Contractor's subcontractors responsible for any aspect of the work required hereunder, or third persons or from any other cause: excepting only risks occasioned solely by affirmative, willful acts of the Authority done subsequent to the effective date of this Contract with the intent of causing the loss or damage,

A. The risk of loss or damage to property of the Authority to the extent arising from the negligent acts or omissions of the Contractor or the Contractor's subcontractors responsible for any aspect of the work required hereunder. The Contractor shall forthwith repair, replace, and make good any such loss or damage without cost to the Authority.

B. The risk of loss or damage to any property of the Contractor to the extent arising from the negligent acts or omissions of the Contractor or the Contractor's subcontractors responsible for any aspect of the work required hereunder.

C. The risk of claims by third persons against the Contractor or the Authority on account of personal injuries (including wrongful death) or property damage to the extent arising from the Contractor's negligent performance of the Contract or to the extent arising from the Contractor's or subcontractor's operations including claims for workers' compensation, whether such claims are made and whether such injuries, damage, or loss are sustained at any time both before and after the completion of the work provided for herein.

D. The risk of claims made against the Contractor or the Authority for loss or damage to any property of subcontractors, materialmen, workmen and others performing the Contract, occurring at any time prior to the completion or removal of such property from the Authority premises or the vicinity thereof.

The Contractor shall indemnify the Authority against all claims described in subparagraphs B, C and D above and for all expenses incurred by it in the defense, settlement or satisfaction thereof, including expenses of attorneys, except where indemnity would be precluded by the New York State General Obligations Law, Section 5-322.1. If so directed, the Contractor shall defend against any claims described in subparagraphs B, C and D above, in which event it shall not, without obtaining express advance permission from the General Counsel of the Authority, raise any defense involving in any way jurisdiction of the tribunal, immunity of the Authority, governmental nature of the Authority or the provisions of any statute respecting suits against the Authority. Such defense shall be at the Contractor's cost.

The provIsIons of this numbered clause shall also be for the benefit of the Commissioners, officers, agents, and employees of the Authority, so that they shall have all the rights which they would have under this numbered clause if they were named at each place above at which the Authority is named, including a direct right of action against the Contractor to enforce the foregoing indemnity, except, however, that the Authority acting through its Commissioners may at any time in its sole discretion and without liability on its part cancel the benefit conferred on any of them by this numbered clause, whether or not the occasion for invoking such benefit has already arisen at the time of such cancellation.

Neither the Authority's acceptance of the performance by the Contractor in part or in whole, nor the making of a payment shall release the Contractor from its obligations under this numbered clause.

Moreover, neither the enumeration in this numbered clause nor the enumeration elsewhere in this Contract of particular risks assumed by the Contractor or of particular claims for which it is responsible shall be deemed (a) to limit the effect of the provisions of this numbered clause or of any other clause of this Contract relating to such risks or claims, (b) to imply that it assumes or is responsible for risks or claims only of the type enumerated in this numbered clause or in any other clause of this Contract, or (c) to limit the risks which it would assume or the claims for which it would be responsible in the absence of such enumerations.

34. Port Authority Technology Standards and Guidelines

The Contractor and any subcontractors shall follow the Port Authority Technology Standard and Guidelines attached hereto and made a part hereof and shall comply with any updates to or changes in best practices related to such Standards and Guidelines.

35. Applicable Law

This Contract shall be construed in accordance with the laws of the State of New York. The Contractor hereby consents to the exercise by the courts of the States of New York and New Jersey of jurisdiction in personam over it with respect to any matter arising out of or in connection with this Contract and waives any objection to such jurisdiction which it might otherwise have; and the Contractor agrees that mailing of process by registered mail addressed to it at the address of the Contractor set forth in the Proposal, shall have the same effect as personal service within the States of New York or New Jersey upon a domestic corporation of said State.

36. Authority Of The Director

Inasmuch as the public interest requires that the Project to which this Contract relates shall be performed in the manner which the Authority, acting through the Director deems best, the Director shall have absolute authority to determine what is or is not necessary or proper for or incidental thereto and the Specifications shall be deemed merely the Director's present determination on this point. In the exercise of this authority, the Director shall have power to alter the Specifications, to require the performance of Work not required by them in their present form, even though of a totally different character

from that not required, and to vary, increase and diminish the character, quantity and quality of, or to countermand any Work now or hereafter required. If at any time it shall be, from the viewpoint of the Authority, impracticable or undesirable in the judgment of the Director to proceed with or continue the performance of the Contract or any part thereof, whether or not for reasons beyond the control of the Authority, the Director shall have authority to suspend performance of any part or all of the Contract until such time as the Director may deem it practicable or desirable to proceed. Moreover, if at any time it shall be, from the viewpoint of the Authority impracticable or undesirable in the judgment of the Director to proceed with or continue the performance of the Contract or any part thereof for reasons within or beyond the control of the Authority, the Director shall have authority to cancel this Contract as to any or all portions not yet performed and as to any materials not yet installed even though delivered. Such cancellation shall be without prejudice to the rights and obligations of the parties arising out of portions already satisfactorily performed, but no allowance shall be made for anticipated profits. To resolve all disputes and to prevent litigation, the parties to this Contract authorize the Director to decide all questions of any nature whatsoever arising out of, under, or in connection with, or in any way related to or on account of, this Contract (including claims in the nature of breach of contract or fraud or misrepresentation before or subsequent to acceptance of the Contractor's Proposal and claims of a type which are barred by the provisions of this Contract) and the matters encompassed by such decision shall be subject to *de novo* judicial review. The Director's decision may be based on such assistance as he/she may find desirable. The effect of the decision shall not be impaired or waived by any negotiation or settlement offers in connection with the question decided, whether or not he/she participated therein, or by any prior decision of his/her or others, which prior decisions shall be deemed subject to review, or by any termination or cancellation of this Contract.

All such questions shall be submitted in writing by the Contractor to the Director for a decision together with all evidence and ~otherpertinent information in regard to ,such questions, in order that a fair and impartial decision may be made. In any action~against the Authority relating to any such question the Contractor must allege in the complaint and prove such submission, which shall be a condition precedent to any such action. No evidence or information shall be introduced or relied upon in such an action that has not been so presented to the Director.

In the performance of the Contract, the Contractor shall conform to all orders, directions and requirements of the Director and shall perform the Contract to his/her satisfaction at such times and places, by such methods and such manner and sequence as he/she may require, and the Contract shall at all stages be subject to his/her inspection. The Contractor shall employ no equipment, materials, methods or persons to which he/she objects, and shall remove no materials, equipment or other facilities from the Authority site without permission. Upon request, he/she shall confirm in writing any oral order, direction, requirements or determination.

The enumeration herein or elsewhere of particular instances in which the opinion, judgment, discretion or determination of the Director shall control or in which the Contract shall be performed to his/her satisfaction or subject to his/her inspection, shall not imply that only the matters of a nature similar to those enumerated shall be so

governed and performed, but without exception the entire Contract shall be so governed and performed.

This provision shall be construed in accordance with the laws of the State of New York excluding its conflict of law provisions.

37. Approvals by the Director

The approval by the Director of any service required hereunder, shall be construed merely to mean that at that time the Director knows of no good reason for objecting thereto and no such approval shall release the Contractor from his full responsibility for the satisfactory performance of the services to be supplied. "Approved equal" shall mean approved by the Director.

38. Contract Review and Compliance Audits

The Contractor, and any subcontractors, shall provide system access and reasonable assistance to the Authority's External and Internal Audit staff or its consultants in their performance of financial, system, security and operational reviews including producing specific requested information, extraction of data and reports. The Contractor, and any subcontractors, shall support requests related to audits of the service level agreement and administration tasks and functions covered by this Contract.

The Authority reserves the right to use and load security and system software to evaluate the level of security and vulnerabilities in all systems which control, collect, dispense, contain, manage, administer, or monitor revenue "owned" by the Port Authority.

Any External Audit staff or consultants performing Contract Review and Compliance Audits shall be required tosign individual Contractor Non-Disclosure Agreements.

39. Authority Access to Records

The Authority shall have access during normal business hours to all records and documents of the Contractor relating to any amounts for which the Contractor has been compensated, or claims he should be compensated, by the Authority above those included in the lump sum or unit price compensation and relating to compensation paid to Contractor's and subcontractors' workers. All Contractor records shall be kept in the New York Port District. The Contractor shall obtain for the Authority similar access to similar records and documents of subcontractors. Such access shall be given or obtained both before and within a period of three years after Final Payment to the Contractor, provided, however, that if within the aforesaid three years period the Authority has notified the Contractor in writing of a pending claim by the Authority under or in connection with this Contract to which any of the aforesaid records and documents of the Contractor or of his subcontractors relate either directly or indirectly, then the period of such right of access shall be extended to the expiration of six years from the date of Final Payment with respect to the records and documents involved.

The Contractor shall provide, at no cost to the Authority, access for and reasonable assistance to such auditors from the Authority or the Authority's external auditors that may, from time to time, be designated to audit detail records which support Contractor charges to the Authority. The Authority shall have access to the detail records that support Contractor charges to the Authority for up to three years following the termination of the contract.

No provision in this Contract giving the Authority a right of access to records and documents is intended to impair or affect any right of access to records and documents which the Authority would have in the absence of such provision.

Any External Audit staff or consultants accessing Contractor records shall be required to sign individual Contractor Non-Disclosure Agreements.

40. Claims of Third Persons

The Contractor undertakes to pay all claims lawfully made against him by subcontractors, materialmen and workmen, and all claims lawfully made against him by other third persons arising out of or in connection with or because of the performance of this Contract and to cause all subcontractors to pay all such claims lawfully made against them.

41. Performance of Work as Agent for Contractor

In the exercise of its right to take over and complete Work as agent for the Contractor, for which provision is made in the clause hereof entitled "Rights and Remedies of the Authority", the Authority shall have the right to take possession of and use or permit the use of any and all plant, materials, equipment and other facilities provided by the Contractor for the purpose of the Work and the Contractor shall not remove any of the same from the site of the Work without express permission. Unless expressly directed to discontinue the performance of all Work, the Contractor shall continue to perform the remainder thereof in such manner as in no way will hinder or interfere with the portions taken over by the Authority. The exercise by the Authority of its right to take over the Work shall not release the Contractor from any of his obligations or liabilities under this Contract.

42. No Discrimination in Employment, Equal Employment Opportunity

During the performance of this Contract, the Contractor agrees as follows:

A. The Contractor is advised to ascertain and comply with all applicable Federal, State and Local statutes, ordinances, rules and regulations and Federal Executive Orders pertaining to equal employment opportunity, affirmative action and non-discrimination in employment.
B Without limiting the generality of any other term or provision of this Contract, in the event of the Contractor's non-compliance with any such statutes, ordinances, rules, regulations or orders, this Contract may be canceled, terminated, or suspended in whole or in part.

43. Integrity

A. Certification of No Investigation (criminal or civil anti-trust), Indictment, Conviction, Debarment, Suspension, Disqualification and Disclosure of Other Information.

By bidding on this Contract, each Proposer and each person signing on behalf of any Proposer certifies, and in the case of a joint bid each party thereto certifies as to its own organization, that the Proposer and each parent and/or affiliate of the Proposer has not:

- been indicted or convicted in any jurisdiction;
- been suspended, debarred, found not responsible or otherwise disqualified from entering into any contract with any governmental agency or been denied a government contract for failure to meet standards related to the integrity of the Proposer;
- had a contract terminated by any governmental agency for breach of contract or for any cause based in whole or in part on an indictment or conviction;
- ever used a name, trade name or abbreviated name, or an Employer Identification Number different from those inserted in the Bid;
- had any business or professional license suspended or revoked or, within the five years prior to bid opening, had any sanction imposed in excess of $50,000 as a result of any judicial or administrative proceeding with respect to any license held or with respect to any violation of a federal, state or local environmentallaw, rule or regulation;
- had any sanction imposed as a result of a judicial or administrative proceeding related to fraud, extortion, bribery, bid rigging, embezzlement, misrepresentation or anti-trust regardless of the dollar amount of the sanctions or the date of their imposition; and
- been, and is not currently, the subject of a criminal investigation by any federal, state or local prosecuting or investigative agency and/or a civil anti-trust investigation by any federal, state or local prosecuting or investigative agency.

B. Non-Collusive Bidding, and Code of Ethics Certification, Certification of No Solicitation Based On Commission, Percentage, Brokerage, Contingent or Other Fees.

By bidding on this Contract each Proposer and each person signing on behalf of any Proposer certifies, and in the case of a joint bid, each party thereto certifies as to its own organization, that

- the prices in its bid have been arrived at independently without collusion, consultation, communication or agreement for the purpose of restricting competition, as to any matter relating to such prices with any other Proposer or with any competitor;
- the prices quoted in its bid have not been and will not be knowingly disclosed directly or indirectly by the Proposer prior to the official opening of such bid to any other Proposer or to any competitor;

- no attempt has been made and none will be made by the Proposer to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition;
- this organization has not made any offers or agreements or taken any other action with respect to any Authority employee or former employee or immediate family member of either which would constitute a breach of ethical standards under the Code of Ethics dated April 11, 1996 (a copy of which is available upon request to the individual named in the clause hereof entitled "Proposer's Questions"), nor does this organization have any knowledge of any act on the part of an Authority employee or former Authority employee relating either directly or indirectly to this organization which constitutes a breach of the ethical standards set forth in said Code; and
- no person or selling agency other than a bona fide employee or bona fide established commercial or selling agency maintained by the Proposer for the purpose of securing business has been employed or retained by the Proposer to solicit or secure this Contract on the understanding that a commission, percentage, ~ brokerage, contingent, or other fee would be paid to such person or selling agency.
- The Proposer has not offered, promised or given, demanded or accepted, any undue advantage, directly or indirectly, to or from a public official or employee, political candidate, party or party official, or any private sector employee (including a person who directs or works for a private sector enterprise in any capacity), in order to obtain, retain, or direct business or to secure any other improper advantage in connection with this Contract.

The foregoing certifications shall be deemed to be made by the Proposer as follows:

- if the Proposer is a corporation, such certification shall be deemed to have been made
  not only with respect to the Proposer itself, but also with respect to each parent, affiliate, director, and officer of the Proposer, as well as, to the best of the certifier's knowledge and belief, each stockholder of the Proposer with an ownership interest in excess of 10%;
- if the Proposer is a partnership, such certification shall be deemed to have been made not only with respect to the Proposer itself, but also with respect to each partner.
-

  Moreover, the foregoing certifications, if made by a corporate Proposer, shall be deemed to have been authorized by the Board of Directors of the Proposer, and such authorization shall be deemed to include the signing and submission of the bid and the inclusion therein of such certification as the act and deed of the corporation.

  In any case where the Proposer cannot make the foregoing certifications, the Proposer shall so state and shall furnish with the signed bid a signed statement which sets forth in detail the reasons therefor. If the Proposer is uncertain as to whether it can make the foregoing certifications, it shall so indicate in a signed statement furnished with its bid, setting forth in such statement the reasons for its uncertainty.

Notwithstanding that the Proposer may be able to make the foregoing certifications at the time the Proposal is submitted, the Proposer shall immediately notify the Authority in writing during the period in which its Proposal is under consideration of any change of circumstances which might under this clause make it unable to make the foregoing certifications or require disclosure. The foregoing certifications or signed statement shall be deemed to have been made by the Proposer with full knowledge that they would become a part of the records of the Authority and that the Authority will rely on their truth and accuracy in awarding this Contract. In the event that the Authority should determine at any time prior or subsequent to the award of this Contract that the Proposer has falsely certified as to any material item in the foregoing certifications or has willfully or fraudulently furnished a signed statement which is false in any material respect, or has not fully and accurately represented any circumstance with respect to any item in the foregoing certifications required; to be disclosed, the Authority may determine that the Proposer is not a responsible Proposer with respect to its bid on the Contract or with respect to future bids on Authority contracts and may exercise such other remedies as are provided to it by the Contract with respect to these matters. In addition, Proposers are advised that knowingly providing a false certification or statement pursuant hereto may be the basis for prosecution for offering a false instrument for filing (see, e.g. New York Penal Law, Section 175.30 et seq.). Proposers are also advised that the inability to make such certification will not in and of itself disqualify a Proposer, and that in each instance the Authority will evaluate the reasons therefor provided by the Proposer. Under certain circumstances the Proposer may be required as a condition of Contract award to enter into a Monitoring Agreement under which it will be required to take certain specified actions, including compensating an independent Monitor to be selected by the Port Authority, said Monitor to be charged with, among other things, auditing the actions of the Proposer to determine whether its business practices and relationships indicate a level of integrity sufficient to permit it to continue business with the Port Authority. ~

C. Proposer Eligibility for Award of Contracts - Determination by an Agency of State of New York or New Jersey Concerning Eligibility to Receive Public Contracts

Proposers are advised that the Authority has adopted a policy to the effect that in awarding its contracts it will honor any determination by an agency of the State of New York or New Jersey that a Proposer is not eligible to bid on or be awarded public contracts because the Proposer has been determined to have engaged in illegal or dishonest conduct or to have violated prevailing rate of wage legislation. The policy permits a Proposer whose ineligibility has been so determined by an agency of the State of New York or New Jersey to submit a bid on a Port Authority contract and then to establish that it is eligible to be awarded a contract on which it has bid because (i) the state agency determination relied upon does not apply to the Proposer, or (ii) the state agency determination relied upon was made without affording the Proposer the notice and hearing to which the Proposer was entitled by the requirements of due process of law, or (iii) the state agency determination was clearly erroneous or (iv) the state agency determination relied

upon was not based on a finding of conduct demonstrating a lack of integrity or violation of a prevailing rate of wage law.
The full text of the resolution adopting the policy may be found in the Minutes of the Authority's Board of Commissioners meeting of September 9, 1993.

D. No Gifts, Gratuities, Offers of Employment, Etc.

During the term of this Contract, the Proposer shall not offer, give or agree to give anything of value either to a Port Authority employee, agent, job shopper, consultant, construction manager or other person or firm representing the Port Authority, or to a member of the immediate family (i.e., a spouse, child, parent, brother or sister) of any of the foregoing, in connection with the performance by such employee, agent, job shopper, consultant, construction manager or other person or firm representing the Port Authority of duties involving transactions with the Proposer on behalf of the Port Authority, whether or not such duties are related to this Contract or any other Port Authority contract or matter. Any such conduct shall be deemed a material breach of this Contract.
As used herein "anything of value" shall include but not be limited to any (a) favors, such as meals, entertainment, transportation (other than that contemplated by the Contract or any other Port Authority contract), etc. which might tend to obligate the Port Authority employee to the Proposer, and (b) gift, gratuity, money, goods, equipment, services, lodging, discounts not available to the general public, offers or promises of employment, loans or the cancellation thereof, preferential treatment or business opportunity. Such term shall not include compensation contemplated by this Contract or any other Port Authority contract. Where used herein, the term "Port Authority" shall be deemed to include all subsidiaries of the Port Authority.

The Proposer shall insure that no gratuities of any kind or nature whatsoever shall be solicited or accepted by it and by its personnel for any reason whatsoever from the passengers, tenants, customers or other persons using the Facility and shall so instruct its personnel.

In addition, during the term of this contract, the Proposer shall not make an offer of employment or use confidential information in a manner proscribed by the Code of Ethics and Financial Disclosure dated April 11, 1996 (a copy of which is available upon request to the Office of the Secretary of the Port Authority).
The Proposer shall include the provisions of this clause in each subcontract entered into under this Contract.

E. Definitions

As used in this section, the following terms shall mean:

Affiliate - Two or more firms are affiliates if a parent owns more than fifty percent of the voting stock of each of the firms, or a common shareholder or group of shareholders owns more than fifty percent of the voting stock of each of the firms, or if the firms have a common proprietor or general partner.
Agency or Governmental Agency - Any federal, state, city or other local agency,

including departments, offices, public authorities and corporations, boards of education and higher education, public development corporations, local development corporations and others.

Investigation - Any inquiries made by any federal, state or local criminal prosecuting agency and any inquiries concerning civil anti-trust investigations made by any federal, state or local governmental agency. Except for inquiries concerning civil anti-trust investigations, the term does not include inquiries made by any civil government agency concerning compliance with any regulation, the nature of which does not carry criminal penalties, nor does it include any background investigations for employment, or Federal, State, and local inquiries into tax returns.

Officer - Any individual who serves as chief executive officer, chief financial officer, or chief operating officer of the Bidder by whatever titles known.

Parent - An individual, partnership, joint venture or corporation which owns more than 50% of the voting stock of the Bidder.

If the solicitation is a Request for Proposal:

Bid - shall mean Proposal;
Bidder - shall mean Proposer;
Bidding - shall mean submitting a Proposal.

In a Contract resulting from the taking of bids:

Bid - shall mean bid;
Bidder - shall mean Bidder;
Bidding - shall mean executing this Contract.

In a Contract resulting from the taking of Proposals:

Bid - shall mean Proposal;
Bidder - shall mean Proposer;
Bidding - shall mean executing this Contract.

F. Conflict Of Interest

During the term of this Agreement, you shall not participate in any way in the preparation, negotiation or award of any contract (other than a contract for your own services to the Authority) to which it is contemplated the Authority may become a party or participate in any way in the review or resolution of a claim in connection with such a contract, if you have substantial financial interest in the contractor or potential contractor of the Authority or if you have an arrangement for future employment or for any other business relationship with said contractor or potential contractor, nor shall you at any time take any other action which might be viewed as or give the appearance of a conflict of interest on your part. If the possibility of such an arrangement for future employment or for another business arrangement has been or is the subject of a previous or current discussion or if you have reason to believe such an arrangement may be the subject of future discussion, or if you have any financial interest, substantial or not, in a contractor

or potential contractor of the Authority, and your participation in the preparation, negotiation or award of any contract with such a contractor or the review or resolution of a claim in connection with such a contract is contemplated or if you have reason to believe that any other situation exists which might be viewed as or give the appearance of a conflict of interest you shall immediately inform the Director in writing of such situation giving the full details thereof. Unless you receive the specific written approval of the Director, you shall not take the contemplated action which might be viewed as or give the appearance of a conflict of interest. In the event the Director shall determine that the performance by you of a portion of your services under this Agreement is precluded by the provisions of this numbered paragraph, or a portion of your said service is determined by the Director to be no longer appropriate because of such preclusion, then the Director shall have full authority on behalf of both parties to order that such portion of your services not be performed by you, reserving the right, however, to have the services performed by others and reserving the right to reduce the lump sum compensation as he/she may deem reasonable in his/her sole discretion. Your execution of this Agreement shall constitute a representation by you that at the time of such execution you know of no circumstances, present or anticipated, which come within the provisions of this paragraph or which might otherwise be viewed as or give the appearance of a conflict of interest on your part.

44. Confidential Information

Confidential information shall mean all information disclosed to the Contractor or the personnel provided by the Contractor hereunder which relates to the Authority's past, present, and future research, development and business activities including, but not limited to, software and documentation licensed to the Authority or proprietary to the Authority and all associated software, source code procedures and documentation. Confidential information shall also mean any other tangible or intangible information or materials including but not limited to computer identification numbers, access codes, passwords, and reports obtained and/or used during the performance of the Contractor's services under this Contract. The Contractor shall hold all such confidential information in trust and confidence for the Authority, and agree that the Contractor and the personnel provided by the Contractor hereunder shall not, during or after the termination or expiration of this Contract, disclose to any person, firm or corporation, nor use for its own business or benefit, any information obtained by it under or in connection with the supplying of services contemplated by this Contract. The Contractor and the personnel provided by the Contractor hereunder shall not violate in any manner any patent, copyright, trade secret or other proprietary right of the Authority or third persons in connection with their services hereunder, either before or-after termination or expiration of this Contract. The Contractor and the personnel provided by the Contractor hereunder shall not willfully or otherwise perform any dishonest or fraudulent acts, breach any security procedures, or damage or destroy any hardware, software or documentation, proprietary or otherwise, in connection with their services hereunder. The Contractor shall promptly and fully inform the Director in writing of any patent, copyright, trade secret or other intellectual property rights or disputes, whether existing or potential, of which the Contractor has knowledge, relating to any idea, design, method, material,

equipment or other matter related to this Contract or coming to the Contractor's attention in connection with this Contract.

The Contractor shall be required to sign Affiliated Computer Services' ("ACS") "One-Way Non-Disclosure Agreement" ("NDA") included herein as Attachment L prior to being granted access to ACS' proprietary documentation for the current system. Any personnel provided by the Contractor hereunder that will be working with ACS' proprietary documentation shall be required to sign individual NDAs.

The Contractor shall adhere to the Port Authority's information security policies and procedures as published in the Port Authority's Technology Standards and Guidelines.

45. Provisions Of Law Deemed Inserted

Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included therein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party, the Contract shall forthwith be physically amended to make such insertion.

46. Invalid Clauses

If any provision of this Contract shall be such as to destroy its mutuality or to render it invalid or illegal, then if it shall not appear to have been so material that without it the Contract would not have been made by the parties, it shall not be deemed to form part thereof but the balance of the Contract shall remain in full force and effect.

47. No Estoppel or Waiver

The Authority shall not be precluded or estopped by any acceptance, certificate or payment, final or otherwise, issued or made under this Contract or otherwise issued or made by it, the Director or any officer, agent or employee of the Authority, from showing at any time the true amount and character of Work performed, or from showing that any such acceptance, certificate or payment is incorrect or was improperly issued or made; and the Authority shall not be precluded or estopped, notwithstanding any such acceptance, certificate or payment, from recovering from the Contractor any damages which it may sustain by reason of any failure on his part to comply strictly with this Contract, and any monies which may be paid to him or for his account in excess of those to which he is lawfully entitled.

48. Non-Liability of The Authority Representatives

Neither the Commissioners of the Authority, nor any officer, agent, or employee thereof shall be charged personally by the Contractor with any liability or held liable under any term or provision of this Contract, or because of its execution or attempted execution, or because of any breach hereof.

49. Modification of Contract

No change in or modification, termination or discharge of this Contract, in any form whatsoever, shall be valid or enforceable unless it is in writing and signed by the party to be charged therewith or his duly authorized representative, provided, however, that any change in or modification, termination or discharge of this Contract expressly provided for in this Contract shall be effective as so provided.

50. M/WBE Subcontracting Provisions

The Port Authority of NY & NJ has a long-standing practice of making its business opportunities available to Minority Business Enterprises (MBE's) and Women-owned Businesses (WBE's) and has taken affirmative steps to encourage such firms to seek business opportunities with the Port Authority. The successful Proposer will use every good faith effort to provide for meaningful participation by Port Authority certified M/WBE's as defined in this document, in all purchasing, subcontracting and ancillary service opportunities associated with this contract, including purchase of equipment, supplies and labor services. Good faith efforts include 1) dividing the services and materials to be procured into small portions where feasible, 2) giving reasonable advance notice of specific subcontracting and purchasing opportunities to such firms as may be appropriate, 3) soliciting services and materials from M/WBE's, which may be certified by the Port Authority and 4) insuring that provision is made for timely progress paYmentsto the M/WBE's.

