Rec'd 7/15/16

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PRA# 19171

July 6, 2016

The Port Authority of New York and New Jersey
Corporate Offices
4 World Trade Center
New York, New York 10007
Attention: FOIL Administrator

Re: Claimant: Naik, Pradip D.
Location: The Central Taxi Hold parking lot, on/by Compass Road at JFK International Airport
Date of Loss: August 1, 2014
File: MAS6515

Dear FOIL Unit:

Please provide copies of any and all deed(s) for the above-mentioned Central Taxi Hold parking lot and copies of lease(s) for the above-mentioned property in effect at the time of the accident, August 1, 2014.

Please provide all construction and repair records, permits, blueprints, designs, drawings, applications for permits, notices of violation, inspections, maintenance and repair orders, contracts, complaints, complaint service requests, work orders, any contracts or correspondence related thereto, gangsheets and crewsheets for the 2 year period prior to and including August 1, 2014 for the above location.

Very Truly Yours,

Joseph Medic, Esq.

Cc: Lauren T. Grodentzik, Esq.
Office of James M. Begley, Esq.
Attorneys for Port Authority of New York and New Jersey
4 World Trade Center
150 Greenwich Street
New York, New York 10007

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY PRA 17171
PUBLIC RECORD ACCESS FORM

Action by (print / type name):

William Shalewitz, Freedom of Information Administrator

Signature: Date:

08/16/2016

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:

Privacy.

☐ 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/17171-C/. Please provide additional information as to location for the remaining portion of the request to be processed.

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

Lillian D. Valenti
Director, Procurement

October 12, 2012

VIA FACSIMILE AND UPS NEXT DAY DELIVERY

Tully Construction Co. Inc.
127-50 Northern Blvd.
Flushing, NY 11368

SUBJECT: JOHN F. KENNEDY INTERNATIONAL AIRPORT – REHABILITATION OF 148TH STREET AND THREE JFK EXPRESSWAY RAMPS – CONTRACT JFK-924.105
PURCHASE ORDER UJFK924105

Gentlemen:

The Port Authority of New York and New Jersey hereby accepts your proposal on the above Contract.

The Port Authority elects not to require you to furnish a performance and payment bond.

Your attention is directed to the clause of the Contract entitled "Time for Completion and Damages for Delay" and to the fact that before you may commence performance of the work you must furnish whichever of the documents mentioned in that clause are applicable.

Forwarded herewith for your use and compliance are "General Instructions Relating to the Direction and Processing of Correspondence and of Those Other Items Specified to be Submitted to the Port Authority Under the Terms of the Contract".

In order to ensure that payments are processed properly, please include the above-referenced Purchase Order No. on all payment invoices and correspondence.

Very truly yours,

THE PORT AUTHORITY OF NEW YORK
AND NEW JERSEY

BY _____
Director of Procurement

Approved as to form: OK F.F.

Darrell Buchbinder
General Counsel

By _____
Attorney
Date 10/12/12

2 Montgomery Street, 3rd Floor
Jersey City, NJ 07302
T: 201 395 7477

TULLY CONSTRUCTION C. INC.

THE PORT AUTHORITY OF NY & NJ

1

CA03924105

F.F.
D.H.

JOHN F. KENNEDY INTERNATIONAL AIRPORT

REHABILITATION OF 148TH STREET AND THREE JFK EXPRESSWAY RAMPS

CONTRACT JFK-924.105

JULY 2012

RECEIVED
AUG 1 2012

This proposal is not complete unless bidder's Signature appears on page 23

THE PORT AUTHORITY OF NY & NJ

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Prevailing Rate Schedule NY

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Analysis of Bid

ADVERTISEMENT

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

Sealed proposals for the following contract will be received by The Port Authority of New York and New Jersey in the office of the Director of Procurement, Attn: Bid Custodian, Two Montgomery Street, 3rd Floor, Jersey City, NJ 07302, until 2:30 P.M. on the date indicated where the proposals will then be publicly opened and read in the Bid Room.

Contract documents may be seen at the Contract Desk on the 3rd Floor, 3 Gateway Center, Newark, NJ and may be obtained upon receipt of a non-refundable payment of $100.00 per set. Only company checks or money orders payable to the order of The Port Authority of New York and New Jersey will be accepted. If checks or money orders for documents are mailed, they should be addressed to The Port Authority of New York and New Jersey, Contract Desk, 3rd Floor, 3 Gateway Center, Newark, NJ 07102. For availability of contract documents, go to http://www.panynj.gov/business-opportunities/bid-proposal-advertisements.html Questions by prospective bidders concerning the contract should be directed only to the person whose name and phone number is listed.

A VALID PHOTO ID IS REQUIRED TO GAIN ACCESS INTO EITHER BUILDING.

Contract JFK-924.105 – John F. Kennedy International Airport – Rehabilitation of 148th Street and Three JFK Expressway Ramps. Estimate Range: $1M – $5M. Bids Due: Tuesday, July 17, 2012*. The work under this contract consists generally of milling and overlay of existing asphalt pavement, localized full-depth pavement replacement, safety improvements, re-striping and signal improvements, bus stop relocation, minor landscaping, drainage improvements, lighting improvements and related Work at 148th Street and the vicinity thereof at John F. Kennedy International Airport. For questions, call Jessamma Vatakencherry at (201) 395-3453 or email – jvataken@panynj.gov.

New York, MONDAY, June 11, 2012

*The date for receipt of Proposals has been changed to Tuesday, August 14, 2012.

INFORMATION FOR BIDDERS

1. FORM AND SUBMISSION OF PROPOSALS

The Port Authority of New York and New Jersey, hereinafter called "the Authority", invites Proposals in the annexed form. Proposals will be received until 2:30 P.M. on Tuesday, August 14, 2012 in the office of the Director of Procurement, Attn: Bid Custodian, Two Montgomery Street, 3rd Floor, Jersey City, NJ 07302 at which time they will be opened and publicly read in the Bid Room. Each Proposal must be contained in the envelope furnished by the Authority, which shall be sealed and conspicuously endorsed with the bidder's name and the number of this Contract in the space provided. This Contract booklet shall not be unstapled or taken apart.

The Proposal must be submitted upon the blank form bound herewith and must give all information required. [1] The Proposal must be signed and the acknowledgment taken on the appropriate form following the Proposal.

No effort is made to emphasize any particular provision of the Contract, but bidders must familiarize themselves with every provision and its effect.

2. PAPERS ACCOMPANYING PROPOSALS

Each Proposal must be accompanied by the following papers, which, unless otherwise indicated, should be enclosed with the Proposal:

A. If the bidder be a corporation, a statement of the names and residences of its officers, which should be included on the page following the Proposal.

If the bidder be a partnership, a statement of the names and residences of its members, indicating which are general and which are special partners, which should be included on the page following the Proposal.

If the bidder be an individual, a statement of his residence, which should be included on the page following the Proposal.

B. Either the Bid Bond bound herewith, duly executed by the bidder as principal and by one or more surety companies duly authorized to carry on the business of suretyship in the state(s) in which the construction site is located, whose names appear on the current list of the Treasury Department of the United States as acceptable as sureties upon federal contracts; or, in lieu of a Bid Bond;

A certified check, payable to the order of The Port Authority of New York and New Jersey, in the same amount appearing in the Bid Bond form, which check shall be placed in an envelope marked "Bid Security" and enclosed with the Proposal.

C.

---

[1] While two or more copies of this booklet may be furnished to each prospective bidder, only one should be submitted. The extra copies are for the bidders use.

1.) Certified financial statements, including applicable notes, reflecting the bidder's assets, liabilities, net worth, revenues, expenses, profit or loss and cash flow for the most recent calendar year or the bidder's most recent fiscal year.

2.) Where such certified financial statements are not available, then either reviewed or compiled statements from an independent accountant setting forth the information described in Paragraph 1, above.

3.) Where neither certified financial statements nor financial statements from an independent accountant are available, then financial statements containing the information described in Paragraph 1, above, prepared directly by the bidder. However, such financial statements must be accompanied by a signed copy of the bidder's most recent Federal income tax return and a statement in writing, signed by a duly authorized representative of the bidder, that such statements accurately reflect the current financial condition of the bidder.

Where statements submitted pursuant to either Paragraph 1 or 2, above, show the position of the bidder as of a date more than forty-five (45) days prior to the date on which Proposals are opened, the bidder shall also submit a statement in writing signed by a duly authorized representative of the bidder, that the present financial condition of the bidder is at least as good as that shown on the statements submitted.