The Port Authority has a list of certified M/WBE firms, which is available to Proposers at their request. The Port Authority makes no representation as to the qualifications and ability of these firms to perform under this contract. The Proposer may use firms which are not on the list but will be required to submit, to the Port Authority's Business and Job Opportunity (BJO) for certification, the names of M/WBE firms it proposes to use. Only Port Authority certified M/WBE firms may be considered to meet the goals. For inquiries and assistance, please contract BJO at (973) 565-5524.

51. Entire Agreement

This Contract including the Request for Proposals for Integrated Toll Collection System (ITCS) In-lane Maintenance and System Administration Services and E-ZPass Plus System Administration Services (including its Scope of Works and other attachments, endorsements and exhibits, if any,) as well as the Proposal submitted by the Contractor contains the entire agreement between the parties. In the event of any inconsistency between this Contract and other attachments, endorsements and exhibits, if any, including the Proposal submitted by the Contractor, this Contract shall be controlling.

52. High Security Areas

a. Services under the Contract may be required in high security areas, as the same may be designated by the Manager from time to time. The Port Authority shall require the

observance of certain security procedures with respect to the high security areas, which may include the escort to, at, and/or from said high security areas by security personnel designated by the Contractor or any subcontractor's personnel required to work therein.

b. Twenty-four hours prior to the proposed performance of any work in a high security area, the Contractor shall notify the Manager. The Contractor shall conform to the procedures as may be established by the Manager from time to time and at any time for access to high security areas and the escorting of personnel hereunder. Prior to the start of work, the Contractor ~shall request a description from the Manager of the high security areas which will be in effect on the commencement date. The description of high security areas may be changed from time to time and at any time by the Manager during the term of the Contract.

53. Data Turnover

Upon termination or expiration of this Agreement and with written notice from the Port Authority, the Contractor shall be responsible for delivering a copy of all Port Authority data included in the system at the time of termination including any other Port Authority data in possession of the Contractor or its subcontractors, to the Port Authority. Such data shall be in either (MS) Excel or (MS) Access database format or other mutually agreed upon format. Data shall be delivered on CD Rom or other Port Authority-approved media within forty-five (45) days after expiration of, or the effective date of, termination. Data turnover, as set forth herein, shall be performed at no additional charge to the Port Authority.

SCOPE OF WORK - 10/4/05

1. GENERAL REQUIREMENTS

A. Customer Status Reporting/Status Meetings

The Contractor shall schedule and conduct regular status meetings (no less frequently than monthly) with the Authority. The purpose of these meetings shall be to inform the Authority's designated Contract Manager of the status of the work, operational status of the systems, any problems noted and immediate and long-term solutions.

The Contractor shall produce and deliver to the Authority, at least 48 hours prior to each status meeting, a proj ect status report. The report shall contain at a minimum a complete statement of work status and shall indicate (1) progress made during the reporting period; (2) progress made on work to correct deficiencies indicated by that review, (3) the status of ongoing system administration/in-lane maintenance activities relative to each of the task groupings comprising the system administration/in-lane maintenance function; (4) activities to be undertaken in the next reporting period; (5) activities/tasks behind schedule; (6) identification of problems/concerns related to the review; (7) corrective actions, (8) progress of any operational enhancements as requested by the Authority, and (9) software release documentation shall be submitted within fifteen days from completion of software release. Include with each status report an updated project schedule that indicates progress made on each activity as of the date of the report, year-to-date or whenever requested by the Authority.

B. Key vendor relationships

Several organizations, which are under separate contract with the Authority, are considered "key" vendors for the Authority in the context of this Contract. Such vendors a) supply equipment and software utilized to implement system functionality, and/or b) provide services that support system operations activities, Mark IV, Hewlett-Packard and Sun Microsystems are considered key suppliers for equipment and software. Hewlett-Packard provides the servers and the operating system for the ECH. Sun Microsystems provides the server and operating system software for the ACH. Mark IV will provide preventive and remedial maintenance services for the AVI equipment only under contract to the Contractor. During the term of this Contract, the Contractor must support the equipment and software provided by these current and any future key vendors and provide coordination in the utilization of their services as they pertain to this Contract.

The Contractor must demonstrate the capability of supporting and maintaining the equipment and software provided by these key vendors. Such support capability should include the ability to utilize the manufacturer's (key vendor) resources for

consultation on product installation and operations, as well as for escalation of problems for resolution.

Additionally, Unisys is the key vendor providing services that support system operations activities. Unisys has been contracted by the Port Authority to provide system administration and technical operations support of the Airport Parking Revenue Control system and its interface to the ACH.

The Contractor must interface and interact with Unisys on an as-needed basis. The interfaces will generally consist of resolving problems when scheduled transmissions of tag status files and transactions file are not received at the proper time. The Contractor must describe any prior working relationships with Unisys, emphasizing the nature of the relationship, the quality and tenor of the relationship and any difficulties experienced with the relationship. Where difficulties are noted, the Contractor will describe any mechanisms and techniques that would be used to avoid similar ones at the Port Authority.

Federal APD provides the servers and software which interface the Airport Parking Revenue Control system with the ACH. As with Unisys, the Contractor must interface and interact with Federal APD on an as-needed basis to resolve problems between the Airport Revenue Control system and the ACH.

C. Asset Security

The Contractor shall ensure that the Authority assets are not removed from Port Authority facilities unless directed by the Contract Manager. The Contractor and others under the management of the Contractor shall adhere to Port Authority rules and regulations regarding physical access to all Port Authority property and Port Authority data centers.

D. Organization

The Contractor agrees to establish and maintain an organization appropriate to the Work to be performed under this Contract. This shall include but not be limited to:

- Assigning appropriate number of staff, acceptable to the Authority, with skills appropriate to the tasks to be performed.

- Supplying direct supervision of staff.

- Providing qualified persons, acceptable to the Authority, for relief of the assigned staffin the event of vacation, illness, personal business or any other absence.

- Providing staff with procedures for resolving technical issues which cannot be solved on-site and providing staff support where required.

- Providing dedicated telephone lines to respond to requests for services in a timely manner.

2. MAINTENANCE OF THE INTEGRATED TOLL COLLECTION SYSTEM

A. General

The Contractor shall be responsible for complete maintenance and repairs of the Integrated Toll Collection System so that said Integrated Toll Collection System may be operated in staffed or unstaffed modes twenty-four (24) hours a day, seven (7) days a week. The maintenance and repair program shall be performed with all reasonable care to keep the Integrated Toll Collection System in a proper, safe, and efficient operating condition capable of accurate toll revenue collection and reporting. The Contractor shall furnish all labor, travel, materials, supplies, parts, equipment, warning signs and other safety devices, and all other things necessary or proper for, or incidental to, such maintenance.

The maintenance performed by the Contractor shall consist of scheduled preventive maintenance, on-call remedial maintenance for in-lane and related equipment, documentation updates, and deploying any lane software updates, reinstallation of lane software or changes to in-lane equipment settings resulting from changes to the Electronic Host Computer (ECH). A schedule of monthly preventive maintenance activities and a description of preventive maintenance procedures for each Work Site shall be submitted to the Contract Manager for review and approval, no later than 30 calendar days prior to the first of each month All comments by the Contract Manager must be addressed to the satisfaction of the Contract Manager prior to initiation of each month's procedures.

Scheduled preventive maintenance shall consist of, but not be limited to, inspection, testing, cleaning, lubricating, adjustment, repairs, the replacement of field installable parts that are approaching unserviceable status, and all actions necessary to prevent Integrated Toll Collection System failures and extend the Integrated Toll Collection System useful life. Such maintenance shall be performed in accordance with the component manufacturers' recommendations.

On-call remedial maintenance shall consist of all unscheduled actions necessary to diagnose and correct Integrated Toll Collection System malfunctions and failures. The Contractor shall repair or replace, at its option, maintaining all original specified performance requirements, as soon as possible, any part or parts of the Integrated Toll Collection System that becomes unsuitable for continued use. Such repair or replacement shall be performed so that any Integrated Toll Collection System equipped lane shall not be out of service for more than the number of hours stipulated in "Maintenance Response Times and Damages for System Downtime".

The Contractor's Trained Personnel shall report to the Facility Manager or his designated representative at the start and upon completion of each maintenance visit. Service personnel shall keep the Contract Manager informed of the work performed by them by furnishing him with a completed "Service Maintenance Form" within Twenty-four hours of completion of work. Said form shall include, in addition to any other pertinent data, such data as times of arrival and departure, materials replaced, the hours any item was out of service, the specific components which were inspected and/or adjusted, and the workers' names, and shall notify the Contract Manager or Facility Manager of additional repairs or replacements which have to be scheduled.

a) Twenty-Four Hour Response

The Contractor will be called in for remedial maintenance when the Integrated Toll Collection System is malfunctioning. The Contractor shall provide a specified telephone number or another Authority approved method at no additional cost to the Authority for the purpose of call-in service that will be staffed 24 hours a day, 7 days a week. The Contractor shall send Trained Personnel fully familiar with the Integrated Toll Collection System and its maintenance requirements, to the premises in response to telephone notification of an Integrated Toll Collection System malfunction, and said personnel shall arrive at the premises and report in to the Facility Manager or his designated representatives within the response period stipulated in the clause entitled "Maintenance Response Times and Damages for System Downtime".

b) Mark IV - AVI Equipment

During the term of this Contract, the Contractor shall have a maintenance contract with Mark IV to perform preventive and remedial maintenance on the Authority's AVI equipment. This maintenance contract shall be consistent with the terms and conditions of the Irrevocable Offer (refer to Part IV, Attachment M) between the Port Authority and Mark IV. The ITCS Contractor shall be responsible for coordinating routine preventive maintenance routines and shall diagnose, notify and coordinate remedial preventive maintenance with Mark IV when repairs are required. The ITCS maintenance Contractor shall be responsible for providing traffic protection and work area safety when Mark IV personnel are on site. Refer to Part III, Section C. "Work Site Conditions and Procedures" and Part IV, Attachment I. The ITCS maintenance Contractor shall be responsible for managing the Mark IV maintenance contract and shall track and report on the status of problems. In the event the Authority as a member of the E-ZPass Interagency Group chooses an AVI equipment provider other than Mark IV, the Contractor shall establish a maintenance contract with the new AVI provider or with Mark IV depending on the decision of the E-ZPass Interagency Group.

c) Error Correction

The Contractor shall perform error corrections as provided for in Part III, Section 4, entitled "ACS Proprietary Software Support System" and "Open Highway Tolling Software License Agreement Contract #4600005761".

B. Emergency Communications

The Contractor shall establish at a minimum one (1) 800 number (or equivalent) telephone service available 24-hours a day, 7 days a week, 365 days a year for purposes of placing service calls to technicians. This 800 number shall be answered by a qualified dispatcher rather than an electronic answering device. The dispatcher shall ensure that calls are placed with all necessary relevant information such as date and time of problem, location of problem, contact person, description of problem, etc., and are properly recorded in the Computerized maintenance reporting software program provided by the Contractor (see Section G below).

The Contractor must establish a protocol and provide a contact list for the escalation of issues by the Authority in the event of an unforeseen emergency and/or failure to respond by the Contractor. It will be the responsibility of the Contractor to keep this list updated at all times

C. Work Site Conditions and Procedures

1. General Rules

Maintenance shall be performed by Certified or Licensed personnel, competently supervised, who shall be qualified to keep the equipment adjusted and repaired and in proper operating condition; any employee of the Contractor, or its Subcontractors, deemed by the Contract Manager not qualified to perform the services hereunder shall be immediately removed from the Work Site and replaced by the Contractor upon request by the Contract Manager.

The Facility Manager will, whenever possible, provide such cooperation as may be necessary to permit entry into locked areas. The Contractor shall give a minimum of 48 hours notice of its intention to perform work (other than On-call Remedial Maintenance Services) under this Contract to the Contract Manager and the Facilities Manager or his designated representative in order that any necessary arrangements may be made by the facility. This notice shall include the Contractor's expected hours of arrival and departure, areas to be serviced and the number of workers which will be working.

The Authority will not furnish any free facility use passes or public parking spaces for the Contractor. In addition, parking at Authority property for each

Work Site may not be available and the Authority makes no guarantee that parking on Authority property will be provided to the Contractor.

In the event the Contractor encounters at the Work Site material reasonably believed to be asbestos, polychlorinated biphenyl (PCB) or any other hazardous material, the Contractor shall immediately stop work in the area affected and report the condition in writing to the Contract Manager or Facility Manager. Work in the affected area shall not thereafter be resumed by the Contractor except upon the issuance of a written order to that effect from the Contract Manager or Facility Manager.

2. Work Area Safety

The Port Authority toll roads have different rules with respect to Contractor access to, and control of, toll lanes and plazas. The Contractor will meet with Port Authority staff to fully document and understand the existing rules of each individual Work Site for safe operation (See Attachment I). This will include Plaza and lane access procedures; Lane closure notification requirements; Lane closure procedures; Traffic protection rules and procedures and any other appropriate safety requirements.

The placement of any warning or directional signs that would affect motorists shall be submitted to the Contract Manager for approval by the Facility Manager prior to placement.

If it becomes necessary to drive test vehicles through Integrated Toll Collection System equipped lanes, the Contractor shall conform to all roadway safety standards that are applicable. Such test driving shall be performed only after the Contractor receives approval of the Contract Manager and Facility Manager.

The Contractor must adhere to all Port Authority safety rules and operation procedures.

At the time the Contractor is carrying out its operations there may be other persons working in the vicinity. The Contractor shall so conduct its operations as to work in harmony and not endanger, interfere with or delay the operations of others, all to the best interests of the Authority and others as may be directed by the Facility Manager.

The Contractor shall provide vehicles, cones, delineators, warning signs, barricades and any other equipment as required to demarcate work areas as approved by the Contract Manager and Facility Manager, or their designated representatives.

The Contractor shall observe and obey (and compel its subcontractors, officers and employees and those doing business with it to observe and obey) the rules

and regulations of the Authority and such further rules and regulations which may from time to time during the effective term of this Contract be promulgated by the Authority for reasons of safety, health, preservation of property or maintenance of a good and orderly appearance of the work areas and facility property.

3. Personnel Requirements

The Contractor shall provide employees with identification badges approved by the Authority. In addition, the Contractor shall obtain for its employees identification badges provided by the Authority. All identification badges shall be worn in a conspicuous and clearly visible position by all employees of the Contractor at all times whenever engaged in work under this Contract.

All Contractor personnel shall present a neat and clean appearance at all times.

D. Spare Parts

In order to make replacements and repairs as expeditiously as possible, the Contractor shall stock, keep and maintain in the New York-New Jersey metropolitan area a sufficient supply of parts and materials, tools or other equipment as may be necessary to make such replacements and repairs.

The Authority will provide to the Contractor at no cost to the Contractor the initial spare parts inventory at the commencement of the Contract. The Contractor will be required to coordinate the relocation of the spare parts inventory from their present location to the Contractor's work site. This work shall be performed at no cost to the Authority.

The Contractor shall establish a program for procuring and managing spare parts and equipment, at the Contractor's own expense, in secure manner that includes record keeping of inventories, determination of reorder points, maintaining supplier information, and conducting parts acquisition and distribution. The Contractor shall establish a maintenance facility to store spare parts and equipment. The Contractor shall manage spare parts and equipment on a "first in, first out" basis so as to maximize the availability of manufacturers warranties that commence on delivery. The Contractor shall also conduct a "bum in" test of not less than I-hour (for touch terminal screens "bum in" time shall be 8-hours) so as to determine the initial functionality of all spare parts and equipment, and shall return all defective spare parts and equipment to their respective manufacturers for replacement. The Contractor shall notify the Contract Manager upon completion of all successful "bum-in" tests, and shall include this information in their reports.

The Authority will own the spare parts and the Contractor shall keep a sufficient inventory of spare parts to allow for the replacement of failed components, and components which in its judgment need replacement. Components that have been

repaired, as opposed to replaced, more than three times shall be replaced at the Authority's option.

Spare parts shall be interchangeable with their corresponding part, equal in quality to original equipment parts. All spare parts shall be reconfigured to the latest revision during the maintenance period. Contractor shall have available at least two U.S. sources for spare parts that are exchanged regularly during preventive maintenance. Contractor shall also endeavor to have other spare parts available from two U.S. sources.

The Contractor shall present to the Authority a listing of the actual inventory. The list shall be supplied on a quarterly basis or more frequently upon request by the Authority.

A detailed list of all spare parts with manufacturer name, model number, quantities required to be on hand, purchase date and warranty information must be provided by the Contractor and submitted to the Director of Tunnel, Bridges and Terminals or Contract Manager at the end or termination of this Contract.

Upon completion of the Contract the Contractor shall return to the Authority at no additional compensation an equivalent inventory of spare parts which was given to the Contractor by the Authority at the beginning of the Contract.

E. Open Highway Speed Tolling

During the term of this Contract, the Contractor shall maintain the Open Highway Speed Tolling System that shall be implemented according to the following schedule:

- Outerbridge Crossing in the Second Quarter of 2005
- George Washington Bridge-Palisades Interstate Parkway Toll Plaza (implementation schedule to be announced)
- George Washington Bridge-Lower Level Toll Plaza in the Second Quarter of 2006

Once Open Highway Speed Tolling is implemented, the lane configuration shall be as follows:

- Outerbridge Crossing with two Open Highway Tolling lanes and five of the existing E-ZPass/Cash toll lanes
- George Washington Bridge-Palisades Interstate Parkway Tolling Plaza with two Open Highway Tolling lanes and two of the existing E-ZPass/Cash toll lanes
- George Washington Bridge-Lower Level Toll Plaza with three open highway tolling lanes and seven of the existing E-ZPass/Cash toll lanes

All equipment for the Open Highway Speed Tolling Projects shall be provided and installed under other contracts including the Badger Reader for the existing E-

ZPass/Cash toll lanes which will replace the eXIsting Roadcheck Reader. The Contractor shall work with Mark IV who will be responsible for removing the Roadcheck Reader from the existing cabinet and replacing it with a Badger Reader. Maintenance for the new Badger Reader will continue under Mark IV.

Please note: The Contractor shall not include the replacement of Readers in the calculation of the Monthly Preventive and Remedial Maintenance Cost. The replacement of Readers shall be considered Extra Work if ordered by the Authority.

F. Standards of Performance

1. Hours of Preventive Maintenance

   Preventive maintenance schedules are subject to the approval of the Contract Manager and to the limitation that no piece of equipment shall be removed from service for preventive maintenance during Peak Operational Periods as defined in Part II, Section 5 "Definitions", without prior approval of the Contract Manager or Facility Manager.

2. Contractor Personnel Standards

   Maintenance shall be performed by certified or licensed personnel, as required by all local and state jurisdictions, who shall be qualified to keep the Integrated Toll Collection System equipment adjusted and repaired and in proper operating condition. The Contractor shall have and maintain, uninterrupted, as required by applicable codes or law as if the Port Authority were a private corporation, all licenses throughout the term of the Contract including the base period and any exercised option periods. The Contractor shall use all reasonable care, consistent with its rights to manage and control its operation, not to employ any person or use any labor, or use or have any equipment or permit any condition to exist which shall or may cause or be conducive to any labor complaints, troubles, disputes or controversies at the Work Site or which interfere or are likely to interfere with the operation of the Work Site or any operations of other contractors operating at the Work Site under other Authority contracts. The Contractor shall give notice to the Authority to be followed by written progress reports, as shall be necessary to advise the Authority of any and all impending or existing labor complaints, troubles, disputes or controversies, and the progress thereof, that the Contractor believes may interfere with the operation of the Authority or any other contractors operating at the Work Site under other Authority contracts stemming from work performed or to be performed under this Contract. The Contractor shall use its best efforts to resolve any such complaint, trouble, dispute or controversy. The Contractor shall observe and obey (and compel its officers, employees, subcontractors, guests, invitees, and those doing business with it to observe and obey) the rules and regulations of the Authority and such further reasonable rules and regulations which may from time to time during the effective period of this Contract be promulgated by the Authority for reasons of safety, security, health,

preservation of property or maintenance of a good and orderly appearance of the Work Site.

3. Standards for Materials and Procedures

The following standards shall be applicable to the work under this Contract in addition to the requirements stipulated above.

1. Replacement equipment shall be identical to the original or equal as approved by the Manager.

2. Maintenance materials shall be of highest caliber and as recommended by the original equipment manufacturer of the equipment to be serviced.

3. Procedures for maintenance including preventive maintenance and intervals of maintenance, shall be as recommended by the original equipment manufacturer and approved by the Manager.

4. All non PVC cable and conduit in interior or occupied spaces shall be low-smoke, zero-halogen (.2% or less), non-toxic, non-corrosive materials.

5. All electrical work shall comply with current version of National Electrical Code (NFPA 70), and for work in New York conform to the Electrical Code of the City of New York, whichever is more stringent.

G. Computerized Maintenance Management System

The Contractor shall provide a Computerized Maintenance Management System that will allow the Authority to track work performed by the Contractor. Refer to General Contract Provisions, Section 7, "Intellectual Property" for procedures governing software substitutes and data turnover.

The software should track at a minimum the following information:

- **Supplier Information** - Information about each supplier including contact information including company name, name of contact person, company address, telephone number(s), fax number(s), and email address.
- **Equipment Inventory** - Information on all parts and components within the system. Track each part and component by supplier, by location, serial number, and part/component ID. If an item is a component such as a lane controller, the system shall maintain information about the individual parts within the lane controller to be entered as well. For example, the serial numbers of each board, power supply, or other part within the lane controller should be recorded and associated with that lane controller. This allows tracking of all components as well as their associated parts.

- **Parts and Component** Usage - Track the disbursement of parts and components to technicians for use in making repairs. Stock should be identified by location, such as warehouse, service van, repair shop, or any other location where equipment is stored. Location also extends to the plaza/lane where the equipment is installed. Each item should have a status, such as "available", "damaged", "on-hold" or others as needed by the operation. All parts and components should be tracked by serial numbers. Information should be maintained so that parts associated with a work order can be tracked. The system should track the performance of equipment used within the system and calculate and maintain Mean Time Between Failure (MTBF) and Mean Time to Repair (MTTR) information.
- **Consumable Inventory** - Maintain information on consumables such as receipt printer paper, traffic light bulbs, or other items that are ordered in bulk and do not have an individual serial number.
- **Reports** All information within the system must be provided to designated Authority personnel using a standard report generator package.
- **Work Order Management** - Track each work order from the time a call is made until the Work Order is closed out. It should also provide for the management of Preventative Maintenance tasks and schedules. The system should include caller identification, date and time of call, description of problem by caller, location of problem, technician assigned, time of technician arrival at site, description of technician action, time of completion of work, parts used with serial numbers, and any other relevant information about the work order.
- **Automatic Paging Notification** System should generate a page to an assigned technician whenever a priority one message equipment error occurs (refer to Part V, Attachment C)

H. Contract Management and Reporting

The Contractor shall develop and make available to the Authority the following reports as part of its maintenance services program and shall attach the reports with each monthly billing cycle. At a minimum, the Authority requires the following types of reports:

- A monthly report detailing the quantity of spare parts consumed in response to performing preventive or remedial maintenance, including, but not limited to, the condition and number of repairs of high value parts and components identified by part and serial number. This report must be submitted with the monthly invoice.

- A monthly report detailing the Contractor's monthly work order history, mean time between failures, mean time to respond and repair, mean time between failures, lane availability, comments, total number of calls, use of labor and materials applied to fulfillment of his maintenance responsibilities. This report must be submitted with the monthly invoice.

- A monthly report detailing all on-call remedial work that will include, but not limited to, the following information:

- Lane Availability - A monthly report summarizing the availability of each lane by Facility.

- Call History - Daily, weekly or monthly listing of all calls which were performed, the specific date, the problem reported, log number, action taken, date and time of completion, technician assigned, and parts used.

- Ongoing/Open Calls - Daily, weekly, or monthly listing of all currently open calls by lane or by call type. Also show the following information:

- Calls exceeding response time - daily, weekly, or monthly listing of all "Priority 1" calls that exceed the repair and response time requirements.

- Calls exceeding response time - daily, weekly, or monthly listing of all "Priority 2" calls that exceed the repair and response time requirements.

- Calls exceeding response time - daily, weekly, or monthly listing of all "Priority 3" calls that exceed the repair and response time requirements.

- All other Calls exceeding response time - daily, weekly, or monthly listing of all other calls that exceed the repair and response time requirements.

- Inventory reorder - listing that indicates part number, vendor, manufacturer, current quantity on hand, and reorder points.

- Closed/Completed Calls - Daily, weekly, or monthly listing of all closed calls by lane or by call type.

- Other management reports to be supplied on a regular basis or whenever requested by the Authority.

I. Performance Measures

The Contractor will be required to adhere to the following performance standards at a minimum. If any of these incidents listed below occurs, the Contractor shall conduct an on-site investigation of the problem and submit a report explaining the problem and what remedies are being taken to alleviate the problem. This report shall be submitted within 5 business days of the incidents being identified or reported.

Performance measure	Acceptable rate	Description
Automatic Vehicle	99%	Vehicles are properly classified; standard is

Classification		calculated as total vehicles less misclassified vehicles divided by total vehicles. Mismatches due to dual-tire classifications are excluded from the calculation except for vehicles in an ORT lane. AVC performance is measured weekly.
Image Acceptance Rate *	99%	For all transactions that require an image to be captured an image is available; standard is calculated as total transactions where an image is available divided by total transactions that require an image. Image Capture Rate is measured daily.
Vehicle Violations	3.5%	System must perform accurately without violations caused by malfunctioning Standard is calculated as total violations divided by total vehicles. equipment and cross reads. Violations should not exceed 3.5% in a dedicated lane during any 24-hour period. Violation Rate is measured daily.
Flush Transactions	.1%	Flush transactions refer to transactions where a tag was reported by the Mark IV reader but cannot be assigned to a particular vehicle. Standard is calculated as total flush transactions divided by total vehicle transactions. Flush transactions that occur immediately after a lane is restarted are not maintenance related, and are thus excluded from any calculation. Flush transactions should not exceed 0.1 % in a dedicated lane during any 24-hour period. Flush Transactions are measured daily.
Cross Lane Reads	.15%	Cross lane reads occurs when a transponder is read in more than one lane simultaneously. Cross lane reads should not exceed 0.15% in a plaza during any 24-hour period. Cross lane reads are measured daily.
Image Reject Rate Note: Image reject rate does not apply to Open Road Toll ORT) lanes since acceptable rates are covered under the licensing agreement.	13.5% at all plazas except: GWBUpper Level 25% and Goethals 19%	Image rejects occur when maintenance related problems [1] result in the inability of the Customer Service Center to identify the vehicle license plate from the image. Image rejects due to non-maintenance related circumstances2 are excluded from any calculation. Standard is calculated as image rejects due to maintenance related problems divided by total violations, based upon sampling images and reviewing image reports generated at the Customer Service Center. The image reject rate should not exceed the acceptable rate established by mutual agreement at any plaza in any 48-hour period.

Additional performance measures may be added by mutual agreement between the Authority and the Contractor.

IRejected images are defined as:

Images too Dark - The plate number itself is too dark to identify.

Images too Light - The plate number itself is too light to identify (includes whitewash plate)

Images out of focus - The plate number itself is out of focus or blurred and cannot be identified.

Image Unacceptable - Images that are distorted, speckled, split or display a black band along perimeter of image that obliterates the license plate. Plates that are obliterated by a glared reflection of light are rejected as Image Unacceptable. Also unacceptable are images that are all black or all white as well as images that are framed incorrectly (e.g. too far right, too far left, incorrect violation capture trigger).

No vehicle in image - Images that capture the toll lane with no evident vehicle in lane (Ghost transaction).

2Image rejects due to non-maintenance related problems are defined as:

License plate obscured - The license plate is obscured by mud, snow or other materials.

License plate obstructed - The license plate is mounted in such a fashion as to be obscured by some other part of the vehicle or license plate frame making it impossible to correctly identify the plate.

No license plate in image - No obvious mounting of license plate in image, or plate is mounted in an obscure location inconsistent with common mounting locations.

License plate damaged - The license plate is bent or mutilated making it impossible to correctly identify the plate.

Incorrectly coded - Image incorrectly rejected at the Customer Service Center.

J. Condition at the Regional Customer Service Center

When the rate of unreadable plates reaches the image reject rates set forth in Section I per toll plaza per 48-hour period the Contractor shall reimburse the Port Authority $0.13 per image plus the cost of the toll fee of the vehicle in each image where the license plate information is not readable for one of the reasons listed in Section II and excluding Section I2. Reimbursement will be collected for all vehicles starting at the stated percentages. The damages will be limited to a maximum of two thousand vehicles up to a maximum of $2000 per 48-hour period per toll plaza. If the class of vehicle cannot be identified in the image then the Contractor shall reimburse the Port Authority for the toll at the minimum rate for that type of vehicle. If there is no image to ascertain the class of vehicle, the Contractor will reimburse the Port Authority for

the toll at the Class 1 rate. The rate of $0.13 per image is to cover the cost of the image review process whether or not any license plate information can be retrieved.

K. Maintenance Repair Times and Damages for System Downtime

Corrective maintenance activities shall be provided to repair or restore the System to normal operating conditions when unanticipated problems occur. Corrective maintenance shall be broken down into three (3) categories based on the severity of the problem:

- Priority I - Instances that cause excessive traffic congestion, create an unsafe traffic condition or prevent the ability to collect toll revenue.

- Priority 2 - Instances that affect operation of the lane that are apparent to the motoring public.

- Priority 3 - All other Integrated Toll Collection System failures.

Response time shall be the elapsed time between notification (whether by telephone, email or autopager) from the Port Authority to the Contractor and the time the Contractor's technician arrives at the site of the work. If the problem is of a type that can be resolved remotely, response time shall be measured as the time from notification until the technician logs into the relevant system, at which time the technician shall notify the designated Port Authority contact.

Priority 1 and Priority 2 repairs shall be performed on an expedited basis. Technicians shall be furnished with sufficient tools and spare parts and equipment, or such spare parts and equipment shall be conveniently positioned so as to expedite repaIrs.

The Contractor shall respond to Priority 1 service calls within 2-hours of notification from The Port Authority, to Priority 2 service calls within 3-hours, and to Priority 3 service calls within 4-hours unless otherwise directed by the Authority. Except during Primary Response Periods.* The Contractor will respond to Priority service calls as quickly as possible not to exceed the required response time. Beginning with the calendar month that follows the 60th day after assumption of full maintenance by the Contractor, failure to meet the response times set forth above shall entitle the Authority to corrective fee reduction as follows:

Failure to meet Priority I during normal Response Time periods shall result in assessment of the following liquidated damages: $2,000.00 for up to the first hour exceeding the response time and $500.00 per additional quarter hour rounded up to the next quarter hour.

Example - During normal Response Time periods: a Priority 1 incident response time of 3 hours and 20 minutes in duration, Corrective fee reduction =($2,000.00 X 1 hour)+(500.00 X 2 quarter hours)=$3,000.00.

Failure to meet Priority 2 during normal Response Time periods shall result in assessment of the following liquidated damages: $1,000.00 for up to the first hour exceeding the response time and $500.00 per additional quarter hour rounded up to the next quarter hour.

Example - During normal Response Time periods: a Priority 2 incident response time 5 hours and 35 minutes in duration, Corrective fee reduction = ($1,000 X 2 hour) +(500 X 3 quarter hours)=$3500.00.

Failure to meet Priority 3 during normal Response Time periods shall result in assessment of the following liquidated damages: $250.00 for each hour exceeding the response time.

Example - During normal Response Time periods: a Priority 3 incident response time 5 hours in duration, Corrective fee reduction = ($250 X 1 hour) =$250.00.

*Primary ResDonsePeriods are:

Primary Response Time Monday through Friday	Location of work site	Response time for Priority 1 calls	Response time for Priority 2 calls
A.M.			
5 A.M. to 9 A.M.	Holland Tunnel, Lincoln Tunnel, George Washington Bridge	1 hour	1 hour
P.M.			
1:30 P.M. to 5:30 P.M.	Goethals, Bayonne, and Outerbridge Crossings	1 hour	1 hour
Saturday and Sunday			
Noon to 4 P.M.	All plazas	1 hour	1 hour

Failure to meet Priority 1 during Primary Response time shall result in assessment of the following liquidated damages: $2,000.00 for up to the first hour exceeding the response time and $500.00 per additional quarter hour rounded up to the next quarter hour.

Example - During Primary Response Time periods: a Priority 1 incident response time of 2 hours and twenty minutes in duration, Corrective fee reduction = ($2,000.00 X 1 hour)+(500.00 X 2 quarter hours)=$3,000.00 ..

Failure to meet Priority 2 during Primary Response time shall result in assessment of the following liquidated damages: $1,000.00 for up to the first hour exceeding the response time and $500.00 per additional quarter hour rounded up to the next quarter hour ..

Example - During Primary Response Time periods: a Priority 2 incident response time of 3 hours and 35 minutes in duration; Corrective fee reduction = ($1,000.00 X 2 hour)+(500.00 X 3 quarter hours)=$3,500.00.

The Contractor shall immediately notify the Contract Manager or Facility Manager if any required response time cannot be met in a particular case, the reason why, and the anticipated time of response. This notification shall not in and of itself relieve the Contractor of his obligations to meet the required response time stated above with the exception of the Mark IV scope of work. The Mark IV repair and response times as set forth in the terms and conditions in the Irrevocable Offer, Extension Agreement and letter dated July 25,2005.

For all work requiring Mark IV's assistance, the Contractor will be assessed liquidated damages, if the Contractor fails to notify Mark IV of any Mark IV equipment malfunction within the response times stated above. All Mark IV related services must be completed within four (4) hours of notification by ACS.

The Port Authority will monitor performance of all toll lanes on a regular basis, and will do so in cooperation with, and support from the Contractor. This monitoring will include assessing lane performance against the performance standards listed in Sections I and J above

Unforeseen System Malfunction

In the event that ITCS fails to record electronic transactions resulting in revenue loss to the Authority, due to reasonably unforeseen malfunctions of the system, including those which are software related, the Contractor shall repair and return the lane and system back to service on an interim basis after twenty-four (24) hours or on a permanent basis after seven (7) days of the Contractor becoming aware of the incident. The Contractor will be assessed liquidated damages up to a maximum of $1000 per day/per lane affected. This does not negate the Contractor's obligation to make repairs in an expedited manner and neither does it negate the Contractor's obligation to respond within the times specified in Section K. For the purpose of this

paragraph, an interim basis shall be deemed to mean a remedy, which, although not permanent in nature, permits the lane and/or system to function as intended.

- If other than in-lane equipment is out of service, damages will be assessed only if the equipment failure closes a toll lane(s) or creates additional work for the Regional Customer Service Center as identified in Section J above, or results in lost revenue, as determined solely by the Contract Manager. In any case, damages are assessed as stated in the above or as a result of additional Regional Customer Service Center costs or to replace revenue, whichever is higher.

3. SYSTEM ADMINISTRATION SERVICES

A. General Information

The following is a description of the tasks and responsibilities of the System Administration Services required by the Contractor. There are two systems that shall require System Administration Services. First is the Integrated Toll Collection System (ITCS) that runs on processors located at the Port Authority's River Crossings and on the Electronic Central Host (ECH) and backup servers. The System Administration Services shall cover the ECH and related equipment, such as lane controllers, plaza supervisors, non-supervisor workstations and Training Academy workstations. The second system is the Airport Central Host (ACH) that supports the Aviation Electronic Parking Collection Systems (E-ZPass Plus). E-ZPass Plus is in use at LaGuardia, JFK International and Newark Liberty International Airports.

The major portion of the Contractor's responsibilities will be associated with the Electronic Central Host (ECH) and Aviation Central Host (ACH) computers. The Contractor will also administer the alternate/back-up ECH and ACH, located at the Port Authority Technical Center, Jersey City, NJ. The alternate systems will not require the same level of administration unless they have been activated as the production processor during an emergency. Both backup systems will require daily verification that they are keeping in sync with their production counterparts.

Except for maintenance activities the ECH and ACH operates twenty-four hours per day seven days per week.

B. Electronic Central Host (ECH)

The Integrated Toll Collection System (ITCS) is a toll collection system that allows customers to pay tolls in any of several ways at the Port Authority's six Hudson River crossings. It is called "integrated" because manual (cash and coupon) and electronic tolls are processed by the same system. Customers purchase radio frequency tags (E-ZPass), which are mounted in vehicles and read when the vehicle uses one of the Port Authority's River Crossings. Every lane at all Port Authority River Crossings and bridges has the capability of processing E-ZPass tags. Transactions are generated by lane controllers (microcomputers) at toll facilities and are subsequently sent to an ITCS host computer, called the E-ZPass Central Host (ECH), located at the TeleCenter via the Port Authority's wide area network (PAWANET). The ECH aggregates the transactions for transmission to a Customer Service Center (CSC), which is responsible for all customer account maintenance and for processing violator transactions. The ECH receives files from the CSC. One such file is the tag file that contains the list of valid tags. Thereafter the tag file is sent to the lane controllers. Additionally, the ECH maintains employee access data, toll schedules and other system-wide data. A Plaza Supervisor application is used to manage the plazas.

The ECH is integrated with the toll touch screen terminals, lane controllers, and other workstations at the Port Authority's River Crossings and offices in New York and New Jersey. The ACH is not integrated with nor does it control other systems: it collects files from and sends files to the airport parking revenue control systems. Both the ECH and the ACH aggregate data and produce reports, and both hosts send files to and receive files from the Customer Service Center. The ECH and the ACH are located at the TeleCenter in Staten Island. The backup ECH and the backup ACH is located at the Port Authority's Technical Center located in Jersey City, New Jersey.

The ITCS system has multiple components including:

- Host computer to store and maintain data, function as a concentration point for transaction data generated by the remote lane controllers in the toll lane, download control data to the lane controllers, and serve as a gateway to the Customer Service Center (sending transactions to the CSC and receiving tag files from the CSC), and the Port Authority enterprise server.

- Deposit terminals at each facility toll plaza where toll collectors perform the deposit process. The system has the capability to produce Tour of Duty reports, which include all deposit information entered by the toll collector.

- Connection to the Port Authority wide area network (PAWANET) for communication with the Customer Service Center, the remote lane controllers and workstations.

- Local Area Networks at each of the toll facilities to provide connectivity from the lane controllers and workstations to PAWANET.

- Workstations at each of the toll facilities to monitor and control the equipment at the Hudson River Crossings, and to provide management reporting of ITCS Host-based data.

- Workstations at the Port Authority Technical Center to provide a training facility for Port Authority toll collection personnel and to provide information to staff of Audit and Revenue Accounting.

- Seventy workstations at the various Port Authority facilities and administration offices to provide high-level management reports. All of these workstations have the ITCS application loaded on the same equipment. With respect to the Authority workstations, the responsibility of the Contractor is to maintain the application (ITCS and/or ECH 'client' software) rather than the user platform (hardware, operating systems and network connections): that work is the responsibility of another maintenance vendor.

- Lane controllers, which control various lane equipment, required to operate the

ITCS system in the toll lanes. Each lane controller includes an Uninterruptible Power Supply backup device for back-up power.

- In-lane toll collection equipment including touch screens, proximity card readers and receipt printers.

- In-lane components include in lane treadles and loops, cameras, overhead profilers, vehicle identification readers, various signs, lights, etc. Please note, during the term of this contract, the components of the VES system will be upgraded under another contract and thereafter the new equipment shall be maintained under this contract.

- The Computerized Maintenance Management System that processes error messages and other transactions.

Locations:

Bayonne Bridge
George Washington Bridge - (Three Plazas)
Goethals Bridge
Holland Tunnel
Lincoln Tunnel
Outerbridge Crossing
Port Authority Technical Center (Training Center location)

The primary Host location is at TeleCenter, Staten Island. The secondary Host is located at the Port Authority Technical Center in Jersey City.

Hardware / Software Environment

CENTRAL PROCESSORS: 2 DEC Alpha servers (4100s) as the primary and two DEC Alpha servers (4100 & 2000) as a backup. All servers are running DEC Open VMS.

LANE CONTROLLERS (at toll facilities): 73 Pentium computers and support hardware running SCO UNIX, SCO C, DECMessageQ, *TCP/IP* and Component Integrator real-time extensions.

OPERATOR WORKSTATIONS: MOMS PC located at the Telecenter running Windows NT and Concert software.

APPLICATION ENVIRONMENT: HOST (DecForms, DEC C, Oracle Rdb7, DECMessage Q, TCP/IP, WORKSTATION (PowerBuilder, Infomaker, TCP/IP).

FIELD EQUIPMENT: In addition to the Lane Controller, there are Mark IV Readers and Antenna, Video enforcement subsystems and overhead profilers.

MAINTENANCE PROVIDER: The maintenance Contractor shall be required to coordinate the work of the following third party hardware and software Port Authority contractors:

- Hewlett-Packard
- Oracle

RESPONSE TIMES: The Contractor shall be available 24-hours per day, 7-days per week including holidays for the resolution of problems with the system. The Contractor shall respond to all complaints and problems reported to them within four (4) hours of notification, from the Port Authority. Failure to respond within the four (4) hour limit shall subject the Contractor to Liquidated Damages as defined elsewhere in this Contract (see Part II, Section 10).

C. Aviation Central Host (ACH)

The Airport Central Host (ACH) receives E-ZPass Plus transactions from the three airport parking lot Revenue Control System (RCS) hosts and transmits them to the Customer Service Center (CSC). Unlike the ECH, the ACH is not involved in the real time operation of the airport parking lots. The ACH also receives tag file (the list of valid tag numbers) from the CSC and forwards them to each of the RCS host clusters at the Authority's airports. The ACH sends and receives reconciliation data to and from the CSC.

Location

The primary ACH machine location is at TeleCenter, Staten Island. The secondary host is located at the Port Authority Technical Center in Jersey City.

Hardware / Software Environment

The ACH server consists of a Sun Solaris Enterprise 450 system running Solaris network operating system and Sun-Unix on a single UltraSPARC II processor. It is equipped with 1GB of memory, Raid 5 and Raid 0+1 hard disk storage as well as other support devices.

In addition to the ACH application software the system uses Oracle 8i and SQL plus, Veritas Volume Manager 3.1.1, Netscape Enterprise 4.0 SP6, Intelligent Decisions server components, and Actuate 4.1.8.

The Port Authority supplied Windows NT workstations run an ACH client application graphical user interface, ACHGUI. There are eleven workstations that have this application software installed located at the Journal Square Transportation Center in the Audit and Revenue Accounting departments. Two additional workstations in the E-

ZPass unit are also running this software. Many of these workstations also have the ITCS application loaded on the same equipment.

MAINTENANCE PROVIDER: The maintenance Contractor shall be required to coordinate the work of the following third party hardware and software Port Authority contractors:

- Actuate
- Sun Microsystems
- Oracle

RESPONSE TIMES: The Contractor shall be available 24-hours per day, 7-days per week including holidays for the resolution of problems with the system. The Contractor shall respond to all complaints and problems reported to them within four (4) hours of notification, from the Port Authority. Failure to respond within the four (4) hour limit shall subject the Contractor to Liquidated Damages as defined elsewhere in this Contract (see Part II, Section 10).

D. Transportation Central Host (TCH)*

It is anticipated that a third host computer, the Transportation Central Host (TCH) shall require system administration services at some point during the term of this Contract. As with the ACH, the TCH will not be an integrated system. It will transmit files from and send files to the airport transportation system. It will also send files to and receive files from the Customer Service Center. It is expected that the TCH will be located at the Port Authority Telecenter and a backup at the Port Authority Technical Center.

* For the purposes of providing a cost estimate for the System Administration of the TCH, assume that the system administration responsibilities for the TCH will be the same as for the ACH.

E. Management OfThe Work

The Contractor will be required to perform System Administration Services for the Port Authority's Integrated Toll Collection System and the Port Authority's Electronic Central Host and Airport Central Host. The Contractor shall effectively perform and manage the work described herein.

F. Schedules

The Work will be managed according to schedules published by the Contractor and approved by the Contract Manager. The schedules shall include, but not be limited to:

- Ongoing recurrent system administration duties.

- Completion of the reVIew and evaluation of the system administration environment.

Performance of the work to bring the system administration environment into conformance with applicable standards as defined in and/or referenced to in this Scope OfWork. (Refer to Part V, Attachment C.)

G. Security

The Contractor shall maintain a secure environment and supply personnel who satisfy Authority and/or regulatory security requirements.

H. Quality Assurance/Auditing

The Contractor shall develop and put into practice a Quality Assurance Program to ensure full compliance to the service requirements herein given, as provided in the System Administration Manuals (listed in Part I, Section 1, H "Available Documents for the two systems and as provided in Standards and Guidelines for Port Authority Technology (Refer to Part V, Attachment D).

The Contractor shall provide an overview within the first three months of the effective date of the Contract, no more than twenty pages in length, of the Quality Assurance policies, methods, techniques, and controls that will be used. The overview shall clearly indicate how the Contractor will provide quality services to the Authority during the terms of the Contract.

I. Training

The Contractor shall provide a regular ongoing training program appropriate to the needs of the system and the staff assigned to maintain the appropriate level of staff knowledge, skills and abilities in administering the Integrated Toll Collection System and the Host systems.

The Contractor at no additional cost to the Authority shall incur the cost of training and related expenses.

J. Detailed Description Of System Administration Services To Be Provided

The Contractor shall perform all system administration tasks and functions as set forth further below in conformity with published Authority standards and the System Administration Manuals, for both the ECH and ACH and related equipment, and in documentation (the complete set of documentation for the system, its programs, hardware, etc. for the Integrated Toll Collection System and for the Airport Host system to be administered). In the absence of any pertinent standard and/or operating procedure, the Contractor shall follow generally accepted industry standards and practices. The Contractor shall communicate, in writing, the absence of such standards and/or procedures to the Contract Manager and provide a recommended procedure.

1. **System Operations**

The Contractor shall be responsible for routine operation of the system (whether on-site or remote), as well as management of the hardware configuration and files. In addition, the Contractor shall be responsible for diagnosing and correcting system-related problems. The Contractor shall monitor the status of communications and report any disruption of service to the appropriate maintenance organizations. Also, the Contractor shall monitor the timely delivery of files, control information and data to subsystems, workstations, host systems, the Customer Service Center and other service organizations. In the event of a failure of these services, the Contractor shall initiate corrective action and report the incident. In the event that a database change or database reorganization is necessary, the software maintainer ACS, State and Local Solutions, Inc. will be responsible for such tasks. The Contractor shall perform all tasks as defined in the following manuals to assure full functioning of the system at the required standards of performance and availability: operations manual, system documentation, other vendor product literature, and applicable Port Authority Standards.

The Contractor shall familiarize themselves with the functionality of the system via a review of all system documentation and consultation with PA staff and consultants. Contractor shall make site visits to facilities as needed to understand the proper functioning and operation of all aspects of the systems.

The scope of the system operations portion of the System Administration Services furnished shall include, but not be limited to the activities identified below:

System Monitoring

a) Performance of scheduled reviews of system and regular system upkeep: On a scheduled basis check the hardware and software components of the system to ensure that all components are present and operating within specified parameters. Based on these reviews, perform needed system upkeep (e.g., de-fragmenting disk files, purging obsolete files from directories, etc.) to ensure uninterrupted operation of the system.

b) Monitoring the system: During actual system operation check system monitoring devices and programs, run-time system utilization parameters, and other diagnostic tools (e.g., file size and allocations, processor loading, response times, etc.) to ensure that all aspects of the system are operating properly and the system is meeting all specified performance criteria.

c) Monitoring integrity of databases: On scheduled and real-time basis as appropriate, review system databases (tables, indexes, views/queries, etc) to ensure that all databases are properly updated, and that appropriate integrity of all system databases is maintained.

d) Monitoring synchronization of production and backup databases on a daily basis.

e) Maintaining logs of all scheduled monitoring and system upkeep activities.

f) Maintaining logs or other appropriate records of all monitoring and System upkeep activities and logs of all anomalies found during any monitoring activities and measures taken to correct those anomalies.

g) Furnish logs to the Authority upon request.

2. Operational Requests for a Non-Plaza Supervisor Workstation

a) Resetting a user password, granting/revoking user access must be performed within two hours.

b) Routine operational requests include adding or deleting a user and installing various applications that are required for ITCS/ECH or ACH. Application and workstation related tools include the ITCS/ECH application as well as InfoMaker The workstations are provided by the Authority and are maintained under another contract.

c) Routine operational request in order to restore operability of a workstation must be satisfied within two working days. This includes installing and making operational the operating system, ITCS application and the Plaza Supervisor application.

Failure to respond within the limit for Non-Plaza Supervisors workstation problem resolution (as in b) and c) above) shall subject the Contractor to Liquidated Damages as defined elsewhere in this Contract (see Part II, Section 10).

3. Operational Requests for a Plaza Supervisor Workstation

a) Resetting a user password, granting/revoking user access must be performed within two hours.

b) Routine operational request must be satisfied within two hours. Routine operational requests include adding or deleting a user and installing various applications that are required for ITCS/ECH and ACH workstations. Application and workstation related tools include the ITCS/ECH application as well as Info Maker The workstations are provided by the Authority and are maintained by another contract.

c) Routine operational request in order to restore operability ofa workstation must be satisfied within four hours. This includes installing and making operational the operating system, ITCS application and the Plaza Supervisor application.

Failure to respond within the time limits Plaza Supervisor workstation problem resolution (as in b) and c) above) shall subject the Contractor to Liquidated Damages as defined elsewhere in this Contract (see Part II, Section 10).

4. System and Application Back-ups and Archiving

a) Backing-up data and programs: The Contractor shall perform scheduled data, application, and system backups as specified in the operations procedures and ensure that back-up media are properly stored, rotated on schedule, and replaced appropriately.

b) Maintaining off-site back-ups: The Contractor shall perform scheduled back-ups for off-site storage or rotate back-up media to and from the off-site storage location as appropriate. Ensure that viable and complete back-ups are delivered to the off-site storage location when scheduled and that media to be rotated is returned from off-site storage location and returned to usage on the system as appropriate. The Contractor shall be responsible only for handing the tapes over to the contractor providing the off-site storage facility. The Authority will pay for use of the off-site storage facilities for back-ups if site is not on the Authority's property.

c) Maintaining records of back-ups: Maintain logs of all back-up activity, rotation of back-ups, and usage/rotation of back-up media and records of all off site data storage.

d) Archiving data: Follow system archiving procedures to capture data to be archived to permanent storage media as required to maintain proper system functioning or as scheduled in the system operating procedures (whichever occurs first). The Contractor shall ensure that archive media is properly logged and maintained and that archived data is viable and accessible throughout the required archive retention period for the data. The off-site storage contractor's personnel will transport the archived storage media to and from the Authority-provided off-site storage location. The Authority will pay for use of the off-site storage facilities for archiving if the site is not on the Authority's property.

e) Accessing archived data: Load archived historic data onto the system as needed to generate reports, perform required searches, etc. and clear loaded historic data from system when it is no longer needed for immediate access.

f) Maintaining inventory of media: Ensure that an adequate inventory of media for primary and backup purposes is available and timely advise the Contract Manager when additional media for backups and archiving data is needed.

5. Fault Detection, Diagnosis, and Correction

a) Diagnosing system faults: React immediately to system faults detected either through monitoring, observation, or by reports from users. Log fault and capture pertinent data (e.g., record state of system components, make periodic system backups, record observations of users, etc.) and make necessary and appropriate notifications (e.g., Port Authority Contract Manager, users, affected customers, etc.). Diagnose nature/cause of problem(s) and determine responsibility for correction of fault.

b) Correction of system faults: Correct faults or follow system procedures to contact the appropriate service provider and initiate response from/resolution by that

provider. The Contractor shall then monitor and log response of service provider to trouble call.

c) Following up on corrective action: Verify that the fault has been appropriately and completely corrected and that there are no uncorrected collateral problems either from the original fault or from the measures taken to correct the fault.

d) Maintaining records of system faults: Log return to proper operation and record all pertinent data regarding fault: fault description and symptoms, how it was detected, impact on system operation, how it was diagnosed, diagnosis and response times, how it was corrected, and elapsed time to restore system operation.

1. Data Entry

Entering data and system parameters: Update and/or populate data bases, assign and/or enter user access data, enter and/or change system or application parameters, enter other needed application and/or system data as required by system activity, application needs or other procedures in effect.

11 Report Generation

- Production of management/user reports: Collect necessary data and print standard and ad hoc reports, collect necessary data and print regular system reports, logs, etc.

- Production of operations reports: Provide system generated and/or manual log reports as required; collect, maintain, and provide regular reports on computer room and system.

- Production of system usage reports, charts and graphs on a monthly basis.

The Contractor is responsible for all consumables in the production of reports, such as paper and other printer supplies.

6. Upgrades, Enhancements and Patch Management

i. The Contractor shall notify the Authority whenever upgrades and/or enhancements to operating system or third-party software become available. The Contractor shall also provide the Authority with an analysis of the potential effects of such upgrades/enhancements on the ACH, ECH or ITCS lane controllers. This analysis shall include, at a minimum, the following:

a) Compatibility of the application software with the new operating system or third-party software.
b) Potential increases or decreases in system performance.

c) The availability of product support for the current (older) version of the operating system or third party software.
d) The testing required to ensure that the upgrade will perform as expected.
e) The cost of the software upgrade, including testing and any other tasks which may be associated with the upgrade.

ii. The Authority will then review the analysis and make a determination whether or not to order the upgrade. If the Authority selects the upgrade, the Contractor shall perform the recommended testing, prepare the test report, and perform the upgrade on the ACH or ECH. This work shall be completed under the Extra Work clause of this Agreement.

iii. The Contractor is responsible for ensuring that all appropriate patches are in place for patching the operating application and database systems including quality assurance, testing and documentation for each patch applied without additional charge. The Contractor should be proactive in notifying the Contract Manager of new patches and subscribe to organizations and companies that issue notifications on patch releases.

K. Management of Hardware/Software Service Providers

The Contractor shall be responsible for the management of hardware maintenance and software support agreements on behalf of the Authority and all hardware/software support suppliers and shall monitor performance of vendors according to contract terms. The Contractor shall act as the primary contact between the Authority and the service providers in the scheduling of services and diagnosing and correction of system faults or failures.

The Contractor shall be responsible for entering into new contracts or the renewal of all contracts for all hardware/software service providers mentioned in Section 3, B, C and D on behalf of the Authority, with the exception of the Oracle licensing for the ACH and TCH. Upon termination or expiration of this Agreement, ownership of all hardware/software maintenance contracts for the ACH and TCH shall be made transferable to the Authority.

The Contractor is responsible for management of hardware maintenance and software support agreements, the scope shall include but not be limited to the activities identifies below:

1. Hardware Maintenance

a) Management of hardware maintenance vendors: Schedule regular preventive maintenance service with the vendor in accordance with service contracts and in coordination with the end users' service level agreements to limit disruption of operations. Maintain records of service visits to ensure that all vendor

contractual obligations are fulfilled and supervise the computer room and other places where service by hardware service providers is taking place. Hold weekly meetings with service providers and users to review all services and identify and correct any deficiencies.

b) Administration of hardware maintenance contracts: When requested by the Contract Manager, review invoices, requests for payment, approvals, deficiency reports, etc. and expeditiously forward comments to the Contract Manager to ensure the timely payment of all contract payments. Maintain records of downtime in order to identify credits due to the Authority, evaluate vendor responsiveness and to ensure all contractual obligations are being met and to recommend corrective actions where they are not. Provide regular reports to the Contract Administrator detailing the status of the hardware and hardware service agreements. Make written recommendations for improving hardware maintenance. Maintain records of service provider performance, contract renewals, and contract deficiencies for evaluation. Recommend changes to be made to support agreements upon renewal.

c) Notifying vendors of system faults: Place service calls to notify appropriate service providers of system faults or failures.

2. Software Upgrades and Patches

a. The Contractor shall maintain current operating system software: Supervise the installation of operating system upgrades and/or patches on all host based processors, servers and personal computer clients, ensuring software is maintained at a release level supported by the vendor and as appropriate within two release levels of the most current release.

b. The Contractor shall maintain current application software: Supervise the installation of application software upgrades and/or patches on all host-based processors, servers and personal computer clients, including packaged software products, as well as new releases of custom software as directed by the Contract Manager. The Contractor is not required to create application software patches or upgrades.

c. The Contractor shall ensure that Intrusion Detection and Anti-Virus software are up to date on servers, ITCS lane controllers and all workstations.

d. The Authority will supply hardware and software upgrades to the Contractor.

e. Contractor shall review and comment on all proposed operating system and application software upgrades and/or patches to ensure that they are complete and properly documented.

3.. Software Support

a. Management of software support vendors: The Contractor shall act as the Authority's representative, with the concurrence of the Contract Manager, in dealing with software support providers, communicating requests for modifications to the system and reporting required fixes to correct software deficiencies. Maintain records and track the status of all such requests, maintain contact with vendors to keep current on the latest releases of and fixes to software, keep the Contract Manager aware of the status of all such releases, fixes and requests through regularly scheduled status meetings and provide written documentation. Where software providers are engaged by the Authority to apply either operating system or application software enhancements, upgrades, and/or patches on host-based processors, servers, personal computer clients, and/or on in-lane computers, supervise the software support provider in performing and testing such work consistent. with all provisions that would govern were the Contractor to apply these changes directly.

b. The Contractor shall administer the software support contracts: When requested by the Contract Manager, review invoices, requests for payment, approvals, deficiency reports, etc. and expeditiously forward comments to the Contract Manager to ensure the timely payment of all contract payments. Maintain records so that service provider performance can be evaluated, contract renewals tracked and contract deficiencies remedied upon renewal.

c. Contractor shall develop and maintain an incident reporting procedure that properly tracks incidents reported by either staff and/or system users. Procedures shall include incident reporting forms and appropriate tracking numbers and tools (e.g., spreadsheets, etc.) to monitor vendor activities on each incident reported.

d. Contractor shall review the change management procedures established for each system and recommend changes as necessary to ensure that all system changes are properly executed. Contractor shall ensure that said change management procedures are properly followed by all vendors. Procedures shall include, but not limited to, change request forms and documenting the action(s) taken to complete the change request.

L. Security **Administration**

The Contractor shall be responsible for creating and maintaining a secure system environment, in terms of system access, in a manner consistent with the Authority's published IT standards and guidelines. (Refer to Part V, Attachments D, E and F).

The scope of the security administration portion of the System Administration services furnished shall include but not be limited to:

1. Maintaining lists of authorized users: Establish a list of users authorized by the Contract Manager to access the system, including system functions that the user is

authorized to exercise. Provide a means for immediate communication with the Contract Manager or other designated person when changes in employment status occur which may require updating of the list.

2. Limiting access to the system: Create logon IDs for only those persons authorized by the Contract Manager and maintain a list of all users for his/her review. Institute a policy of password assignment, expiration and change to limit the exposure to unauthorized access. Limit access by individuals to the functions authorized through user profiles or other such means as are available through the application or operating system. Institute controls over super passwords or other special passwords so that their use is documented and approved by the Contract Manager. Research sign-on violations to determine if a pattern is evident and report any findings to the Contract Manager.

3. The Contractor on a quarterly basis will review all computer access accounts used by the Authorities to determine if any account(s) has not accessed the system for more than 90 days or has never accessed the system, and report back to the Authority of such account(s) for possible deletion of such account(s) from the system. In addition, the Contractor on a quarterly basis should review all accounts used by the Contractor staff for any accounts that have not accessed the system for more than 90 days or never accessed the system for possible deletion of such accounts from the system.

4. Provide reports documenting security status.

M. Capacity Management And Performance Monitoring

The Contractor shall monitor the system and network performance to ensure that performance and response meet the operational needs of the users and ensure the continued effective operations of the system through the accepted industry capacity management and performance monitoring procedures and recommend corrective actions to correct capacity or performance inadequacies.

The scope of the capacity management and performance monitoring portion of the System Administration services furnished shall include, but not be limited to the activities identified below and shall be in accordance with the System Administration manuals for the ECH and ACH and the Authority's published standards and guidelines, or in their absence, established industry standards.

1. Capacity Management

   a) Maintaining records: Maintain records on system performance and resource usage, message queuing, user response time, etc. adequate to project needed upgrades to hardware and software based on current performance and expected growth.

   b) Forecasting upgrade needs: Maintain communication with the Contract Manager and with users in regard to plans for system expanSIOn or modification that will affect system capacity or performance.

   c) Tracking resource usage: Track such items as database/file sizes, network

traffic volume and simultaneous connections to ensure adequate resources will be available for the foreseeable future.

2. Performance Monitoring

   a) Maintaining proper allocation of resources: Alter file distribution on direct access storage devices and reconfigure workstations and networks as needed to maintain adequate system performance.

   b) Troubleshooting: Investigate and diagnose system problems that result in unsatisfactory system performance and take steps to remedy the problem.

   c) Maintaining data structures: De-fragment files and purge/reorganize databases on a scheduled and as needed basis.

3. Hardware Configuration Changes

   The scope of the change management portion of the System Administration Services furnished shall include, but not be limited to:

   a) Managing hardware changes: Make provisions for the orderly implementation of hardware changes and upgrades minimizing the disruption of system services or users. Oversee and control changes to the hardware configuration and be responsible for the area where the work is being performed during installation.

   b) Testing new hardware: Ensure that all hardware configuration changes are tested within the Port Authority test environment prior to use in the production environment . Where possible and appropriate, arrange for factory testing prior to acceptance of new hardware.

   c) Informing management of new hardware options: Maintain contact with vendor(s) to stay aware of all hardware upgrades, maintenance fixes, etc., which are available for the system and communicate this information to the Contract Manager.

   d) Documenting the hardware configuration: Ensure that all documentation is received for new hardware and that configuration changes are properly documented and filed in the documentation library.

4. Software Configuration Changes

   a) Verification and control of software: Verify that no unauthorized software has been introduced onto the system (ECH, ACH, ITCS lane controllers or workstations). Check for and remove viruses, games, personal software, etc. and report to the Contract Manager. Check versions of authorized software verify that no unauthorized changes have been made. Research automated tools for change control and recommend their use where appropriate.

b) Informing management of new software options: Maintain contact with vendor(s) to stay aware of software upgrades and fixes.

c) Establishing a segregated test environment. Maintain a segregated test environment insulated from the production environment for testing of changes to software prior to introduction to the production environment.

d) Controlling software migrations: Establish and enforce procedures to ensure only approved changes are implemented by ensuring that:

I Modification request forms have been received for all changes to be made to software.

11 Access controls prevent more than one retrieval of a module for modification.

111 Multiple changes to the same module are coordinated.

IV There is synchronization of changes so that all modules affected by a modification to a data element or other factors are changed simultaneously.

v Migration of modules is controlled through the test and implementation cycle.

VI New application and system software versions are thoroughly tested within the Port Authority test environment prior to use on the production system.

Vii New application and system software versions are thoroughly documented.

Viii Changes to application software are deposited in escrow by the software vendor.

e) Maintaining prior versions of software: Exercise control over software versions, ensuring the proper version of software is migrated and that prior versions are available for roll back in the event of an emergency.

f) Testing new software: Maintain a set of test transactions and known results to verify the integrity of the system along with new software releases. Update the test transactions to include test data for all new conditions arising out of maintenance or enhancement of the system.

N. System **Documentation Library**

Establish and maintain a documentation library in an environmentally controlled area containing all documentation for hardware and software developed during the project and ongoing maintenance, hardware inventory and configuration of operating and ,administrative procedures. Ensure that all documentation needed for the continued operation and management of the system is accurate and available. Documentation for the Electronic Central Host, lane controllers and all other plaza related equipment, all workstations, and Airport Central Host other than System Administration documentation will be provided by others.

The system documentation responsibilities of the System Administration Services to be furnished by the Contractor shall include, but not be limited to:

1. Documentation Library

   a) Establishing a documentation library: Where one does not already exist, establish and maintain a documentation library containing all documentation material for hardware and software, standards manuals and procedure manuals and act as the Authority's agent in obtaining any needed documentation not in the Authority's possession. All materials in or obtained for the documentation library shall be or become the property of the Authority. Where a documentation library does exist the Contractor shall ensure that it meets Authority standards.

   b) Controlling documentation: Control access to documentation materials, signing out manuals to authorized individuals when appropriate and tracking location of signed out materials.

   c) Maintaining operating system documentation library: Maintain documentation for the operating system including the suppliers' reference manuals, information regarding upgrades and fixes applied and currently available upgrades not yet applied.

   d) Maintaining application system documentation library: Maintain a functional specifications document describing the business purpose of the system and a high-level description of the processes and reports; the design specification document detailing the technical solution to the business function described in the functional design document described above; and maintain program documentation.

   e) Maintaining hardware and wiring documentation library: Maintain a complete description of all hardware installed including model and serial numbers, ensure the availability of user and troubleshooting guides for all hardware. Maintain a document specifying the maintenance organization responsible for each item of hardware and for network wiring. Maintain wiring diagrams showing all network connections and wiring specifications.

2. Test Plans and Results Documentation Library

   Maintaining test plans: Maintain a library of test plans and procedures for retesting the system after modifications to software or hardware configuration or fixes to software. Also maintain a file of all test results and evaluations of results along with any recommendations arising out of that testing. All test plans and related files and data shall be or become the property of the Authority. Test plan documentation library shall include:

   a) Factory testing - maintain factory test plans to verify the functioning of new system components at the vendor site prior to delivery. Factory tests must provide assurance that the system will operate as specified and will provide adequate throughput.

   b) Field testing - maintain test plans similar to factory testing to verify that similar results are achieved.

c) Integration testing - maintain test plans to test the entire system with the new component installed to verify the integrity of the system as a whole and to determine that the intended purpose of the new component is achieved.

d) Acceptance testing - maintain test plans to verify the functioning of the new component in the production environment for a specified period prior to final acceptance.

3. OffSite Storage

Maintaining off-site storage: Manage the off-site storage of backup copies of all documentation and periodically inspeCt the storage facility and perform a physical inventory of its contents. As needed or upon request, the Contractor shall provide copies of existing manuals to the Contract Manager. The off-site storage location shall be a secure and environmentally controlled area facility designated by the Contract Manager; all records and material in said location shall be or become the property of the Authority. Ensure the timely update of off-site copies of documentation etc., such that the off-site and on-site documentation are consistent with one another.

O. End User Assistance

The Contractor shall provide technical assistance to system users, act as the Authority's agent for vendor contacts, provide technical support to facility and other user department staff at internal/external meetings and assist system users as described below.

1. Provide technical support to facility and other user department staff at internal/external meetings.

2. Staff a function as appropriate to provide technical assistance to system.

3. Act as the Authority's representative for vendor contacts.

4. Research and take corrective action on reported hardware/software malfunctions.

5. Participate in system assessment, including internal and external audits, as directed by the Contract Manager.

6. Perform other support activities as may be directed by the Contract Manager (e.g., visit/review similar systems or facilities, interview potential service providers, etc.) the cost of the necessary expenses incurred in this support will be paid for by the Authority.

P. Business Resumption Plan and Disaster Recovery Plan

The Contractor shall participate in the implementation and testing of the Authority's Business Resumption plan.

1. Testing the plan: Participate with the Contract Manager in scheduling and conducting annual tests of the contingency plan.

2. Effecting the plan: In case of a disaster, participate in the recovery effort and perform the system administrator's responsibilities identified in the plan.

Q. Contractor Review /Report **On** System Administration Environment

In order to better ensure the Contractor's responsibilities are fulfilled and all tasks pertaining to them are performed in a thorough and professional manner in accordance with Information Technology standards published by the Authority and that all prerequisites to Contract performance have been satisfied, the Contractor shall at the outset of his/her engagement conduct a complete review to validate the adequacy of the system administration environment for which he/she will assume operational responsibility upon execution of this agreement. In the conduct of this review the Contractor shall use as a standard of performance against which to make its evaluation the description of system administration activities contained in this document and applicable Authority standards defined in the same section. Within ninety (90) days of commencement of System Administration Services or commencement of production on the system whichever is later, the Contractor shall furnish to the Authority a formal report based on such comprehensive review. The report shall include:

1. An executive summary addressing key findings and recommendations.

2. A complete inventory of system hardware, software and operational documentation including serial numbers and license numbers, hardware configuration diagrams, software configuration descriptions (including release/version numbers), complete database descriptions and existing operational and trouble-shooting documentation.

3. A review and evaluation of each of the following task elements/prerequisites needed to effectively perform the system administration function:

   a) Review and evaluation of the operations environment, existing procedures, hardware configuration, and operational and system configuration documentation. This review will be to determine whether existing environmental conditions, operational procedures, hardware configuration and associated supporting documentation meet the operational requirements of the system and are in full compliance with Authority Standards.

   b) Review and evaluation of all hardware and software support agreements and warranties that are in effect and performance expectation with respect to these agreements. Review all maintenance support logs and other records for the previous year or since installation of the system (whichever is a shorter period), interview users to assess the degree to which the agreements are being fulfilled. Evaluate record keeping relative to these services, including the existence of appropriate logs/records to ensure all services due are provided.

   c) Review and evaluation of the physical access and system access environment. This review will be to determine whether existing security practices and procedures limit physical and logical access to the system, provide for review of attempted intrusions, protection from physical hazards such as fire and flood, adequate back power supply protection, etc.

   d) Review and evaluation of the capacity management and performance monitoring procedures. In conjunction with the Contract Manager the Contractor shall establish

parameters that define acceptable performance, establish procedures to measure system performance and establish a reporting mechanism to communicate system performance measures to the Contract Manager on a scheduled basis. Evaluate the procedures on database reorganization, file defragmentation and other routine operations designed to maintain adequate system performance. Evaluate the long range tracking and forecasting of system capacity to ensure adequate information is compiled and reported to management to ensure capacity remains adequate through the foreseeable future.

e) Review and evaluation of the change management procedures. This review will be to determine whether existing change management procedures provide for an orderly migration to new hardware and/or software installations and to ensure that such migrations are thoroughly tested and documented prior to installation.

f) Review and evaluation of items included in the system documentation library.

g) Evaluate the procedures for organizing and maintaining up-to-date documentation, create a catalog of all project/system documentation and establish a table of contents/system organization. Review and evaluate all existing documentation to determine if it meets the operational needs of the system and is in full compliance with Authority Standards.

h) Review and evaluation of the training and support programs for the system to determine if the users are receiving training and support adequate to ensure that the system provides the full value intended in the design.

i) Review and evaluation of the business continuation plan for use in emergency situations.

4. The Contractor's assessment of deficiencies in environment, procedures, and/or documentation and how the procedures implemented by the Contractor will address and correct these deficiencies.

5. Service levels have been established (Refer to Part I, Section 1, H, "Available Documents") for the ECH and the ACH. At a minimum, the Contractor must maintain the system administration level of support throughout the term of the Contract including the base period and any exercised option periods. The following are addressed in the System Administration manuals for both the ECH and the ACH:

a) System availability-- Servers, workstations, communication lines, and, if applicable, end of line devices and other specialty hardware.

b) System response times: Transactions and Alarms / Alerts, if applicable.

c) Trouble call response time: Standards for system administrator's response to trouble calls; standards for management of service providers.

d) Software releases: Maintaining currency of the operating system and utility software.

e) Operational Requests: Maximum amount of time before a routine operational request is satisfied (e.g., adding a new user, adding a workstation, creating a network directory; granting a user access to an existing application).

f) Customer Meetings/Reports-- Schedule for status meetings and reports.

g) System Reports: Schedule for delivery of standard reports.

h) Backups and Archiving: Frequency and type of backup; frequency of archive.

i) Disaster Recovery/Contingency: Schedule for tests of disaster recovery plan; time to respond to disasters or significant emergencies.

j) Patch Management

Upon submission of the report by the Contractor, the Authority will review the report and will either accept it or return it to the Contractor with a list of items that must be corrected by the Contractor to make it acceptable. Upon acceptance of the report, the Contractor shall assume responsibility for the repair of deficiencies in the system administration environment, which may include, but are not limited to, coordinating; acquisition of additional hardware and/or software by the Authority, developing or obtaining additional documentation and/or developing new operating procedures. If software modification is required, the Contractor shall work with the Contract Manager to negotiate if required with the software vendor(s) the needed enhancements, and perform all tasks related to implementation of such changes. Acceptance of this report and corrective action plan shall be made by the Contract Manager.

Some of the work will be occasionally performed at The Telecenter, Staten Island or Jersey City, NJ. However, on occasion it may be necessary to travel to other Authority sites or to non-Authority sites within the Port district as directed by the Authority.

4. ACS **PROPRIETARY SOFTWARE SUPPORT SYSTEM**

ACS, State and Local Solution, Inc. (herein ACS) shall provide help desk support and software modifications to the proprietary software (Lane, ITCS, ECH Host, ECH Host Backup, Plaza Supervisor, ACH Host and ACH Host Backup) as requested by the Authority. Contractor shall include the following activities as a minimum:

A. **Help** Desk **Support**

Help desk support shall be available to the Authority twenty-four hours per day, 7-days a week, 365 days per year. Calls will be logged by ACS and routed for telephone support by ACS personnel. ACS shall make every attempt to resolve issues within four (4) hours and make best business efforts to resolve issues quickly and effectively.

ACS shall respond to calls placed by the Authority by the next business day during normal working hours unless specifically requested by the Authority to provide after hours or emergency support. Normal working hours shall be Monday through Friday, 8:30 A.M. to 5:30 P.M., excluding holidays as defined herein.

ACS shall furnish to the Contract Manager a monthly activity report detailing all logged calls, a brief description of the nature of the call/problem, call initiated on behalf of appropriate Port Authority department (i.e., Aviation and/or TB&T) date, time and length of call, resolution and time of resolution, balance of time remaining in current contract year and all open calls (including Software Discrepancy Reports (SDR). This report must be submitted with each monthly invoice.

ACS will notify the Authority of any material defects or malfunctions in the software or related documentation that ACS learns from any source. Any required corrections will be performed at no cost to the Authority and will commence within twenty-four hours of notification.

ACS shall provide support in identifying, troubleshooting and/or resolving problems as described by caller. In the event that the caller's problem cannot be resolved, ACS will open a Software Discrepancy Report (SDR). ACS should follow SDR procedure in the System Administration Manual section 7.3, "Configuration Control" and section 7.1.1, "Software Discrepancy Report (SDR) Process and section 7.1.2, SDR cycle".

ACS will provide up to 500 hours of Help Desk Support each year as a base amount with the option of the Authority to request additional hours in blocks of 100 hours each. Hours in the base amount, if not used in anyone calendar year may not be carried over into the next contract year. Similarly, hours not used in a purchased

block of 100 hours which are not used in the calendar year may not be carried over into the following calendar year.

Software changes estimated at 100 hours or less may be included in the 500 base hours supplied each year at the Authority's option. Software changes applied to the base hours must be identified by the end of the eighth month of each contract year, and scheduled for completion by end of that calendar year. Any software changes requested by the Authority will be charged against that calendar year's allotment whether or not completed within that calendar year. No hours may be carried over to the next calendar year.

Calls requiring after hours support and emergency requests will be billed at a premium rate (1-1/2 times per standard hour of service) and will be compensated at the rate of:

River Crossings or TB&T and Aviation	25 hrs.	$9375/yr.

ACS will not perform additional work or bill more hours on a support issue without prior written approval from the Authority.

Reimbursement for travel and related expenses for non-local travel will be billed separately to the Authority at actual cost with records and receipts of expenses. Reimbursement for airfare shall not exceed standard coach fare. Reimbursement for travel related expenses shall require prior written approval of the Contract Manager.

B. Software Modifications

At the request of the Authority, ACS will provide modifications to the existing base software. ACS will submit a proposal consisting of a Statement of Work to be performed, a schedule to complete the work and pricing/required hours for all required changes. Proposal shall include, but not be limited to, software development, test plan, testing, schedule for release and written documentation of changes to the Authority.

Changes requiring 200 or more hours will require detailed estimates for software development, test plan, testing, schedule for release to the Authority and written documentation of changes, as well as a breakdown of type of labor used in each phase. Pricing shall be in accordance with the applicable hourly rates as set forth in c) below.

Any material defects or malfunctions in the existing software which require error correction in order to ensure the performance of the software will be performed at no additional cost to the Authority.

Any changes requested, therefore, will be considered a software modification and shall be priced in accordance with the applicable hourly rates, as set forth below. Invoices for this work will include labor detail by type and rate.

Compensation:

The prices listed below are for the first and second years of the Contract. Pricing will be adjusted in each subsequent year in accordance with the Section entitled "Escalation" .

a) At the discretion of the Authority, software changes requiring 100 or less hours of labor for development, testing and documentation may be included in the 500 base hours provided under Help Desk Support above. If this option is not exercised changes requiring 100 or less hours shall be billed as follows

For each hour of labor required for development, testing and documentation $125.00 per hour.

b) Changes requiring more than 100 hours but less than 200 hours shall be billed as follows:

For each hour of labor required for development, testing and documentation $125.00 per hour

c) Changes requiring 200 or more hours shall be billed per hour as follows:

Rate per Regular Working Hours*	$125.00 per hour
Rate per Overtime Working Hours*	$187.50 per hour

*Refer to section entitled "Definitions" in the General Contract Provisions for definitions of "Regular Working Hours" and "Overtime Working Hours."

C. Requests initiated prior to September 30, 2005

Any requests initiated by the Authority prior to September 30, 2005 will be completed without being charged against the base 500 hours in anyone calendar year. The following four (4) have been mutually agreed to between the Authority and ACS:

DR 10923 ITCS sweeper in lane is added to PA Passes total

DR 10925 ITCS toll evader total

DR 11207 ITCS 15 minor report improvements

DR 11558 ITCS Bad ill and other

ATTACHMENT I

Port Authority Maintenance of Traffic (MOT)

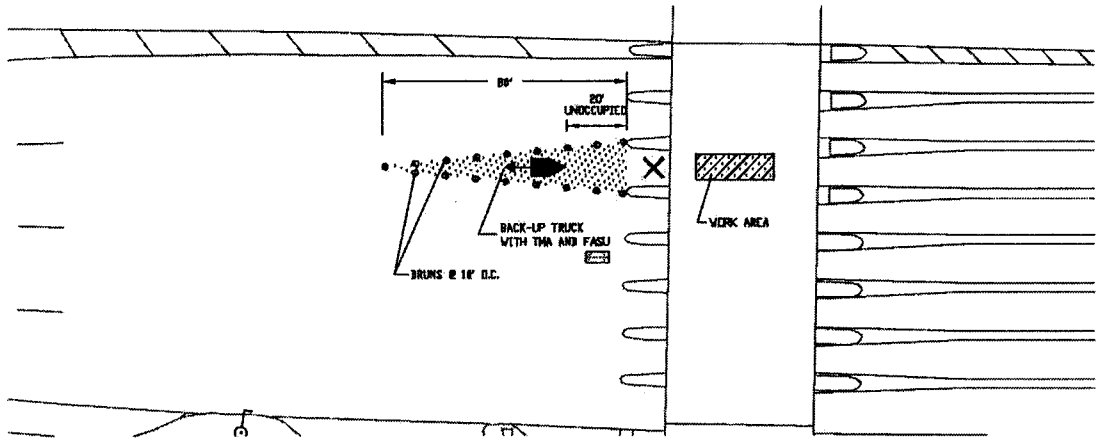
Revised August 10, 2005

Typical Toll Lane Closure

TYPICAL TOLL LANE CLOSURE

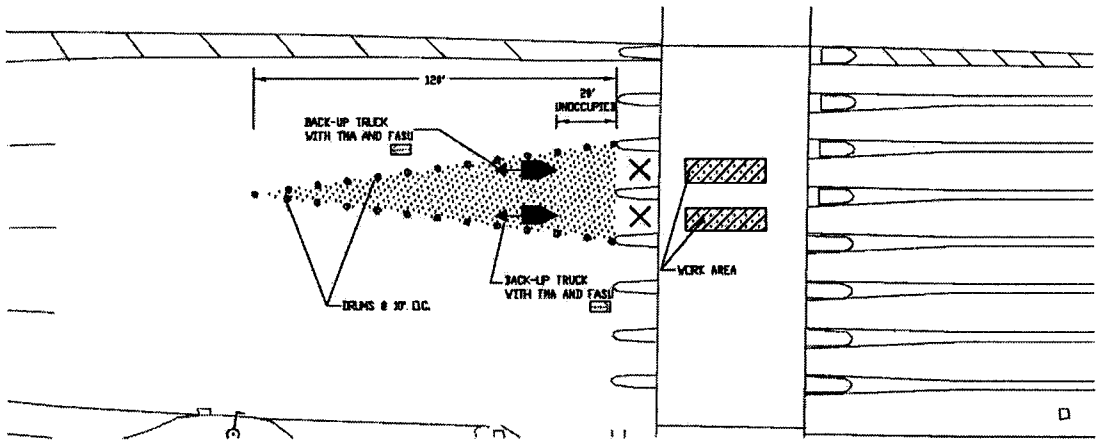
LEGEND:

TMA – TRUCK MOUNTED ATTENUATOR
FASU – FLASHING ARROW SIGN UNIT
X – TOLL LANE CLOSED BY THE FACILITY. TURN TOLL LANE SIGNAL TO RED.



ONE TOLL LANE CLOSURE

0 20 40
SCALE IN FEET



TWO TOLL LANES CLOSURE

0 20 40
SCALE IN FEET

Sheet of

THE PORT AUTHORITY OF NY & NJ

CHIEF TRAFFIC ENGINEER

No.	Date	Revision	Approved

ENGINEERING DEPARTMENT

FACILITY NAME

TRAFFIC
Title

TYPICAL TOLL LANE CLOSURE

Designed by Drawn by Checked by
Date
Contract Number
Drawing Number
FILE NUMBER

Highway Speed E-ZPass Standards Lane Closure Guidelines - Notes

O&M 20 – Roadway Work Area Protection

ROADWAY WORK AREA PROTECTION

I INTRODUCTION

- This Standard establishes the typical, methods and procedures to ensure protection of motorists, and Port Authority and Contractor' (s) crew working on Port Authority roadways for short durations. (One day's work schedule is considered short-duration on it may be necessary to reconstruct the protection schemes on following days.) work projects requiring long-term barricading, detour design, et-c- require special study by the Chief Traffic Engineer's office, which shall provide appropriate traffic drawings before work is started.

II SHORT DURATION WORK AREA PROTECTION SCHEMES

Four typical roadway work area protection schemes are illustrated.

- They include:
- Closure of left lane (on a divided or non-divided roadway).
- Closure of right lane.
- Closure of center lane of a one way roadway.
- Closure of two adjacent, lanes of a one way roadway.

Examination of schemes will guide maintenance crews in the required procedures.

III USE OF TRAFFIC CONTROL DEVICES

A General

Traffic control devices shall be properly installed prior to the commencement of construction or maintenance operations, and shall be continually monitored and properly maintained- The devices shall remain in place as long as construction or maintenance is in progress and shall be

THE PORT AUTHORITY OF NY & NJ

Tunnels, Bridges & Terminals

October 14, 2014

Mr. Thomas Dorazio
Senior Vice-President, Northeast ETC ASCGT
Xerox
375 McCarter Highway
Newark, NJ 07114

RE: Unprocessed Image Files in 2013 and 2014

Dear Tom:

In August 2014, the Port Authority discovered that a number of image files had not been processed appropriately, beginning at least as far back as January 2013 and continuing through June 2014. There were 8,663 violation images not processed during this period. The Authority requested that Xerox investigate and provide a report of their findings.

Of these 8,663 unprocessed images, the CSC lost 3,046 images (Apr 2013 OBX, Jun 2014 GB/HT); the toll system lost 3,161 images (Aug 2013 OBX, Nov 2013 LT, May 2014 all plazas, after duplicates removed); and 2,456 (1,725 in 2013 and 731 in 2014) images were lost in transmission from the toll system to the CSC. For this last group of missing images, Xerox did not analyze the data and consequently we could not determine from Xerox's report the cause of the problems or whether the problems occurred at the CSC or at the toll system.

Of the 8,663 images lost, 2,016 occurred in June 2014. At the Authority's direction, Xerox processed the June 2014 images for posting or violations noticing. Due to the age of the remaining images, the Authority feels it is not reasonable to process the remaining 6,647 images and is seeking damages as described in the following paragraphs.

Damages under the CSC Contract
As per Article 8.04 Actual Damages of Customer Service Center Contract #4600006947, the Authority is seeking a credit for actual damages related to lost revenue. Based upon Xerox's analysis of the lost images, and the Authority's analysis of 2013 and 2014 violations (which accounts for recovery levels), the Authority has calculated that the direct revenue loss (tolls and fees) caused by the CSC and/or related processes is $11,418.99 for the 1,030 images not processed in April 2013.

The Authority anticipates it will see a credit of $11,418.99 in the next monthly invoice for Contract #4600006947.

Damages under the In-Lane Maintenance Contract
As per Part II, Article 10 of the Integrated Toll System Contract #4600006009, the Authority is seeking a credit for actual damages related to lost revenue. Based upon Xerox's analysis of the lost images, and the Authority's analysis of 2013 and 2014 violations (which accounts for

2 Montgomery Street - 4th Floor
Jersey City, NJ 07302

recovery levels), the Authority has calculated that the direct revenue loss (tolls and fees) caused by the In-Lane System and/or related processes is $35,241.51 for 3,161 images not processed in August and November 2013, and May 2014.

The Authority anticipates it will see a credit of $35,241.51 in the next monthly invoice for Contract #4600006009.

Additional Damages

Finally, as per the Contracts and related Articles above, the Authority is seeking a credit for actual damages related to lost revenue (tolls and fees) of $13,402.02 for 2,456 images not processed, for reasons that have not been identified by Xerox, during the remainder of the period. Since no analysis was performed on these images, the Authority's analysis accounted for recovery levels and for potential duplicates.

The Authority anticipates it will see a credit of $13,402.02 in the next monthly invoice for either Contract #4600006947 or Contract#4600006009, or some combination thereof.

Calculation Parameters

	Description	2013	2014
A	Number of lost transactions by Category	Above	Above
B	Toll Rate – Average Toll Rate for Transactions posted to Accounts	$11.23	$12.60
C	Violation Toll Rate	$13.00	$13.00
D	Violation Admin Fee Rate	$50.00	$50.00
E	Violation Toll Recovery Rate based on dollars	35.90%	30.80%
F	Violation Fee Recovery Rate based on dollars	13.10%	11.00%
G	Violation Tolls Posted to Accounts Rate based on transactions	59.50%	57.30%
H	Violation Transaction Notice Rate based on transactions	39.30%	40.00%
I	Duplication Transaction Rate for the unknown transactions	51.90%	51.90%

The above table provides the key parameters used by the Authority to arrive at the lost revenues (tolls and fees) for each grouping of lost transactions.

If you have any questions, please contact me.

Sincerely,

Allison L. C. de Cerreño, Ph.D.
Program Director, Toll Systems & Revenue Operations

cc: George Karabin and Carlos Mata, Xerox
Steven Knapp and Charles Fausti, PANYNJ

Port Authority New York and New Jersey

Technical Proposal

Strategic Toll System Upgrade Initiative

Transportation Solution Systems, TSS

Mark Cantelli, VP, CTO
Mark.cantelli@Xerox
301 820 4205 (office)
301 820 4495 (fax)
240 305 2228 (cell)

Xerox State and Local Solutions
11404 Milestone Center, 4th Floor
Germantown, MD 20874 USA

Xerox Transportation Systems & Services, TSS

Revision History

Revisions of this document are listed in chronological order. There is no relationship between the document release number and the software release number.

Version Date	Changes	Version #
August 2013		1.0
October 2013		2.0
November 2013		3.0
November 12, 2013	Revised Option 5	4.0
November 15, 2013	Revisions per comments dated November 12, 2013	5.0
January 13, 2014		6.0

Document Ownership

Owner	Mark Cantelli, VP, CTO
Author	Mark Cantelli, VP, CTO

Important: This document has been through a formal review process. To the best of our knowledge it is accurate. Xerox reserves the right to make further modifications.

This material contains proprietary information Xerox owns. There is an understanding that you will not disclose to others, use or copy anything in this document without our written authorization.

Trademarks

All trademarks mentioned herein are the property of their respective holders.
©2014 Xerox Transportation Solutions Systems, TSS

TABLE OF CONTENTS

1 Executive Summary 2
2 Introduction 3
3 Lane Controller Upgrade 6
4 Replace the VES with a JAI VIS CAM1000 VES 8
4.1 Network Bandwidth Analysis – Future License Plate Recognition Processing ... 9
5 Replace the TOMS Overhead Laser Scanner with the Sick LMS 511 TP 10
6 Network Upgrade 11
7 Outerbridge ORT Lane System Upgrade 12
8 Close Up Lane Observation Video Monitoring 13
9 Lane Mode Sign Upgrade 13
10 Replacement of the ITCS Deposit Terminals and Associated Interface 14
11 ECH Storage Expansion for Images 15
12 Factory Acceptance, On-Site First Installation Testing and Lane Commissioning 18
12.1 Proposed Schedule 19
12.2 Proposed Milestone Payments 20
13 Deferment of Maintenance SLAs and Proposed Go Live SLAs 20
14 Assumptions 21
15 Appendix A. PANYNJ Strategic Upgrade Project Schedule 28
16 Appendix B. PANYNJ Strategic Upgrade Technical Proposal 31
17 Appendix C. PANYNJ Strategic Upgrade Technical Proposal Bill of Materials 32

1 Executive Summary

The Xerox proposal provides an upgrade to the PANYNJ and the traveling public with a quick and effective transition into a fully upgraded environment with features and functionality that meet (and often exceed) the solicited PANYNJ requirements. The innovative, cost effective, scalable, robust and reliable solution presented here will deliver that goal for you and your customers.

For your strategic toll system upgrade initiative of PANYNJ tunnels, bridges, and terminals, Xerox will provide all the equipment, software, installation services and testing. Xerox and its subcontractors will remove the existing lane computers and provide new lane computer hardware, upgrades to the LEC panel equipment and port the existing lane code from Unixware to operate on our current version of Red Hat Linux Enterprise operating system (the existing PANYNJ code will be ported to the Linux operating system).

Xerox will remove the existing Traffic Observation Management Sensor (TOMS) overhead laser scanner and replace it with our SICK LMS511 laser measurement system and modify the exiting PANYNJ AVC lane application to use the LMS51. Xerox will also remove the existing camera and illumination system and replace them with a JAI All-In-One violation enforcement camera system.

Xerox will upgrade the OBX ORT system to include new redundant HOT standby zone controllers with automatic failover capabilities consistent with Section 2.0, new VES equipment incorporating the JAI VIS Cam 1000 (one front and one rear camera per lane) consistent with Section 3.0, new JAI TNL-50 night flash with the internal VIS Cam 1000 illumination. Xerox will reuse the existing Idris smart loops and loop detectors and do not anticipated any replacements.

Xerox will install a new close up lane observation (CULO) video monitoring in-lane video camera in all lanes to provide the same capability you currently have to view and monitor traffic at the tolls lanes.

Continuing with the Xerox tradition of offering innovative technological electronic tolling solutions, the ETC Central Host (ECH) approach minimizes the risk of changing most critical and complicated components, the ECH Alpha Severs will continue to provide all the existing financial, cash management, plaza supervisor, reconciliation, and auditing applications by executing these functionalities on existing legacy ECH software and hardware platforms. The Xerox solution will add processing power, disk storage capability and secure FTP communications to the customer service center by adding new IBM x3650 M4 Linux Enterprise Servers and NetApp network array storage device with 8TB of mass storage, scalable to 25TB of mass storage.

Transition from one system and customer service operation to another is one of the most challenging tasks for any tolling project team. The primary goal of any transition must be to upgrade the infrastructure while ensuring continuity of service to the customer with minimal disruption, and to protect a continual revenue stream. The following sections provide details for how our solution will do exactly that for you.

2 Introduction

Xerox will provide all equipment, software, installation services and testing for the lane system upgrade as part of this Technical Proposal (TP) for the PANYNJ Tunnels, Bridges, and Terminals. The work will include:

- Upgrade to the lane controllers' equipment and software, violation enforcement system (VES) equipment and software including new conduit, overhead vehicle scanner (OVS) equipment and software,
- Replacement of the lane mode signs (LMS),
- Replacement of the ITCS LAN network equipment and network equipment interfacing with PAWANET including new connections to all the existing fiber connections,
- Replacement of the 8 lane enclosure cabinets at the Goethals Bridge with NEMA 4X stainless steel enclosures,
- Upgrade to the ECH with a new image server
- Complete upgrade to the Outerbridge Crossing ORT lane equipment and software

Table 1 lists the major benefits and improvements by section number of the new and retrofitted items to the PANYNJ toll collection system for this strategic toll system upgrade initiative.

Table 1. System Item List and How Each Benefits and Improves PANYNJ ETC

Sec. #	Item	Benefit and Improvement
3.1	Lane Controller Hardware	Upgrading the lane controller and peripheral hardware as detailed in the TP removes obsolescence issues and provides forward compatibility for video tolling. Higher availability Greater reliability, less failures Higher availability Full manufacturer support, lower replacement and repair costs with 5-10 years serviceability Removes obsolescence from the system,
3.2	Lane Controller Software	Upgrading to the Linux operating system provides forward compatibility, maintainability in addition to improved performance capabilities, and increases system's serviceability lifecycle Upgrade device interfaces as detailed in the TP, Phoenix DIO, and network based EN Cameras, overhead scanners, and internal components (multi-core processors, larger disk spacing, CPU, RAM and storage capabilities) to support video tolling and improve system performance capabilities. Conversion to network based software interfaces removes

Sec. #	Item	Benefit and Improvement
		obsolescence issues associated with SSIO card, frame grabbers including dependencies on lower level OS-specific device drivers Backwards compatibility with existing PANYNJ ECH solution removes costs associated with upgrading ECH software. Enhanced logic to reduce issues associated with tag correlation by applying event based logic as detailed in the TP. Backwards compatibility for existing collector interfaces which removes retraining requirements. Provides backward compatibility to existing ECH solution using BEA MessageQ. Greater access to support, and routine updates and patches Replatforming provides greater access to a larger set of supported hardware components
3.3	Violation Enforcement System	Improve image quality performance by replacing existing cameras low resolution cameras and frame grabbers with high resolution (2056x 2048) VIS 1000 cameras, which support a 75ms frame rate and adaptive light sensing technologies. Upgraded images meet/exceed LPR image quality requirements Higher accuracy respectively, resulting in improve related performance Removes obsolescence from the system, lower risks Full manufacturer support, lower replacement and repair costs 5-10 years serviceability
3.4	Overhead Laser Scanner	SICK 511 Laser Measurement System provides higher scan rate and multi sensor capabilities, enabling detailed profile data to more accurately identify vehicle attributes, filter out noise due to weather and improve separation performance. LMS 511 has a 10ms scan rate, provides enhanced support for data filtering (fog, rain, etc. using multiple sensors and pulse data). Application layer processing of raw scanner beam data enables customizations and enhanced algorithms for processing specific vehicle types and anomalies. Removes obsolescence from the system, lower risks Higher accuracy respectively, resulting in improve related performance Full manufacturer support, lower replacement and repair costs 5-10 years serviceability
3.5	Network	The network speed is being increased from 10Mbps to 100Mbps which enable support for video tolling (transferring of higher resolution images where the compressed high resolution image

Sec. #	Item	Benefit and Improvement
		sizes will have a typical size of 200K per images). Removes obsolescence from the system, lower risks Full manufacturer support, lower replacement and repair costs 5-10 years serviceability
3.6	OBX Open Road Tolling Upgrades	Upgrading to a high availability, network based redundant solution. Minimizes down time via providing automated failover capabilities and redundant controller (e.g. one system can be updated while the other continues to process traffic). Removes obsolescence points such as SSIO. Redundant lane controllers are being provided as part of Xerox's high availability solution (refer to write up provided earlier). Digital I/O processing is being converted to a network compatible solution. VES is being upgraded to EN cameras requiring only a network interface (as opposed to discrete, serial and network interfaces and cabling in addition to both camera and VIC APIs. Higher availability Full manufacturer support, lower replacement and repair costs. 5-10 years serviceability.
3.7	Close Up Lane Observation Cameras	Upgrading COLU hardware and software to provide the same messages on legacy systems as currently supported on the ORT system via the text inserter. This provides enhanced audit capabilities for the conventional lanes via CULO video which will include text overlay of AVC, AVI and transaction data. Higher availability Full manufacturer support, lower replacement and repair costs 5-10 years serviceability
3.8	Lane Mode Sign	Upgrading LMS signs to remove obsolescence Higher availability Removes obsolescence from the system, lower risks Full manufacturer support, lower replacement and repair costs 5-10 years serviceability
3.9	Replacement ITCS Deposit & Supervisor Workstations	Addresses obsolescence issues with the deposit workstations and associated equipment. Higher availability Full manufacturer support, lower replacement and repair costs 5-10 years serviceability
3.10	ECH/CSC Interface	Proposed Enterprise Linux 6 Server will act like secure external interface with VECTOR 4 CSC for transfer of transactions and

Sec. #	Item	Benefit and Improvement
	(CSC CO #103)	Image files using secure file transfer. It will transfer Image file to CSC Secure FTP server. It will transfer Transactions Files(ST) to CSC Secure FTP Server It will receive Reconciliation Files (RT) from CSC for further processing.
3.11	ECH Storage Expansion for Video Tolling Servers	Inexpensive and secure solution to add extra processing power and 8TB disk space with RAID technology for video tolling with minimum changes to existing legacy ECH solution. Proposed Linux Image Server with 13 months online storage capability, which exceeds PANYNJ requirements. It will add extra processing capability to Legacy ECH systems by take care of Transactions transfer and Image transfer functionality. ECH 3 will transfer transactions files and image files at periodic intervals from ECH2 and transfer these files. Proposed Enterprise Linux Server Version 6, with disk size capability can be extended up to 100TB.

3 Lane Controller Upgrade

Xerox will remove the existing lane computers and provide new lane computer hardware, upgrades to the LEC panel equipment, port the existing lane code from Unixware to operate on our current version of Red Hat Linux Enterprise operating system (the existing PANYNJ code will be ported to the Linux operating system (OS), and appended with any new modules) and provide:

- Project management
- Software support for analysis
- Testing and inspection and demonstration
- Equipment installation services
- Quality assurance
- Testing
- Commissioning

This scope also includes the furnishing and installation of new lane controllers, modifying the PANYNJ lane application to integrate new components defined within, provide project management, software support for analysis, testing and inspection, and demonstration, equipment installation services, QA, test, system commissioning and a one year manufacturer's warranty on all equipment. Warranty labor will be provided using the existing maintenance personnel.

Xerox will also replace the Goethals lane controller electronic cabinets (LEC) with new NEMA 4x stainless steel cabinets, SCE-48XEL3712SSLP, from Saginaw Controls and Engineering along with the back panel assembly that will be populated with the same new components installed in the other stop and go lanes. Xerox will remove and dispose of the existing cabinets, install any other ancillary conduit or junction boxes necessary to complete the upgrade of these island LECs.

The new hardware will consist of a new industrial PC with following internal component upgrades:

- Lane Computer
  - Rackmount or Shelf mount Chassis 19”x21”x7”
  - PCI passive backplane
  - Redundant 400W hot swappable power supplies
  - Three cooling fans, one is hot swappable
  - Q77P6 i3/i5/i7 Quad Core SBC with VGA & Cooling Fan
  - Intel i5-2400 Quad Core 3.1GHz CPU
  - Dual 1000/100/10 NICS
  - 2 SATA 1T bytes drives of mass storage in RAID 1 configuration
  - EZ RAID dual hot swap drive
  - Comtrol Rocketport multiport serial card
  - 16G bytes of RAM
  - DVD Burner, Mouse and Keyboard
  - Red Hat Linux Enterprise OS
- LEC Panel Upgrades
  - 4 Channel loop detector with solid state outputs
  - Phoenix D I/O controller and relay modules
  - Removal of SSIO and legacy loop detector
  - Industrial 8 unmanaged Gigabit Ethernet switch
  - Fiber to copper network media converter
  - Ethernet switch +24VDC power supply
- Lane Application Refresh Includes: Requirements Analysis to identify specific scenarios and sequences for the changes to each lane configuration includes,
  - Mapping of TOM classification to new SICK classification
  - Identification and design of online diagnostics, MOMS alarms, and alarm priorities
  - Speed detection business rules, identification of event scenarios and potential vehicle processing anomalies, failure detection, failure handling, alarms, and alarm priorities
- SSIO real time software porting and testing for the Phoenix DI/O

- Legacy Code, script change for supporting new real time processes
- The Lane Controller will interface to the existing ECH without requiring any changes on the ECH notwithstanding the changes required
- Unit testing
- Factory Acceptance Testing at Xerox's Crofton, MD Test Facility
- Demonstration Testing as described in Section 13 on a PANYNJ production site
- Provide PANYNJ revisions to the Maintenance and Service Manual for review and approval. See 14 Assumptions at the end of this TP.

4 Replace the VES with a JAI VIS CAM1000 VES

Xerox will remove the existing camera and illumination system and replace them with the Xerox provided JAI All-In-One violation enforcement camera system. The new cameras will be installed on a new 5-foot stanchion at the existing camera locations. Xerox will provide new 2" island for the new composite JAI camera cable to be in compliance with NEC conduit spacing requirements.

This scope also includes the furnishing and installation of new camera composite communication and power cable, modify the PANYNJ VES lane application to integrate the JAI equipment, provide project management, software support for analysis, testing and inspection, and demonstration, equipment installation services, QA, test, system commissioning and a one year manufacturer's warranty on all equipment warranty labor will be provided using the existing maintenance personnel.

For the VES upgrade the new hardware will consist of the following:

- VIS-CAM-1000-AIO
- VIS Junction Panel, VJP-300, installed within the existing lane Electronics Cabinet (LEC)
- AC Power Supply Unit
- VIS-CAM-1000 Cable
- 5-foot Stanchion w/Transformer Base with mounting hardware
- Lane Application refresh includes: Software System, configuration setup, network setup, trigger point setup
- Real time process Porting code change
- Legacy code change for triggering and frame capture
- Process for image violation association
- Process for image transfer
- Integration testing
- Unit testing
- Factory Acceptance Testing at Xerox's Crofton, MD Test Facility

- Demonstration Testing as described in Section 13 on a PANYNJ production site

4.1 Network Bandwidth Analysis – Future License Plate Recognition Processing

As requested, and for the PANYNJ planning purposes, Xerox has included the network bandwidth requirement calculation for the potential implementation of LPR processing at the CSC.

Bandwidth Assumptions:
With the proposed VES camera for PANYNJ refresh, the LPR can work with a jpeg file directly from camera (jpeg compress ratio is about 1/20), and for PANYNJ Xerox assumes Xerox will transfer 5 images (1 front, 4 rear) per vehicle for legacy lanes and 4 images (1 front, 3 rear) per vehicle for OBX ORT lanes. The analysis included the bandwidth requirements for peak times at each plaza which can be extrapolated for worst case requirements for a 24 hour period.

Bandwidth Calculations Notes: Each vehicle with compressed jpg images is approximately 1.25 M size of images to be transmitted from the lanes to the ECH

Example: GWB UL - Peak traffic for October 21st, 4:00pm to 8:00pm
Peak Period (4 hours) Trx = 2750 Cash Trx+348 Mismatch = 3,098 transaction with images 5MByte image * (1/20 compression)* 3098*5 images)/(4*3600 s)*8 bits per byte = 2.25M bps at peak hour.

PLAZA	Start Time*	End Time*	# Cash & Violations	# Class Mismatches (ETC Payment Types)	Image Size/Vehicle (MB)**	Total Bytes (MB)	Bandwidth Rq'd Mbps
BB	6am	10am	243	32	1.25	343.75	0.200248889
GB	6am	10am	1204	205	1.25	1761.25	1.026002489
GWBL	6am	10am	2259	145	1.25	3005	1.750539378
GWBP	6am	10am	578	47	1.25	781.25	0.455111111
GWBU	6am	10am	2239	758	1.25	3746.25	2.1823488
HT	6am	10am	1900	320	1.25	2775	1.616554667
LT	6am	10am	2215	965	1.25	3975	2.315605333
OBX	6am	10am	1107	111	1.25	1522.5	0.886920533
BB	4pm	8pm	321	24	1.25	431.25	0.251221333
GB	4pm	8pm	1428	105	1.25	1916.25	1.116296533
GWBL	4pm	8pm	2174	77	1.25	2813.75	1.639128178
GWBP	4pm	8pm	572	59	1.25	788.75	0.459480178
GWBU	4pm	8pm	2750	348	1.25	3872.5	2.255894756
HT	4pm	8pm	1896	135	1.25	2538.75	1.478929067
LT	4pm	8pm	1171	816	1.25	2483.75	1.446889244
OBX	4pm	8pm	1104	61	1.25	1456.25	0.848327111
Total			**23161**	**4208**	**1.25**	**34211.25**	**9.9647488**

5 Replace the TOMS Overhead Laser Scanner with the Sick LMS 511 TP

Xerox will remove the existing Traffic Observation Management Sensor (TOMS) overhead laser scanner and replace it with our SICK LMS511 laser measurement system and modify the exiting PANYNJ AVC lane application to use the LMS511 and provide:

- Project management
- Software support for analysis
- Testing and inspection and demonstration
- Equipment installation services
- Quality assurance
- Testing
  Commissioning

This scope also includes the furnishing and installation of a new Overhead Vehicle Sensor (OVS) SICK LMS511, modify the PANYNJ lane application to integrate the new scanner equipment, provide project management, software support for analysis, testing and inspection, and demonstration, equipment installation services, QA, test, system commissioning and a one year manufacturer's warranty on all equipment warranty labor will be provided using the existing maintenance personnel.

Any patch to the canopy structure due to voids occurring for the TOMS replacement will be done following the professional engineering drawings that will provide matched material and color of the canopy or fascia.

As an additional service, Xerox will audit each lane to determine the status of the existing loops, treadles and cabling. Xerox will provide a report on the status of each lane's AVC equipment and the recommended any changes if needed.

The new Overhead Vehicle Sensor will consist of the following:

- SICK LMS511-1046135
- Sick LMS511 Laser Dust Cover, 2063050
- Sick LMS511 Laser Power Cable, 6036161
- Sick LMS511 Laser Communication Cable, 6036158
- Sick LMS511 Laser Mounting Set Quick, 2018304
- Traco Power Supply, TSP360-124

Lane Application refresh includes:

- Business rules development using the Sick LMS511, requirements documentation, mapping new scanner data to existing PANYNJ classes, degraded mode rules (TOMS-

provided specific classes, SICK provide geometric attributes L/W/H, number of units, combine treadle data with SICK for proper classification). Xerox has assumed that the business rules and degraded mode processing would be similar as the current overhead laser scanner.

- Develop and test interface for LMS 511to new lane controller
- Scanner Software porting and interface to Legacy
- Implement lane business rule and classification changes (from TOMS&Treadle to SICK&Treadle classes) in PANYNJ code
- Remove TOMS data from speed processing and incorporate the Exit and VES loop data for speed reporting
- Unit testing
- Factory Acceptance Testing at Xerox's Crofton, MD Test Facility
- Demonstration Testing as described in Section 13 on a PANYNJ production site

6 Network Upgrade

Xerox will furnish and replace all the existing DEC-90FL fiber optic (FO) network repeaters from the lane equipment cabinet (LEC) to the plaza network rack with new Cisco Catalyst 3750V2 24 100BASE-FX WS-C3750V2-24FS-S fiber optic switches (see catalog cut sheet at, www.cisco.com) and WS-C3750V2-24TS-E Ethernet copper switches for the Teleport and PATC and the re-termination of all the existing multi-mode and single mode connections related to this network with new SC connectors, or replace the ST patch cables with ST/SC patch cables.

Xerox will also furnish and replace the DEC-90T 10BaseT network repeaters associated with the ITCS system with new Cisco SG102 switches.

Table 2 lists the scope of this effort is limited to the location and quantities for this network upgrade.

Table 2. Milestone Items and Payment by Percent of TCV

Item	DEC 90FL	DEC 90T	Cisco SG102024 Ports	Cisco Catalyst 3750 C3750V2-24FS-S 24 Ports Fiber	Cisco Catalyst 3750 WS-C3750V2-24TS-E 24 Ports Fiber
HT	3	1	1	1	0
LT	4	1	1	1	0
GB	3	1	1	1	0
OBX	2	1	1	1	0
BB	1	1	1	1	0

Item	DEC 90FL	DEC 90T	Cisco SG102024 Ports	Cisco Catalyst 3750 C3750V2-24FS-S 24 Ports Fiber	Cisco Catalyst 3750 WS-C3750V2-24TS-E 24 Ports Fiber
GWBPIP	3	1	1	1	0
GWB Upper	3	1	1	1	0
GWB Lower	3	1	1	1	0
Training	0	1	1	1	0
PATC	0	1	1	0	1
Teleport	0	1	0	1	1
Total	22	11	10	9	2

The network connections will be tested by a licensed union electrician certified to perform fiber optic network cabling. New copper to FO patch cables and FO converters will be provided to connect the existing 10BT plaza toll collection equipment NICs to the upgraded FO network at the Ethernet switch.

The connection from the lane to the plaza will be accomplished by the addition of a new Ethernet switch with two fiber optic strands in each lane electronics cabinet to the new Cisco fiber switch (see lane controller section 2.0). This change will increase the bandwidth capacity from the LEC to the plaza from 10Mbps to 100Mbps.

7 Outerbridge ORT Lane System Upgrade

The OBX ORT system will be upgraded to the include new redundant HOT standby zone controllers with automatic failover capabilities consistent with Section 2.0, new VES equipment incorporating the JAI VIS Cam 1000 (one front and one rear camera per lane) consistent with Section 3.0, new JAI TNL-50 night flash with the internal VIS Cam 1000 illumination, and including external illumination, new networking equipment, new lane electronics panel consistent with the details in Section 2.0 and the appropriate lane system software upgrades will be incorporate into the OBX ORT system.

Xerox will reuse the existing Idris smart loops and loop detectors and has not anticipated any replacement effort of either component.

Xerox has reviewed the OBX ORT Software license agreement dated April 19, 2005 and will extend the current terms and conditions from September 28, 2015 to December 31, 2016 at a fee of $90,000.00. Payment terms are net thirty (30) days and to be invoiced at the start of the extended year.

8 Close Up Lane Observation Video Monitoring

Xerox will install a new close up lane observation (CULO) video monitoring in-lane video camera in all lanes to provide the same capability currently at the PANYNJ to view and monitor traffic at the tolls lanes. The system will use a Sony analog camera (PN: SSCG113A,

http://pro.sony.com/bbsc/ssr/cat-securitycameras/cat-cctv/?navId=4294966436+4294963588), housed in an all-weather Pelco housing (PN: EH3508,

http://www.pelco.com/sites/global/en/products/camera-solutions/range-presentation.page?p_function_id=9506&p_family_id=10240&p_range_id=2953) mounted on the VES stanchions using an adjustable Pelco camera bracket (PN: EM1009,

http://www.pelco.com/sites/global/en/products/camera-solutions/range-presentation.page?p_function_id=9507&p_family_id=10224&p_range_id=2879). The new CULO camera system will incorporate new Geovision GV- Data Capture Box V3E text inserter similar to that used at OBX today, recording devices and video playback monitors.

Our TP is limited to furnishing and installing the components listed above. Xerox will route CULO camera video signals to existing DVR/NVR and playback monitors or to PANYNJ provided DVR/NVR and playback monitors.

9 Lane Mode Sign Upgrade

The scope includes all labor and materials to remove the existing lane mode signs (LMS), and to furnish, install, integrate, and test the Daktronics AF-Galaxy 20mm RGB Outdoor LED Matrix, model number AF-355-48x128-20-RGB-SF LMS (see the attached specification sheets).

The new lane controller (Section 2.0) will be integrated with the LMS using Ethernet communications protocols. These signs are currently installed at the DRJTBA Ohio Turnpike, and PA Turnpike.

Xerox has analyzed the electrical requirements for the new signs and has not identified any requirement for improving the current electrical infrastructure for these signs. This assessment was based on the Vultron signs requiring 2.5KW @ 120VAC and the Daktronics will only require 1.2KW @ 120VAC. The weight of the proposed new Daktronics LMS is 280lbs.

Exhibit 1. Daktronic Lane Mode Signs on the Pennsylvania Turnpike

This TP assumes that the new LMS sign will be installed and tested within the same timeframes as the other upgrades in the TP.

10 Replacement of the ITCS Deposit Terminals and Associated Interface

For the deposit terminals upgrade, Xerox is proposing the replacement ITCS Deposit Terminal and associated interface equipment listed in Table 3. Xerox will procure, install and test the equipment listed below at each of the facilities. Integration or interfacing to the existing cash collection equipment, such as coin counters or currency counters is not anticipated in this TP. Integration with the existing PANYNJ proximity readers will be provided as part of this TP.

Table 3. Milestone Items and Payment by Percent of TCV

Description	Equipment Type	Quantity
Plaza Supervisor Stations	Lenovo ThinkCentre M71e 3167 - SFF - 1 x P G620 / 2.6 GHz - RAM 2 GB - HDD 1 x 250 GB - DVD - HD Graphics 2000 - Gigabit Ethernet - Windows 7 Professional 64-bit	16
Plaza Supervisor Stations	Monitors - Lenovo ThinkVision LT2252p - LED monitor - 22" - 1680 x 1050 - TN - 250 cd/m2 - 1000:1 - 5 ms - DVI-D, VGA, Display Port - business black - for ThinkCentre	16

Description	Equipment Type	Quantity
	M71; M80; M81; M90; M91; ThinkPad W530; ThinkStation C20; D20; E30; S20	
Receipt Printer	Thermal Printer Epson tm-t88v Ethernet	30
Drop Terminals	Lenovo ThinkCentre M71e 3167 - SFF - 1 x P G620 / 2.6 GHz - RAM 2 GB - HDD 1 x 250 GB - DVD - HD Graphics 2000 - Gigabit Ethernet - Windows 7 Professional 64-bit Monitors - Lenovo ThinkVision LT2252p - LED monitor - 22" - 1680 x 1050 - TN - 250 cd/m2 - 1000:1 - 5 ms - DVI-D, VGA, Display Port - business black - for ThinkCentre M71; M80; M81; M90; M91; ThinkPad W530; ThinkStation C20; D20; E30; S20	30
Printer paper	Case of 50 #T318-230	8
Terminal Emulator	HP Neoware TeemTalk Terminal Emulator for Windows PCs or Servers - (v. 7)	46

11 ECH Storage Expansion for Images

As per our discussions about the ECH system upgrade for video tolling, Xerox will provide all labor, materials. Xerox considered the maturity and importance of the ETC Central Host (ECH) and considered the effort involved in upgrading this system to be video tolling ready. Our approach is inexpensive and secures solution to add extra processing power and disk space for video tolling with minimum changes to existing legacy ECH solution as shown in exhibit 2.

The scope of this work will include the following:

1) Xerox will maintain the current state and functionality of the existing legacy ECH systems.
2) To extend the existing ECH systems video tolling capability and secure external system interface capability, Xerox will add new IBM x3650 M4 Linux Enterprise Server with today's server class technology.
3) Xerox will add new external multiple array 8TB NetApp Storage Array, scalable to 25TB, with RAID technology to expand ECH systems images retention capability up to 13 months.
4) The newly added Linux system will act like store and forward server to VECTOR CSC/Back Office systems for Transaction files (ST) and Image files at regular intervals from existing legacy ECH systems using Secure File Transfer (SFTP).
5) The newly installed Linux server receives transaction reconciliation files (RT) from VECTOR CSC/back office over secure file transfer and forward same file to existing legacy ECH systems.
6) The Existing ECH2 Server Data backup functionality will be retained. No data backup will be provided for ECH3 as this data will be available in VECTOR CSC/back office and at the lane controller level.

The Xerox approach is to minimize the risk of changing most critical and complicated components that continue all the existing financial, cash management, plaza supervisor, reconciliation, and auditing applications by executing these functionalities on existing legacy ECH software and hardware platforms and adding extra processing power, disk storage capability and security by adding new Linux Enterprise Servers.

Given these high risk activities and the need for continuing operations during the upgrade, Xerox has decided to expand the storage capacity of the ECH to accommodate the potential rollout of video tolling, in lieu of upgrading the ECH system as shown in Exhibit 2.

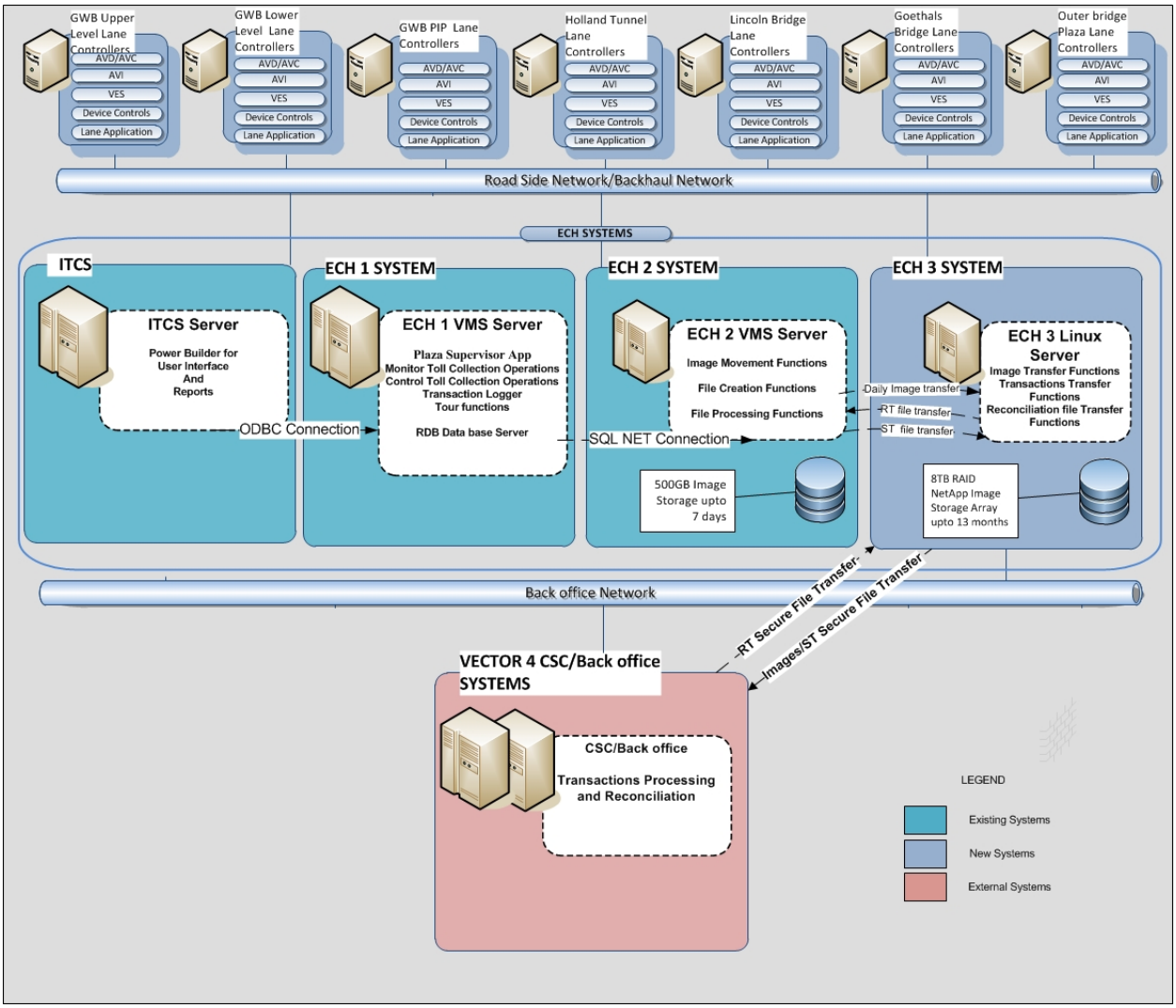


Exhibit 2: Existing ECH and Proposed Upgrade Logical Representation

This solution includes all labor and materials to furnish, install and test the upgraded storage array depicted in the diagrams above. Presently, existing ECH image data, operating system and

application software are hosted by HSZ40 based disk storage array. None of these components will be modified. The current legacy storage array and controllers are at capacity and provided no expansion capability.

The software environment of the ECH image server is OpenVMS Alpha version 6.2-1H3 running on an Alphaserver 4100 server. Proposed new ECH 3 will be deployed on state of the art new up to date IBM server technology with Linux Enterprise Operating system with new application software mentioned in Exhibit 2.

Exhibit 3 shows the existing, and our proposed solution, an upgraded ECH system.

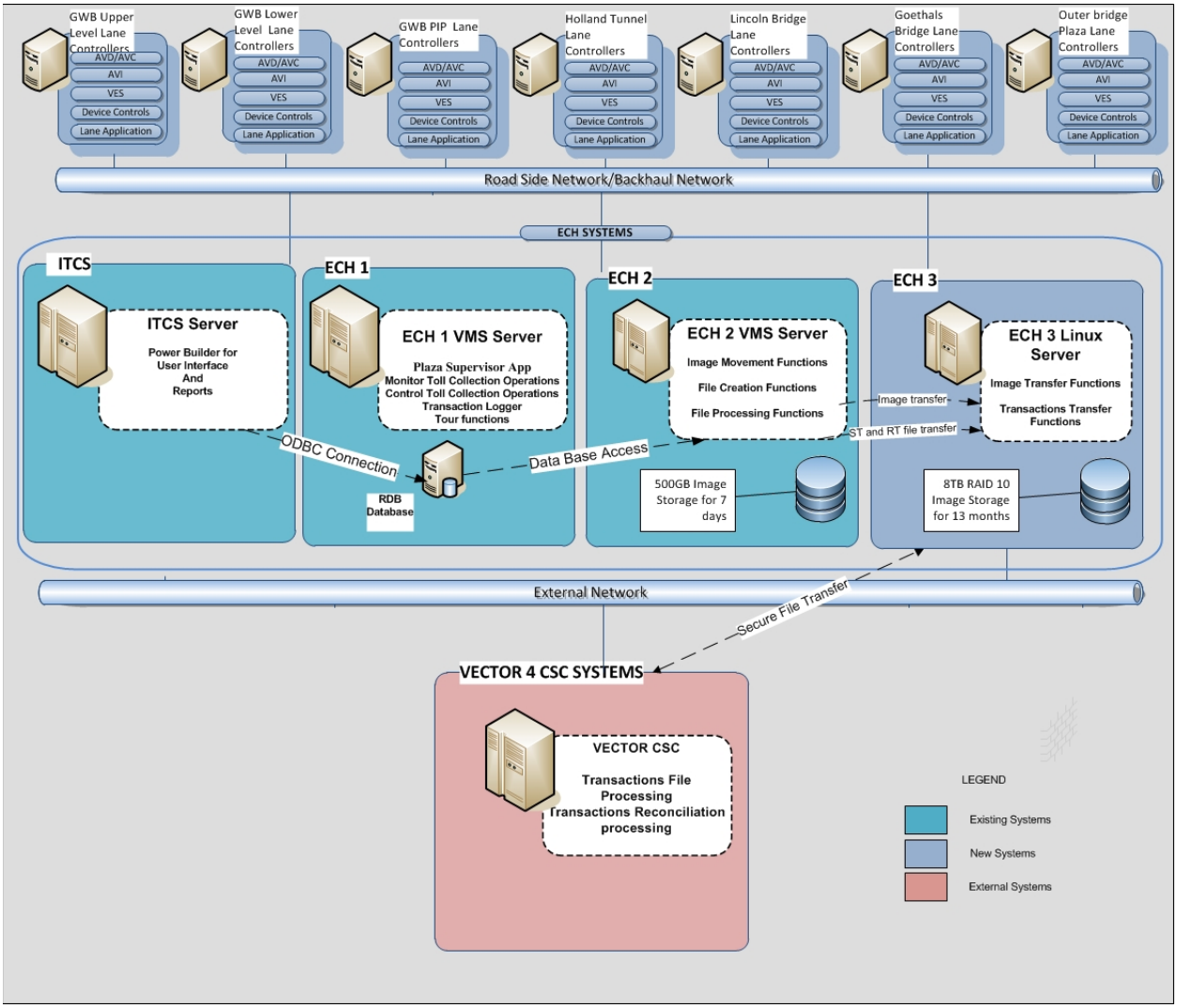


Exhibit 3. Updated ECH System Diagram

12 Factory Acceptance, On-Site First Installation Testing and Lane Commissioning

The Factory Acceptance Test (FAT) will be conducted at our Crofton MD Testing facility. It is a one-week test that incorporates all the system changes as well as regression testing of the system components that did not change. FAT is intended to be a scripted test that using PANYNJ approved test procedures and is witnessed by representatives of the PANYNJ.

Test vehicles of various classes are used in the FAT to simulate typical traffic situations at the PANYNJ facilities. Issues are tracked and resolved using our JIRA system for Configuration Management. Xerox will submit a Test Report for your review.

The On-site First Installation Test (OFIT) is a one-week test and is conducted in a controlled environment at a PANYNJ production site to demonstrate the new components and existing functionality under near production conditions. Xerox recommends a lower-volume site such as an OBX or GWB PIP lane.

The OFIT incorporates an agreed-upon subset of the FAT procedures for lane/plaza/host validation and additional procedures for testing and validating connectivity to the Plaza/Host systems and the BOS. Test vehicles are used in the OFIT to validate AVC, VES, and AVI compliance. The OFIT also includes validation of agreed-upon system generated reports. The OFIT is witnessed by the PANYNJ. An OFIT report is submitted for review by the PANYNJ.

Field Check-Out Tests (FCOT's) and lane commissioning are conducted as each tolling site (lane) is installed to ensure the system and communications are working correctly. Agreed-upon subsets of FAT/OFIT procedures are used to validate system operation and requirements compliance for each lane and plaza. A completed FCOT checklist and Commissioning Report are submitted after the completion of each plaza for the review of the PANYNJ. The testing component of this TP also includes:

- Submit existing demonstration test scripts for review
- Provide Factory Acceptance Test for the system upgrade
- Conduct demonstration testing on the designated PANYNJ test lane
- Provide existing Field Checkout and Test and commissioning procedures. Given that these are existing procedures and have been conducted for several clients, Xerox has assumed minimum revisions (2) will be required.
- Provide existing Commissioning Testing procedures. Given that these are existing procedures and have been conducted for several clients, Xerox has assumed minimum (2) revisions will be required.
- Conduct field checkout and test procedures (FCOT) and commissioning test on each lane

12.1 Proposed Schedule

Table 4 lists the estimated timeframe for us to develop, test, install and commission the upgraded system. (See Attachment A. PANYNJ Strategic Upgrade Project Schedule.)

Table 4. Milestone Items and Payment by Percent of TCV

Timeline	Start Month	End Month	Dur-ation	Scope
NTP	1	1	1	Assume March 2014 Start
Requirements	1	2	2	TP for Lane Controllers, VES Camera, Scanner, Network Equip, CCTV
Design	2	3	2	
Development	3	5	3	
Procurement 1	5	6	2	First procurement for FAT related equip, and long lead items
Internal Testing	6	7	2	
Crofton Setup for FAT	7	7	1	
FAT Testing	8	8	1	
Procurement 2	7	8	2	Second procurement for remaining implementation related equip
Installation/Deployment	9	14	6	OFIT on First lane
GWBP Plaza (7)	9	9	1	Install 2 lanes at a time. FCOT after each lane
GWBU Plaza (12)	10	11	2	Install 2 lanes at 2 plazas at a time for remainder of installation period
GWBL Plaza (11)	10	11	2	
LT Plaza (14)	12	13	2	
HT Plaza (9)	12	13	2	1.5 months
GB Plaza (8)	13	13	1	
OBX Plaza (5, 2 ORT)	13	13	1	
BB Plaza (4)	14	14	1	
Reduced SLA Period	15	17	3	SLA deferment during burn-in mode.
Warranty Start			1	
Warranty End			1	

12.2 Proposed Milestone Payments

Table 5 lists the milestone phases of the upgrade project by percent of total contract value (TCV).

Table 5. Milestone Items and Payment by Percent of TCV

Item	Description	% of TCV
1	NTP – Mobilization	15%
2	Approval of Requirements Matrix and Design materials	20%
3	Completion of Factory Acceptance Test (FAT)	20%
4	Installation and commissioning of First Site	10%
5	Commissioning per lane	.5%/lane
6	Start of warranty	1%

13 Deferment of Maintenance SLAs and Proposed Go Live SLAs

The new image reject rate calculations are based on the following factors:

1. Thirteen (13) months of 48-hour reject rate data was compiled for each plaza. This data spanned September 2012 to September 2013.
2. For each plaza:
   a. This data was sorted from lowest to highest 48 hour rejected image values
   b. Outliers (data that was markedly different in value from the others of the sample at the bottom or top end of the range) were discounted.
   c. Calculations were completed assuming a 25% improvement in image rejections.
3. From these calculations, Table 6 provides values that were determined and recommended as the new contractual 48 hour image rejects rate targets.

Table 6. Image Rejection Rate Service Level Agreement

	Contract-ual SLA	Existing Contract-ual Require-ment	Proposed SLA Adjustment to Plazas Being Converted	Proposed SLA Post 90-Day Commission-ing as of 2013-12-18	Proposed SLA Post 90 Day Commiss-ioning as of 2014-01-08 Start of Adjustment Duration Period
	Image Rejection Rate by Plaza				
6a	BB	13.50%	18.5% + LDs threshold set to $1,000	10.50%	10.35% + LDs threshold set to $2,000
6b	OBX	13.50%	18.5% + LDs threshold set to $1,000	11.50%	10.60% + LDs threshold set to $2,000
6c	GWBL	13.50%	18.5% + LDs threshold set to $1,000	10.50%	6.25% + LDs threshold set to $2,000
6d	GWBP	13.50%	18.5% + LDs threshold set to $1,000	10.50%	6.30% + LDs threshold set to $2,000
6e	HT	13.50%	18.5% + LDs threshold set to $1,000	11.50%	11.50% + LDs threshold set to $2,000
6f	LT	13.50%	18.5% + LDs threshold set to $1,000	11.50%	11.35% + LDs threshold set to $2,000
6g	GB	19.00%	24.0% + LDs threshold set to $1,000	14.00%	13.00% + LDs threshold set to $2,000
6h	GWBU	25.0%	30% + LDs threshold set to $1,000	20.00%	15.20% + LDs threshold set to $2,000

14 Assumptions

- Maintenance of traffic (MOT) will be provided by Xerox and will comply with the PANYNJ MOT requirements.
  a. Xerox assumes that 2 lanes at two plazas can be closed during normal business hours for the conduct of this TP, and 3 adjacent lanes during off-hours. Xerox further

assumes that the lane under work will remain closed for the duration of these upgrades without being returned to service. (See Attachment A, PANYNJ Strategic Upgrade Project Schedule.)

b. Toll lanes shall not be taken out of service at the George Washington Bridge Upper Level, Lower Level or PIP plazas simultaneously. Toll lanes shall not be taken out of service at the Goethals Bridge and Outerbridge Crossing simultaneously.
c. Construction at the Lincoln Tunnel XBL shall only be performed during 1100PM to 5:00AM. Subject to the time restrictions noted above, the lane shall be open to vehicular traffic by 5:00 AM daily. The existing Lincoln Tunnel XBL Lane system must remain functional throughout construction during operational hours until such time that a cut over to the new XBL lane system can be completed during overnight hours and the new XBL lane system can be put into production.
d. As each lane is taken out of service, according to the staging plan below, it will remain out of service until work is completed and the contractor returns the lane to service.

- Existing Detail Design Documentation (DDD) or related documentation will be updated to reflect the new design modifications pertaining to the Lane Controller, VES and, the AVC functionality and system diagrams and drawings. Xerox has assumed one review of no more than 10 working days and an additional revision of the document. The PANYNJ will provide comments using a Comment Disposition Matrix (CDM) to which Xerox will provide their responses to comments. Xerox's comment responses will require approval prior to any revisions to the document. The approval of this document or any document related to this TP will not prevent the start of implementation or the receipt of milestone payments.
- Expedite the delivery of the updated PANYNJ Detailed Design Document (DDD) within 60 calendar days after Notice-to-Proceed (NTP) (by Month 3).
- The PANYNJ will work with Xerox to expedite the submission of the administrator manuals by month 5
- The PANYNJ will be available for discussions on requirements, business rules, and other discovery within 10 business days of NTP.
- All network switches and end equipment placed on the PAWANNET network as part of this proposal, Xerox will be responsible for preventive (excluding real-time monitoring), corrective, and emergency maintenance of the network equipment.
- PANYNJ is responsible for providing all IP address schemes to accommodate the new network equipment.
- Equipment and software maintenance is estimated through the term of the Maintenance Extension CO ending December 31, 2016.
- Given the direction to increase the capacity of the ECH in lieu of the proposed solution, Xerox has been able to obtain costs estimates to furnish the necessary equipment for what is considered retired equipment for some time. Xerox has also been able to obtain estimates for long-term hardware maintenance for the new storage array, controllers, and

related storage items. In the event that this maintenance estimate increases over the term of this agreement, Xerox will require an equitable adjustment in the proposed price.

- Maintenance and Service manuals will be updated as required for Xerox and Xerox Subcontractor technicians to conduct day to day maintenance activities. Xerox has assumed one review of no more than 10 working days and an additional revision of the document. The PANYNJ will provide comments using a Comment Disposition Matrix (CDM) to which Xerox will provide their response to comments. Xerox's comment responses will require approval prior to any revisions to the document. The approval of this document or any document related to this TP will not prevent the start of implementation or the receipt of milestone payments.
- Xerox will provide the disposal of removed equipment and components.
- All work described in this TP will be conducted or performed during normal business hours, 7:30am – 6:00pm Monday through Friday.
- No work or tasks associated with the Bayonne Bridge Navigational Clearance improvements are included in this TP.
- Xerox assumes that there are no special noise abatement treatments required in the performance of this TP.
- Xerox assumes that the selected replacement equipment and components will not require specific or dedicated environmental testing or special unit testing to validate or confirm the manufacture's stated specifications.
- Xerox assumes that the new lane controller will not require a new Lane Electronic Cabinet and that the existing cabinet will not require material or structural remediation of any type.
- Xerox will provide signed and sealed drawings for both the electrical and structural requirements of the proposed SICK LMS -511 OVS. Structural design and analysis will include the SICK mount, mounting hardware, and inspection of the existing OVS mounts. It is assumed that the existing connection to the canopy and canopy structure does not require additional analysis or design given the reduced (TOM=27.2lbs versus SICK=8.5lbs) weight requirements.
- Repairs to the canopy fascia due to equipment relocation will done by patching with metal plates, secured using sheet metal screws and painted to match existing canopy color.
- All conduit for the VES cameras will be new and the concrete island will be trenched for the new conduit and concrete will be patched to match existing toll island surface
- The lane loop, treadle, and treadle frame audit within this option is limited to visual inspection, photo-documentation if needed, and a final audit (findings) report. No remediation's for these findings or any findings are included in this estimate.
- For the LMS sign replacement the price includes the material, installation and power and communication cabling. Xerox will provide signed and sealed drawings for both the

electrical and structural requirements of the proposed Lane Mode Signs (LMS). Structural design and analysis will include the LMS mount, mounting hardware, and inspection of the existing LMS mounts. It is assumed that the existing connection to the canopy and canopy structure does not require additional analysis or design given the reduced (Vultron=>800lbs versus Daktronics = 280lbs) weight requirements.

- Test equipment for the factory acceptance test will be new and unused.
- The equipment used for the factory acceptance test will be un-installed from the Crofton test site and will be installed in a production lane at the PANYNJ bridges and tunnels.
- OBX ORT – Xerox assumes that the existing loops and loop detectors are in acceptable working order and no new loops or detectors are required.
- The scope assumes that the new LMS sign will be installed and tested within the same timeframes as the other upgrades in the TP.
- Spare parts for the replaced equipment have been included for the upgraded equipment in this proposal. Current spare parts levels in the existing maintenance agreement have not been adjusted. Spare parts levels for the upgrade proposal are at 5%.
- Per the email dated October 22, 2013 from James Summerville, Contracts Specialist for the PANYNJ, SLA and associated liquidated damages will be reduced per the attached scheduled labeled, "PANYNJ SLA Adjustment Template 2013-10-V3B final.xls."
- This TP is only to port the existing code to the newer platform and integrate new devices to address obsolescence and provide forward compatibility, no new logic is anticipated.
- This TP is limited to software modifications associated with switching from timer to event based logic. Based on prior discussions with PANYNJ, it is assumed that the scope is limited to the following two changes:
  1. Modify the traditional lane software to generate E-ZPass or Flush (configurable) transactions for tag reads that remain in the queue for more than a configurable number of milliseconds when all 3 lane loops are low for more than a configurable number of milliseconds.
  2. Modify the traditional lane software to generate a flush transaction for vehicles that remain in the queue for more than a configurable number of milliseconds when all 3 lane loops are low for more than a configurable number of milliseconds.
- There are no performance requirements for speed detection with PANYNJ.
- There is no convoy support in AET lanes/modes.
- There are no changes to the lanes for special or escort support in AET lanes/modes.
- There are no changes to lanes for carpool in AET lanes/modes.
- There is no carpool processing in AET lanes/modes.
- Video tolling mode will be implemented on both the conventional and ORT lanes.
- The plaza supervisor workstation does not display fares .

- References to CTH interface points in CO 103 are not within the scope of this change order and that the ECH is only interfacing with the Xerox back office system.
- The same version of MessageQ will be used on the ECH and the ORT client version will be deployed to all conventional lanes.
- For CO103 - Section 6, #1 - OpenVMS does not support Secure FTP, and given the security requirements of the CSC a FTP port will not be open and the CSC will be required to pick up the files from the ECH.
- Xerox assumes the Lane Business Rules changes are limited to the following parameters: Scanner classification (geometry based data mapped to TOM classifications, then mapped to PANYNJ classes)
    - Alarms (SICK, Phoenix DIO, VES, Redundant Controllers)
    - Failover processing (automated or manual)
    - Video Toll Transaction support
    - VT Mode processing
    - Remote command changes
    - Island mode processing and maintenance utilities
    - Patron feedback display modifications to support AET modes
    - Toll rate processing changes to support video tolling
    - Any changes to or from the AET modes are via remote commands or lane utilities and that there will be no changes to key switch logic or hardware.
- Our System Engineering and Software teams will deploy the software to the remaining sites after the initial testing is completed at the first location.
- PANYNJ will need to provide a test lane and Xerox assumes one of your crossing sites will be used for testing.
- PANYNJ will be responsible for providing equipment needed to construct the Factory Acceptance Test site for conventional lane testing including, but not limited to, MLT, receipt printers, PFDs, card readers, etc.
- PANYNJ will be responsible for their and their subcontractor travel costs related to the FAT and OFIT testing.
- If any additional issues are encountered during the testing that are outside of the TP as listed in prior assumptions, you will have the option of having them addressed on a time and materials basis, via a new TP or by reverting back to the prior software version.
- This TP includes no operations and maintenance (O&M) estimates.
- No performance or payment bond is included for this TP.
- No asbestos or lead abatement work is included.
- Contaminated soil testing, excavation, and disposals are excluded
- No special insurance is included.
- No permits or fees are included.

- No DCA Permits or inspections are included.

ACCEPTED AND AGREED

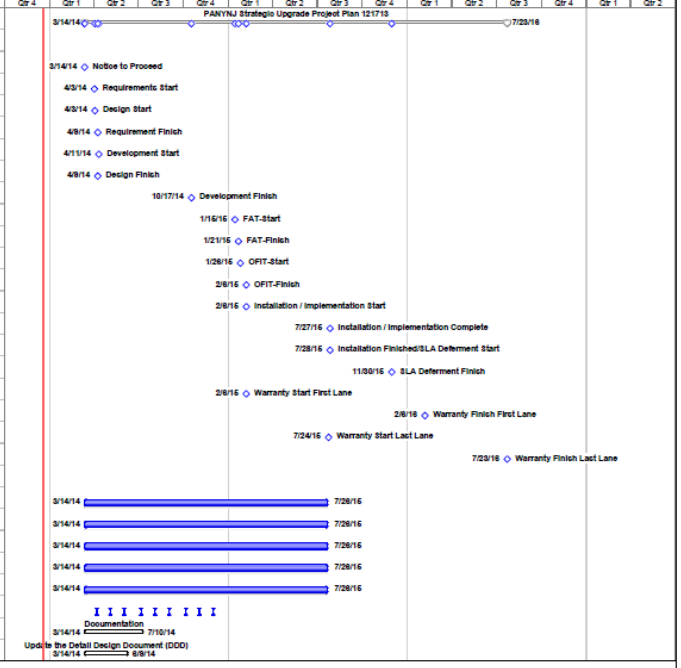
Xerox - Americas Commercial and State Government Transportation (AC&SGT)	**Port Authority of New York and New Jersey**
_____	_____
Signature	**Signature**
_____	_____
Name	**Name**
_____	_____
Title	**Title**
_____	_____
Date	**Date**

15 Appendix A. PANYNJ Strategic Upgrade Project Schedule

On the three pages below, Appendix A lists the tasks, major milestones, task duration, start date, finish date, and breakdown by quarter of this PANYNJ Strategic Upgrade Project Technical Proposal.

PANYNJ Strategic Upgrade Project Plan 121713

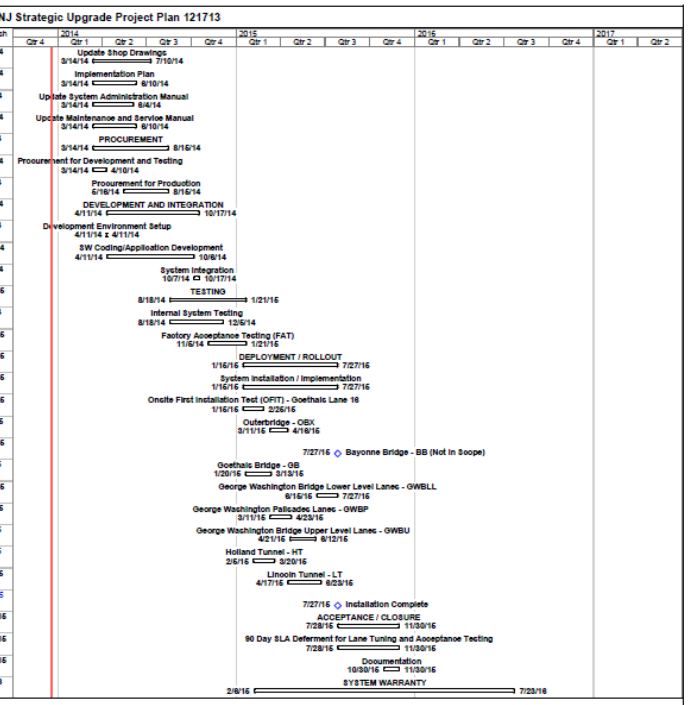
ID	Task Name	Duration	Outlook Start	Outlook Finish
0	PANYNJ Strategic Upgrade Project Plan 121713	588 d	Fri 3/14/14	Sat 7/23/16
1	MAJOR MILESTONES	588 d	Fri 3/14/14	Sat 7/23/16
2	Notice to Proceed	0 d	Fri 3/14/14	Fri 3/14/14
3	Requirements Start	0 d	Thu 4/3/14	Thu 4/3/14
4	Design Start	0 d	Thu 4/3/14	Thu 4/3/14
5	Requirement Finish	0 d	Wed 4/9/14	Wed 4/9/14
6	Development Start	0 d	Fri 4/11/14	Fri 4/11/14
7	Design Finish	0 d	Wed 4/9/14	Wed 4/9/14
8	Development Finish	0 d	Fri 10/17/14	Fri 10/17/14
9	FAT-Start	0 d	Thu 1/15/15	Thu 1/15/15
10	FAT-Finish	0 d	Wed 1/21/15	Wed 1/21/15
11	OFIT-Start	0 d	Mon 1/26/15	Mon 1/26/15
12	OFIT-Finish	0 d	Fri 2/6/15	Fri 2/6/15
13	Installation / Implementation Start	0 d	Fri 2/6/15	Fri 2/6/15
14	Installation / Implementation Complete	0 d	Mon 7/27/15	Mon 7/27/15
15	Installation Finished/SLA Deferment Start	0 d	Tue 7/28/15	Tue 7/28/15
16	SLA Deferment Finish	0 d	Mon 11/30/15	Mon 11/30/15
17	Warranty Start First Lane	0 d	Fri 2/6/15	Fri 2/6/15
18	Warranty Finish First Lane	0 d	Sat 2/6/16	Sat 2/6/16
19	Warranty Start Last Lane	0 d	Fri 7/24/15	Fri 7/24/15
20	Warranty Finish Last Lane	0 d	Sat 7/23/16	Sat 7/23/16
21	PROJECT MANAGEMENT	381 d	Fri 3/14/14	Wed 8/9/16
22	Project Delivery Management Oversight	500 d	Fri 3/14/14	Sun 7/26/15
23	SW Development Management Oversight	500 d	Fri 3/14/14	Sun 7/26/15
24	Integration and Testing Management Oversight	500 d	Fri 3/14/14	Sun 7/26/15
25	Engineering Management Oversight	500 d	Fri 3/14/14	Sun 7/26/15
26	QA/QC Management Oversight	500 d	Fri 3/14/14	Sun 7/26/15
27	Monthly Progress Meetings	346 d	Mon 4/7/14	Wed 8/9/16
46	Documentation	74 d	Fri 3/14/14	Thu 7/10/14
47	Update the Detail Design Document (DDD)	66 d	Fri 3/14/14	Mon 6/9/14



xerox
Confidential Information
Page 1
Wed 12/18/13

PANYNJ Strategic Upgrade Project Plan 121713

ID	Task Name	Duration	Outlook Start	Outlook Finish
71	Update Shop Drawings	74 d	Fri 3/14/14	Thu 7/10/14
80	Implementation Plan	68 d	Fri 3/14/14	Tue 6/10/14
91	Update System Administration Manual	62 d	Fri 3/14/14	Wed 6/4/14
100	Update Maintenance and Service Manual	68 d	Fri 3/14/14	Tue 6/10/14
111	PROCUREMENT	99 d	Fri 3/14/14	Fri 8/15/14
112	Procurement for Development and Testing	20 d	Fri 3/14/14	Thu 4/10/14
115	Procurement for Production	60 d	Fri 5/16/14	Fri 8/15/14
118	DEVELOPMENT AND INTEGRATION	119 d	Fri 4/11/14	Fri 10/17/14
119	Development Environment Setup	1 d	Fri 4/11/14	Fri 4/11/14
122	SW Coding/Application Development	110 d	Fri 4/11/14	Mon 10/6/14
172	System Integration	8 d	Tue 10/7/14	Fri 10/17/14
177	TESTING	87 d	Mon 8/18/14	Wed 1/21/15
178	Internal System Testing	72 d	Mon 8/18/14	Fri 12/5/14
198	Factory Acceptance Testing (FAT)	45 d	Wed 11/5/14	Wed 1/21/15
212	DEPLOYMENT / ROLLOUT	138 d	Thu 1/15/15	Mon 7/27/15
213	System Installation / Implementation	138 d	Thu 1/15/15	Mon 7/27/15
214	Onsite First Installation Test (OFIT) - Goethals Lane 18	30 d	Thu 1/15/15	Wed 2/25/15
224	Outerbridge - OBX	27 d	Wed 3/11/15	Thu 4/16/15
234	Bayonne Bridge - BB (Not in Scope)	0 d	Mon 7/27/15	Mon 7/27/15
239	Goethals Bridge - GB	39 d	Tue 1/20/15	Fri 3/13/15
249	George Washington Bridge Lower Level Lanes - GWBLL	31 d	Mon 6/15/15	Mon 7/27/15
263	George Washington Palisades Lanes - GWBP	32 d	Wed 3/11/15	Thu 4/23/15
273	George Washington Bridge Upper Level Lanes - GWBU	39 d	Tue 4/21/15	Fri 6/12/15
288	Holland Tunnel - HT	32 d	Thu 2/5/15	Fri 3/20/15
300	Lincoln Tunnel - LT	48 d	Fri 4/17/15	Tue 6/23/15
316	Installation Complete	0 d	Mon 7/27/15	Mon 7/27/15
317	ACCEPTANCE / CLOSURE	90 d	Tue 7/28/15	Mon 11/30/15
318	90 Day SLA Deferment for Lane Tuning and Acceptance Testing	90 d	Tue 7/28/15	Mon 11/30/15
323	Documentation	22 d	Fri 10/30/15	Mon 11/30/15
327	SYSTEM WARRANTY	533 d	Fri 2/6/15	Sat 7/23/16



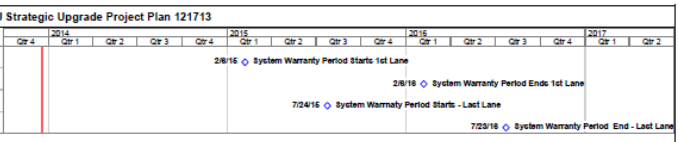
xerox
Confidential Information

Page 2

Wed 12/18/13

PANYNJ Strategic Upgrade Project Plan 121713

ID	Task Name	Duration	Outlook Start	Outlook Finish
328	System Warranty Period Starts 1st Lane	0 d	Fri 2/6/15	Fri 2/6/15
329	System Warranty Period Ends 1st Lane	0 d	Sat 2/6/16	Sat 2/6/16
330	System Warmaty Period Starts - Last Lane	0 d	Fri 7/24/15	Fri 7/24/15
331	System Warranty Period End - Last Lane	0 d	Sat 7/23/16	Sat 7/23/16



xerox
Confidential Information

Page 3

Wed 12/18/13

16 Appendix B. PANYNJ Strategic Upgrade Technical Proposal

Appendix B lists prices, by section in this Technical Proposal, for the items proposed for this PANYNJ Strategic Upgrade Project.

Change Order #1 to Contract #460006009 / Purchase Order # 4500043187

Attachment 6. Pricing Schedule

Section Number	Item	Price
3.1	Lane Controller Hardware	$ 1,041,202.12
3.2	Lane Controller Software	$ 1,824,120.41
3.3	Violation Enforcement System	$ 5,299,264.18
3.4	Overhead Laser Scanner	$ 2,371,451.86
3.5	Network	$ 487,394.35
3.6	OBX Open Road Tolling Upgrades	$ 382,352.89
3.7	Close Up Lane Observation Cameras	$ 312,457.29
3.8	Lane Mode Sign	$ 2,226,049.25
3.9	Replacement ITCS Deposit & Supervisor Workstations	$ 95,693.71
3.10	ECH/CSC Interface (CSC CO #103)	$ 185,084.00
3.11	ECH Storage Expansion for Video Tolling Servers	$ 1,325,870.57
4.0	Project Management	$ 527,090.18
5.0	Documentation	$ 127,573.60
6.0	Decommissioning Lanes	$ -
7.1	Factory Acceptance Test	$ 40,961.43
7.2	On-site First Installation Test	$ 60,345.10
7.3	Field Checkout Test	$ 60,345.10
8.0	Spares	$ 274,932.60
		$ 16,642,188.66

17 Appendix C. PANYNJ Strategic Upgrade Technical Proposal Bill of Materials

Appendix C provides the Bill of Materials (BOM) for the items proposed for this PANYNJ Strategic Upgrade Project Technical Proposal.

Materials List for Lane Controller Hardware

Item Nr.	Description	Manufacturer	Part Number	OBX Qty.	GB Qty.	GWBP Qty	GWBL Qty.	GWBU Qty.	HT Qty.	LT Qty	Unit Cost	Extended Cost
	Lane Controller											
1	RK-415B Rack mount System (19"W x 21"D x 7"H) Short 5" Depth vs RK-416	Arise	RK-415B	5	8	7	10	12	9	14		
2	PCI-14S Backplane			5	8	7	10	12	9	14		
3	400W/400W Redundant Hot-Swappable Power supply			5	8	7	10	12	9	14		
4	With 2 Fixed Fans, No 3 hot-Swappable Fans			5	8	7	10	12	9	14		
5	Q77P6 i3/i5/i7 Quad Core SBC with VGA & Cooling Fan			5	8	7	10	12	9	14		
6	Intel i5-2400 Quad Core 3.1GHz CPU			5	8	7	10	12	9	14		
7	Raid 0,1,10 controller			5	8	7	10	12	9	14		
8	16GB Memory			5	8	7	10	12	9	14		
9	EZ Raid DD4 Dual Hot Swap + DD4-DZRDPK			5	8	7	10	12	9	14		
10	SATA HD Enclosure with Raid 0, 1			5	8	7	10	12	9	14		
11	2 x 1TB SATA HD			5	8	7	10	12	9	14		
12	DVD Burner			5	8	7	10	12	9	14		
13	Mouse			5	8	7	10	12	9	14		
14	KB-104 Keyboard			5	8	7	10	12	9	14		
15												
16	**Lane Controller Peripherals**											
17	Comtrol RocketPort 30129-5 PCIe 8 Port DB25M RS232/422/485 Express Octa	Comtrol	30129-5	5	8	7	10	12	9	14		
18	Phoenix Assy, ILC 130 ETH, SNMP, 4-Output, 8-Input	Pheonix	ILC 130 ETH	5	8	7	10	12	9	14		
19	EDI Loop Detector 4C LMD304 , Solid State Output and Cable Assembly	EDI	LMD304S	5	8	7	10	12	9	14		
20												
21	**Goethals LEC Cabinet**											
22	48H X 37.375W X 12D SS304 Cabinets with 48H x 36W Back Panel	SCE	SCE-48XEL3712S	0	8	0	0	0	0	0		
23	18H x 18W Piggy Back Box	SCE	SCE-1614CHNFS	0	8	0	0	0	0	0		

Materials List for Lane Controller Software

Item Nr.	Description	Manufacturer	Part Number	OBX Qty.	GB Qty.	GWBP Qty	GWBL Qty.	GWBU Qty.	HT Qty.	LT Qty	Unit Cost	Extended Cost
1	Red Hat Linux MCT0988 SW	Red Hat	MCT0988	5	8	7	10	12	9	14		

Materials List for Network Equipment

Item Nr.	Description	Manufacturer	Part Number	OBX Qty.	GB Qty.	GWBP Qty	GWBL Qty.	GWBU Qty.	HT Qty.	LT Qty	Training	PATC	Teleport	Unit Cost	Extended Cost
1	Cisco SG SG1-2-24	Cisco	SG102-24	1	1	1	1	1	1	1	1	1	1		
2	Cisco Catalyst 3750 Fiber Switch	Cisco	C37502V2-24FS-S	1	1	0	2	0	1	1	0	0	0		
3	Cisco Catalyst 3750 WS Copper Switch	Cisco	WS-37500V2-24TS-E	0	0	0	0	0	0	0	0	1	1		
4	Copper Patch cables	Cables2Go		AN	AN	AN	AN	AN	AN	AN	AN	AN	AN		
5	Fiber to Copper Media converters	Comtrol		1	1	0	2	0	1	1	0	0	0		
6	ST/SC Connectors	Cables2Go		AN	AN	AN	AN	AN	AN	AN	AN	AN	AN		
7	ST Connectors	Cables2Go		AN	AN	AN	AN	AN	AN	AN	AN	AN	AN		
8	Fiber Patch cables	Cables2Go		AN	AN	AN	AN	AN	AN	AN	AN	AN	AN		
	* AN = As Needed														

Materials List for VES

Item Nr.	Description	Manufacturer	Part Number	OBX Qty.	GB Qty.	GWBP Qty	GWBL Qty.	GWBU Qty.	HT Qty.	LT Qty	Unit Cost	Extended Cost
1	JAI VIS-CAM-1000-AIO, 31015856	JAI	31015856	10	16	14	20	24	18	28		
2	JAI Dynamic Traffic Light Sensor TLS-300, 31014203	JAI	31014203	7	8	7	10	12	9	14		
3	JAI VIS Junction Panel, VJP-300, 31014201	JAI	31014201	7	8	7	10	12	9	14		
4	JAI AC Power Supply Unit, 10010162	JAI	10010162	7	8	7	10	12	9	14		
5	JAI VIS-CAM-1000 Cable, 10010171	JAI	10010171	10	16	14	20	24	18	28		
6	FAB 5ft Stanchion w/Transformer Base	FAB		10	16	14	20	24	18	28		
7	Mounting Hardware, Concrete Wedge Anchors	Hilti		40	64	56	80	96	72	112		
8	Mounting Hardware, Anchor Spacers	Hilti		40	64	56	80	96	72	112		

Materials List for Overhead Laser Scanner

Materials List for Overhead Laser Scanner

Item Nr.	Description	Manufacturer	Part Number	OBX Qty.	GB Qty.	GWBP Qty	GWBL Qty.	GWBU Qty.	HT Qty.	LT Qty	Unit Cost	Extended Cost
1	Sick LMS511 Laser Sensor, 1046135	Sick	1046135	5	8	7	10	12	9	14		
2	Sick LMS511 Laser Dust Cover, 2063050	Sick	2063050	5	8	7	10	12	9	14		
3	Sick LMS511 Laser Power Cable, 6036161	Sick	6036161	5	8	7	10	12	9	14		
4	Sick LMS511 Laser Communication Cable, 6036158	Sick	6036158	5	8	7	10	12	9	14		
5	Sick LMS511 Laser Mounting Set Quick, 2018304	Sick	2018304	5	8	7	10	12	9	14		
6	Traco Power Supply, TSP360-124	Traco	TSP360-124	5	8	7	10	12	9	14		
7	Misc. Mounting Hardware	Xerox	TBD	5	8	7	10	12	9	14		

Materials List for Close Up Lane Observation Video Monitoring

Item Nr.	Description	Manufacturer	Part Number	OBX Qty.	GB Qty.	GWBP Qty	GWBL Qty.	GWBU Qty.	HT Qty.	LT Qty	Unit Cost	Extended Cost
1	Sony CCTV Camera SSCG113A	Sony	SSCG113A	7	8	7	10	12	9	14		
2	Pelco housing	Pelco	EH3508-1	7	8	7	10	12	9	14		
3	Pelco mount	Pelco	EM2000	7	8	7	10	12	9	14		
4	Geovison GS-POS Text Inserter	Geovision	GS-POS	7	8	7	10	12	9	14		
5	MeanWell, Power Supply DR-30-5	MeanWell	DR-30-5	7	8	7	10	12	9	14		

Materials List for Lane Mode Sign

Item Nr.	Description	Manufacturer	Part Number	OBX Qty.	GB Qty.	GWBP Qty	GWBL Qty.	GWBU Qty.	HT Qty.	LT Qty	Unit Cost	Extended Cost
1	Daktronics AF-Galaxy 20mm RGB Outdoor LED Matrix	Daktronics	AF-3550-48X128-20-RGB-SF	5	8	7	10	12	9	14		

~~OBX ORT Gantry, Laser Scanner~~			
~~Sick LMS511 Laser Sensor, 1046135~~	~~Sick~~	~~1046135~~	~~0~~
~~Sick LMS511 Laser Dust Cover, 2063050~~	~~Sick~~	~~2063050~~	~~0~~
~~Sick LMS511 Laser Power Cable, 6036161~~	~~Sick~~	~~6036161~~	~~0~~
~~Sick LMS511 Laser Communication Cable, 6036158~~	~~Sick~~	~~6036158~~	~~0~~
~~Sick LMS511 Laser Mounting Set Quick, 2018304~~	~~Sick~~	~~2018304~~	~~0~~
~~Traco Power Supply, TSP360-124~~	~~Traco~~	~~TSP360-124~~	~~0~~
OBX ORT VES Cameras			
JAI VIS-CAM-1000-AIO, 31015856	JAI	31015856	4
JAI Flash Unit TNF-31	JAI	31014230	4
JAI AC Power Supply Unit, 10010162	JAI	10010162	2
JAI VIS-CAM-1000 Cable, 10010171	JAI	10008879	4
JAI TLS-300 Cable, 10008879	JAI	10008879	0
JAI TLS Quick Disconnect Cable Kit, 20004921	JAI	20004921	4
Mounting Hardware	Xerox	TBD	4

Materials List for ITCS Supervisor and Deposit Workstations

Item Nr.	Description	Manufacturer	Part Number	OBX Qty.	GB Qty.	GWBP Qty	GWBL Qty.	GWBU Qty.	HT Qty.	LT Qty	Training	PATC	Teleport	Unit Cost	Extended Cost
1	Plaza Sup Stations - Lenovo ThinkCentre M71e 3167 - SFF - 1 x P G620 / 2.6 GHz - RAM 2 GB - HDD 1 x 250 GB - DVD - HD Graphics 2000 - Gigabit Ethernet - Windows 7 Professional 64-bit -	Lenovo	M71e 3167	1	1	1	1	2	1	1	2	0	0		
2	Monitors - Lenovo ThinkVision LT2252p - LED monitor - 22" - 1680 x 1050 - TN - 250 cd/m2 - 1000:1 - 5 ms - DVI-D, VGA, DisplayPort - business black - for ThinkCentre M71; M80; M81; M90; M91; ThinkPad W530; ThinkStation C20; D20; E30; S20	Lenovo	LT2252p	1	1	1	1	2	1	1	2	0	0		
3	Printer - Thermal Printer Epson tm-t88v Ethernet	Epson	C31C636014	3	3	3	5	5	3	6	2	0	0		
4	Plaza Drop Workstations - Lenovo ThinkCentre M71e 3167 - SFF - 1 x P G620 / 2.6 GHz - RAM 2 GB - HDD 1 x 250 GB - DVD - HD Graphics 2000 - Gigabit Ethernet - Windows 7 Professional 64-bit -	Lenovo	M71e 3167	3	3	3	5	5	3	6	2	0	0		
5	Plaza Drop Station Monitors - Lenovo ThinkVision LT2252p - LED monitor - 22" - 1680 x 1050 - TN - 250 cd/m2 - 1000:1 - 5 ms - DVI-D, VGA, DisplayPort - business black - for ThinkCentre M71; M80; M81; M90; M91; ThinkPad W530; ThinkStation C20; D20; E30; S20	Lenovo	LT2252p	3	3	3	5	5	3	6	2	0	0		
6	Printer paper - Case of 50 #T318-230	Epson	T318-230	1	1	1	1	1	1	1	2	0	0		
7	HP Neoware TeemTalk Terminal Emulator for Windows PCs or Servers - (v. 7)	HP	BC054AAE	3	3	3	5	5	3	6	2	0	0		

VES Hardware / OLS / Network Equipment / ORT Equipment / CULO Equipment / LMS / **Workstations** / ECH Storage / Spare

Materials List for ECH Storage Expansion for Video Tolling

Item Nr.	Description	Manufacturer	Part Number	Qty	Unit Cost	Extended Cost
1	NetApp Storage 14 TB of Usable space - 11125723 FAS2240HA-2 int 600GB x 1TB DS4246 36 mo SEP	NetApp	11125723 FAS2240HA-2	1		
2	Computer Rack 42U, 600mm Wide x 1060mm Deep Enclosure with Sides, Black, Single Rack	APC	AP2400FP1	1		
3	Cable Mgt (QTY =2), Vertical Cable Organizer, 8 Cable Rings, Zero U	APC	AR8442	1		
4	Rack Air Distribution Rack Air Distribution Unit 2U 120V 60HZ	APC	ACF201BLK	1		
5	Rack LCD Console, 17" Rack LCD Console	APC	AP5717	1		
6	RACK KVM	APC	KVM0108A	1		
7	PDU, Metered, 2U, 30A, 120V, (16) 5-20	APC	AP7802	1		
8	Compact 24 Port Gigabit Switch with 2 Combo Mini-GBIC Ports	CISCO	SF100-24	1		
9	Misc Cable			1		
10	IBM x3650 M4	IBM	x3650 M4	1		
11	RHEL Linux Enterprise Server	Red Hat	RH0155783	2		
12						
13						

Materials List for Spares.

Item Nr.	Description	Manufacturer	Part Number	Qty	Unit Cost	Extended Cost
1	**Arise PC**					
2	RK-415B Rack mount System (19"W x 21"D x 7"H) Short 5" Depth vs RK-416		RK-415B	4		
3	PCI-14S Backplane			4		
4	400W/400W Redundant Hot-Swappable Power supply			4		
5	With 2 Fixed Fans, No 3 hot-Swappable Fans			4		
6	Q77P6 i3/i5/i7 Quad Core SBC with VGA & Cooling Fan			4		
7	Intel i5-2400 Quad Core 3.1GHz CPU			4		
8	Raid 0,1,10 controller			4		
9	16GB Memory			4		
10	EZ Raid DD4 Dual Hot Swap + DD4-DZRDPK			4		
11	SATA HD Enclosure with Raid 0, 1			4		
12	2 x 1TB SATA HD			4		
13	DVD Burner			4		
14	Mouse			4		
15	KB-104 Keyboard			4		
16						
17	Comtrol RocketPort 30129-5 PCIe 8 Port DB25M RS232/422/485 Express Octa		30129-5	4		
18						
19	**LEC Panel**					
20	Phoenix Assy, ILC 130 ETH, SNMP, 4-Output, 8-Input		ILC 130 ETH	4		
21	EDI Loop Detector 4C LMD304 , Solid State Output and Cable Assembly		LMD304S	4		
22						
23						

24	JAI VIS-CAM-1000-AIO, 31015856		31015856	7		
25	JAI Dynamic Traffic Light Sensor TLS-300, 31014203		31014203	2		
26	JAI VIS Junction Panel, VJP-300, 31014201		31014201	4		
27	JAI AC Power Supply Unit, 10010162		10010162	4		
28	FAB 5ft Stanchion w/Transformer Base			7		
29						
30						
31	Sick LMS511 Laser Sensor, 1046135		1046135	4		
32	Sick LMS511 Laser Dust Cover, 2063050		2063050	4		
33	Sick LMS511 Laser Power Cable, 6036161		6036161	4		
34	Sick LMS511 Laser Communication Cable, 6036158		6036158	4		
35	Sick LMS511 Laser Mounting Set Quick, 2018304		2018304	4		
36	Traco Power Supply, TSP360-124		TSP360-124	4		
37						
38						
39	**OBX ORT LEC**					
40	Lane Controller		Quote No: 101813-1DS	1		
41	Intel PRO/1000 GT Desktop Adapter - Network Adapter		PWLA8391GT	1		
42	VIS Junction Panel		31014201	1		
43	8-Port Remote Power Manager		99442-5	1		
44	DeviceMaster Pro, 8-Port Serial Port Server		919970	1		
45	RS-422 / RS-485 protection module		991920	1		
46	RS-232 protection module			1		
47						
48	**OBX ORT Gantry, Laser Scanner**					

49	Sick LMS511 Laser Sensor, 1046135		1046135	1		
50	Sick LMS511 Laser Dust Cover, 2063050		2063050	1		
51	Traco Power Supply, TSP360-124		TSP360-124	1		
52						
53	**OBX ORT VES Cameras**					
54	JAI VIS-CAM-1000-AIO, 31015856		31015856	1		
55	JAI Flash Unit TNF-31		31014230	1		
56	JAI AC Power Supply Unit, 10010162		10010162	1		
57						
58						
59	**LEC Switches**					
60	Comtrol Unmanaged Industrial Ethernet switch, eight full Gigabit Ethernet ports		32085-2	4		
61	Comtrol 32021-0 RocketLinx Fast Ethernet Media Converter MC7001		32021-0	4		
62	RocketLinx PS1020 24V 24W 24V DIN Rail Power Supply		32100-2	4		
63						
64	Cisco Plaza Switches					
65	Catalyst 3750V2 24 100BASE-FX ports + 2 SFP Standard Image, WS-C3750V2-24FS-S		WS-C3750V2-24FS-S	1		
66	SMARTNET 24X7X4 Catalyst 3750V2 24 1		CON-SNTP-37524FSS	1		
67	Catalyst 3750V2 24 100BASE-FX ports + 2 SFP Standard Image, WS-C3750V2-24FS-S		WS-C3750V2-24TS-E	1		
68	SMARTNET 24X7X4 Catalyst 3750V2 24 100BASE-FX ports + 2, CON-SNTP-37524FSS		CON-SNTP-37524FSS	1		
69	Comtrol, RocketLinx Fast Ethernet Media Converter MC7001		32021-0	1		

70	Comtrol, RocketLinx PS1020 24V 24W 24V DIN Rail Power Supply		32100-2	1		
71						
72	**LMS**					
73	Daktronics Sign, Single Face, 3'10" x 8'10" x 8" LED LMS		AF-355-48x128-20-RGB-SF	4		
74						
75	**CULO**					
76	Sony CCTV Camera SSCG113A		SSCG113A	4		
77	Pelco housing		EH3508-1	4		
78	Pelco mount		EM2000	4		
79	Geovison GS-POS Text Inserter		GS-POS	4		
80	MeanWell, Power Supply DR-30-5		DR-30-5	4		
81						
82	**ITCS Terminals**					
83	Plaza Sup Stations - Lenovo ThinkCentre M71e 3167 - SFF - 1 x P G620 / 2.6 GHz - RAM 2 GB - HDD 1 x 250 GB - DVD - HD Graphics 2000 - Gigabit Ethernet - Windows 7 Professional 64-bit -		M71e 3167	1		
84	Monitors - Lenovo ThinkVision LT2252p - LED monitor - 22" - 1680 x 1050 - TN - 250 cd/m2 - 1000:1 - 5 ms - DVI-D, VGA, DisplayPort - business black - for ThinkCentre M71; M80; M81; M90; M91; ThinkPad W530; ThinkStation C20; D20; E30; S20		LT2252p	1		
85	Printer - Thermal Printer Epson tm-t88v Ethernet		C31C636014	2		

86	Plaza Drop Workstations - Lenovo ThinkCentre M71e 3167 - SFF - 1 x P G620 / 2.6 GHz - RAM 2 GB - HDD 1 x 250 GB - DVD - HD Graphics 2000 - Gigabit Ethernet - Windows 7 Professional 64-bit -		M71e 3167	2		
87	Plaza Drop Station Monitors - Lenovo ThinkVision LT2252p - LED monitor - 22" - 1680 x 1050 - TN - 250 cd/m2 - 1000:1 - 5 ms - DVI-D, VGA, DisplayPort - business black - for ThinkCentre M71; M80; M81; M90; M91; ThinkPad W530; ThinkStation C20; D20; E30; S20		LT2252p	2		
88	CISCO Network Switch - Cisco Small Business 100 Series SG102-24-NA		SG102-24-NA	1		

EXHIBIT A - Revised January 07, 2014 - Maintenance Year 2016

Revised Cost Proposal Sheets (including ORT lanes and spares)

Itemized Preventive and Remedial Maintenance and Repairs

Tunnel, Holland Tunnel and Training Academy

ITCS item	(A) Monthly Maintenance and Remedial Repair Cost per Item of Equipment	(B)[5] Number of Items of Equipment at all Facilities	(C) Estimated Total Monthly Maintenance and Remedial Repair Cost per Item of Equipment
AVI Antenna[1] (Mark IV Service & Spare Parts)	$ 45.70	73	$ 3,336
AVI Reader[1](Mark IV Service & Spare Parts)	$ 513.16	13	$ 6,671
AVI UPS[1](Mark IV Service & Spare Parts)	$ 384.87	13	$ 5,003
Booth Equipment[2]	$ 488.83	58	$ 28,352
ETC Canopy Traffic Light	$ 48.34	69	$ 3,335
Communications[3]	$ 500.33	Quantity N/A	$ 500
Deposit workstation equipment	$ 52.12	24	$ 1,251
Driver Feedback Sign and Traffic Light	$ 107.77	58	$ 6,251
Lane Controller	$ 406.93	71	$ 28,892
Lane Mode Sign	$ 435.07	69	$ 30,020
Loops	$ 163.43	209	$ 34,157
ORT Lane Electronic Components	$ 166.78	2	$ 334
ORT Loops (2 axle, 6 Main)	$ 25.64	8	$ 205
ORT Light Sensors	$ 108.40	2	$ 217
Overhead Vehicle Profiler	$ 314.22	69	$ 21,681
Plaza Supervisor workstation	$ 50.03	10	$ 500
Treadle[4]	$ 106.35	69	$ 7,338
UPS-Lane Controller	$ 258.38	71	$ 18,345
VES Equipment (including lights)	$ 719.91	139	$ 100,067
VES Equipment (including lights) -ORT	$ 667.11	10	$ 6,671
Video Monitoring & VCR	$ 82.13	8	$ 657
VES VIC Computers -- ORT	$ -	3	$ -
Training Academy:			
Booth Equipment	$ 271.01	8	$ 2,168
Deposit workstation	$ 41.69	2	$ 83
Plaza Workstation	$ 41.69	4	$ 167

Total Estimated Monthly Maintenance Cost at River Crossings or TB&T

$ $ 306,202

(Sum of column [C])

1. Mark IV diagnostic and service replacement
2. Includes ETC override switches located in separate enclosures attached to the lane controller cabinets at GWB.
3. PAWNET connection at each Plaza and related ITCS network equipment and connection.
4. Includes maintenance of treadle drains

Note: All prices will be inclusive of parts and replacement costs if required, and personnel costs. Also, all prices will cover components and subcomponents related to ITCS

EXHIBIT B

Cost Proposal Sheets
Computerized Maintenance Management System
River Crossings or TB&T

Software	**Cost per Authority Licensed User**	**Required Number of Authority Licensed Users**	**Monthly Total**
Software Licenses (per user)	$ 1,009.66	**3**	$ 3,028.99
Other		**3**	
Other:		**3**	
Other:		**3**	
Other:		**3**	
Other:		**3**	
Other:		**3**	
Total Monthly Price for Computerized Maintenance Management System at all River Crossings or TB&T (sum of column "Monthly Total")		**$ 3028.99**	

EXHIBIT C - Revised January 07, 2014

Cost Proposal Sheets – System Administration Services and Hardware/Software Support

River Crossings or TB&T

I. Total Monthly Price for System Administration at all River Crossings or TB&T	**$**	$ 31,086.04
II. Total Estimated Monthly cost for ACS Proprietary Software Support for the ECH	**$**	$ 5,763.12
III. Total Estimated Monthly cost for HP/Compaq Hardware/Software Support	**$**	$ 8,409.36
IV. Total Estimated Monthly cost for Oracle RBD Software Support	**$**	$ 528.29
V. Total Estimated Monthly cost for BEA MessageQ Software Support	**$**	$ 528.29
Total Monthly Price for System Administration and Harware and Software Support at all River Crossings or TB&T	**$**	$ 46,315.09

(Sum of I through V above)

Notes:

1. For the purpose of this proposal, the yearly cost for H/S support will calculated as a monthly charge.

EXHIBIT D - Revised Revised January 07, 2014

Cost Proposal Sheets - System Administration Services and Hardware/Software Support Aviation

I. Total Monthly Price for System Administration for the ACH	**$**	$ 10,996.76
II. Total Estimated Monthly cost for ACS Proprietary Software Support for the ACH	**$**	$ 1,440.78
III. Total Estimated Monthly cost for Actuate Hardware/Software Support	**$**	$ 2,906.77
Total Monthly Price for System Administration, Hardware and Software Support for Aviation	**$**	$ 15,344.31 (Sum of I through III above)

Notes:

1. For the purpose of this proposal, the yearly cost for H/S support will calculated as a monthly charge.

EXHIBIT E

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services and Additional Repairs due to negligence not the River Crossings or TB&T
Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regualr Hourly Rate*	10	$ 120.50	$ 1,205.04
Data Base Administrator Overtime Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 120.50	$ 602.52
System Administrator Regular Hourly Rate*	10	$ 96.84	$ 968.35
System Administrator Overtime Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Premium Overtime Hourly Rate*	5	$ 96.84	$ 484.18

Total Estimated Monthly Additional System Administration **$** $ 4,346.77

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

Maintenance and Repair Personnel	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly AdditionalRepairs due to negligence not the faultof the Contractor
Laborers Regular Hourly Rate*	15	$ 102.57	$ 1,538.61
Laborers Overtime Regular Hourly Rate*	10	$ 144.60	$ 1,446.02
Laborers Premium Hourly Rate*	5	$ 186.63	$ 933.15
Elecricians Regular Hourly Rate*	15	$ 154.53	$ 2,317.95
Electrian Overtime Hourly Rate*	10	$ 222.54	$ 2,225.43
Electrians Premium Overtime Hourly Rate*	5	$ 290.57	$ 1,452.83
Mechanics Regular Hourly Rate*	15	$ 121.95	$ 1,829.27
Mechanics Overtime Hourly Rate*	10	$ 173.67	$ 1,736.69
Mechanic Premium Overtime Hourly Rate*	5	$ 225.39	$ 1,126.93

Total Estimated Monthly Additional Repairs due to negligence ı **$** $ 14,606.90

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours”

**Wage rates shall be all-inclusive including overhead, taxes, including tolls, travel time, cost of vehicle use and profit.

List additional personnel if appropriate to the submitted Proposal.

The above additional maintenance and repair personnel rates shall be for loss or damage caused by willful of negligent acts

EXHIBIT F

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services
Aviation (for ACH)

This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regualr Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Overtime Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 120.50	$ 602.52
System Administrator Regular Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Overtime Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Premium Overtime Hourly Rate*	5	$ 96.84	$ 484.18

Total Estimated Monthly
Additional System **$** $ 3,260.08

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours"

**Wage rates shall be all-inclusive including overhead, taxes, including tolls, travel time, cost of vehicle use and profit.

List additional personnel if appropriate to the submitted Proposal.

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

EXHIBIT G - Revised January 07, 2014

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services and Additional Repairs for Non-River Crossings or TB&T
Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regualr Hourly Rate*	10	$ 120.50	$ 1,205.04
Data Base Administrator Overtime Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 120.50	$ 602.52
System Administrator Regular Hourly Rate*	10	$ 96.84	$ 968.35
System Administrator Overtime Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Premium Overtime Hourly Rate*	5	$ 96.84	$ 484.18

Total Estimated Monthly Additional System Administration **$** $ 4,346.77

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

Maintenance and Repair Personnel	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Repairs and maintenance for non-emergency extra work
Laborers Regular Hourly Rate*	15	$ 102.57	$ 1,538.61
Laborers Overtime Regular Hourly Rate*	10	$ 144.60	$ 1,446.02
Laborers Premium Hourly Rate*	5	$ 186.63	$ 933.15
Elecricians Regular Hourly Rate*	15	$ 154.53	$ 2,317.95
Electrian Overtime Hourly Rate*	10	$ 222.54	$ 2,225.43
Electrians Premium Overtime Hourly Rate*	5	$ 290.57	$ 1,452.83
Mechanics Regular Hourly Rate*	15	$ 121.95	$ 1,829.27
Mechanics Overtime Hourly Rate*	10	$ 173.67	$ 1,736.69
Mechanic Premium Overtime Hourly Rate*	5	$ 225.39	$ 1,126.93

Total Estimated Monthly Repairs and Maintenance for non-emerger **$** $ 14,606.90

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours"

**Wage rates shall be all-inclusive subject, but not limited to, overhead, taxes, including tolls, travel time, cost of vehicle use and profit. The rates set forth above shall not be subject to mark up as set forth in Section 13. Compensation for Extra Work of Part II - General Contract Provisions.

List additional personnel if appropriate to the submitted Proposal.

The above additional maintenance and repair personnel rates shall be for loss or damage caused by willful of

EXHIBIT H- Revised January 07, 2014

Cost Proposal Sheets
Skills & Hourly Rates/Additional System Administration Services for Non-Emergency Extra Work
Aviation (for ACH)

Note: This information must be provided.

System Administration Personnel Title Function	Estimated Number of Hours per Month	All Inclusive Hourly Rate**	Total Estimated Monthly Additional System Administration Services
Data Base Administrator Regular Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Overtime Hourly Rate*	5	$ 120.50	$ 602.52
Data Base Administrator Premium Overtime Hourly Rate*	5	$ 120.50	$ 602.52
System Administrator Regular Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Overtime Hourly Rate*	5	$ 96.84	$ 484.18
System Administrator Premium Overtime Hourly Rate*	5	$ 96.84	$ 484.18

Total Estimated Monthly Additional System Administration Personnel Aviationfor Non-emergency Extra Work **$** $ 3,260.08

* Refer to Section entitled “Definitions” for definitions of “Regular Working Hours”, Overtime Working Hours” and “Premium Overtime Working Hours”

**Wage rates shall be all-inclusive subject, but not limited to, overhead, taxes, including tolls, travel time, cost of vehicle use and profit. The rates set forth above shall not be subject to mark up as set forth in Section 13. Compensation for Extra Work of Part II - General Contract Provisions.

List additional personnel if appropriate to the submitted Proposal.

The above rates inserted by the Contractor shall be for additional System Administration Services as ordered by the Authority.

EXHIBIT I - Revised January 07, 2014 - For Maintenance Year 2016

Cost Proposal Sheets - Price Summary Sheet

Item	Category of Work	Estimated Price
1.	**From Exhibit "A"** Estimated Monthly Preventative and Remedial Maintenance and Repairs at all River Crossings or TB&T.	$ 306,202.50
2.	**From Exhibit "B"** Estimated Monthly Computerize Maintenance Management System at River Crossings or TB&T.	$ 3,028.99
3.	**From Exhibit "C"** Estimated Monthly System Administration Services and Harware/Software Support at River Crossings or TB&T.	$ 46,315.09
4.	**From Exhibit "D"** Estimated Monthly System Administration Services and Hardware/Software Support (for ACH) at Aviation.	$ 15,344.31
5.	**From Exhibit "E"** Estimated Monthly Extra Services for System Administration Personnel and Maintenance and Repair Personnel- River Crossings or TB&T.	$ 18,953.67
6.	**From Exhibit "F"** Estimated Monthly Extra Services, System Administration Personnel (for ACH) - Aviation	$ 3,260.08
7	**From Exhibit "G"** Estimated Monthly Non-Emergency Extra Work Services for System Administration Personnel and Maintenance and Repair Personnel- River Crossings or TB&T.	$ 18,953.67
8	**From Exhibit "H"** Estimated Monthly Non-Emergency Extra Work Services, System Administration Personnel (for ACH) - Aviation	$ 3,260.08

I. River Crossings or TB&T:

TOTAL ESTIMATED CONTRACT EXTENSION PRICE: River Crossings or TB&T

A. $ 4,721,447.01

(Multiply Total Estimated Price of Items 1, 2, 3, 5 and 7 by 12 months; from 1/1/16-12/31/16)

B. $ 18,953.67

(Insert the one-time charge from Item 7)

II. Aviation:

TOTAL ESTIMATED CONTRACT EXTENSION PRICE: Aviation

$ 262,373.66

(Multiply Total Estimated Price of Item 4, 6 and 8 by 12 months, from 1/1/16-12/31/16)

TOTAL EST. CONTRACT PRICE FOR ONE YEAR

$ 5,002,774.33

(Sum of I.A., I.B., and II above)

THE PORT AUTHORITY OF NY & NJ

Tunnels, Bridges & Terminals Department

VIA FAX, E-Mail & US First Class Mail
September 9, 2010

Mr. Ken Philmus
ACS, Inc.
375 McCarter Highway
Newark, New Jersey 07114

Subject: ACS's Change Order Proposal for the continuation of ITCS Maintenance Services under Contract 4600006009 for ITCS Maintenance and System Administration and E-ZPass Plus Administration

Dear Mr. Philmus:

In reviewing the subject Change Order Proposal (the Proposal) dated August 6, 2010, we were surprised to see statements made under the section entitled "Maintenance of Traffic" on page 3 of the Proposal, that suggest use of something less than the standard Port Authority Maintenance of Traffic standards for lane closures. In particular, I am referring to the statements on page 3 of the Proposal that refer to the contract's requirement to use truck-mounted attenuators in closed lanes, stating: "The Holland Tunnel, Lincoln Tunnel, and all three levels of the George Washington Bridge do not enforce these same requirements, but for purposes of safety ACS will use the attenuator trucks in these locations when available." Our current contract for maintenance includes a Maintenance of Traffic Plan (MOT Plan), which clearly requires the use of truck-mounted attenuators when ACS or its subcontractors are working in a toll lane. (Please see Sections 2.C.2 and 2.A.b of our maintenance agreement, which is included for your reference as Attachment I.)

As you know, this matter involves the safety of our employees, contractors, and customers. Please confirm by close of business on Tuesday, September 14th that ACS and all its subcontractors are deploying the MOT Plan during all lane closures at Port Authority toll plazas as required by the contract. We are unwilling to accept anything less, not in the current contract or in any potential extension thereto. In your response, please include my colleagues copied at the end of this letter.

Sincerely,

Charles Fausti

Charles Fausti
General Manager
E-ZPass Programs

Cc: Alan Allegretto
Jose Rivera, Port Authority of NY & NJ, Chief Traffic Engineer (jrivera@panynj.gov)
James Summerville, Port Authority of NY & NJ, Sr. Buyer (jsummerville@panynj.gov)

One Madison Avenue, 5th Floor
New York City, NY 10010