4.) A statement of work which the bidder has on hand, including any work on which a bid has been submitted, containing a description of the work, the dollar value, the location by city and state, the current percentage of completion and the expected date for completion.

5.) Fill in below the name and address of the bidder's chief banking representative handling the bidder's account.

Banking Institution: Merrill Lynch

Address: 1010 Northern Blvd
Great Neck, NY 11021

Bank Representative: Phil Ressa

Telephone Number: (516) 498-3372

6.) Fill in below the bidder's Federal Employer Identification Number (i.e., the number assigned to firms by the Federal Government for tax purposes); the bidder's Dun and Bradstreet number, if any; the name of any other credit service to which the bidder has furnished information and the number, if any, assigned by such service to the bidder's account.

[redacted]

Federal Employer Identification No.

61508 3169

Dun and Bradstreet No.

Other Credit Service

Account No.

D. The Form of Contract bound herewith, with the bidder's prices inserted in the clause thereof entitled "Unit Prices and Lump Sum". The amounts must be given both in figures and in writing and, in case of discrepancy, the writing shall control. The unit prices must be extended and totaled. The Estimated Total for Classified Work and the Lump Sum must be entered in the recapitulation and totaled. One copy of each addendum, if any, issued during the bidding period shall be initialled and attached to the Proposal, but any Proposal submitted without such addendum initialled and attached will nevertheless be construed as though such addendum had been initialled and attached.

E. The bidder's analysis of bid filled in on the form furnished herewith. The Contractor will be required to furnish a more detailed analysis of bid at a later date in accordance with the requirements of the Section of Division 1 of the Specifications referring to the Analysis of Bid.

3. QUALIFICATION INFORMATION

At any time after the opening of Proposals, the Chief Engineer may give oral or written notice to one or more bidders to attend a pre-award meeting and to furnish the Authority with information relating to his qualifications to perform the Work, including the following, which information shall be furnished within seven (7) days thereafter:

A. The bidders MBE/WBE Participation Plan submitted on the form annexed hereto as Schedule C (see the clause hereof entitled "Minority and Women's Business Enterprises Program") and a detailed list of the plant and equipment which the bidder proposes to use, indicating which portions it already possesses.

B. Detailed information relating to work which the bidder has completed for others, including personal and corporate references, sufficient to the Authority to determine the Contractor's responsibility, experience and capacity to perform the Work. If required by the Chief Engineer, the foregoing information shall include information to demonstrate to the satisfaction of the Chief Engineer that the Contractor has within the past five years been a contractor on at least one contract of the same general type, extent and complexity as the Contract on which the Proposal has been submitted, and completed the work skillfully, in a satisfactory manner and on time.

C. Information to supplement a) data shown in the financial statements and the statement of work on hand required to be submitted with the Proposal; and b) any statement submitted under the clauses hereof entitled "Certification of No Investigation (Criminal or Civil Anti-Trust), Indictment, Conviction, Suspension, Debarment, Disqualification, Prequalification Denial or Termination, etc, Disclosure of Other Required Information", "Certification of Participation in a State-Registered Apprenticeship Program" or "Non-Collusive Bidding and Code of Ethics Certification; Certification of No Solicitation Based on Commission, Percentage, Brokerage, Contingent Fee or Other Fee".

D. Moreover, in the event that the bidder's performance on a past Port Authority or PATH contract or contracts has been rated less than satisfactory, the Chief Engineer may give oral or written notice to the bidder to furnish information demonstrating to the satisfaction of the Chief Engineer that, notwithstanding such rating, such performance was, in fact, satisfactory, or that the circumstances which gave rise to such unsatisfactory rating have changed or will not apply to performance of the Contract, and that such performance will be satisfactory.

E. If the bidder has performed a contract for the States of New York or New Jersey, or any governmental entity within such States and has filed a questionnaire or other document required to be submitted in order for the bidder to qualify to perform the contract, the bidder may be requested by the Chief Engineer to submit the most recent completed questionnaire or other such document, or if the most recent completed questionnaire or other such document is not available, to submit a written statement indicating the approximate date of the contract and the name of the governmental entity which awarded them the contract.

F. Any additional information relevant to the bidder's Proposal including information to supplement the bidder's initial analysis of bid.

In the event that any of the foregoing is requested and is not furnished within seven days thereafter or within such additional time as the Chief Engineer, in his sole discretion, may allow, the Authority may not be in a position to determine whether the bidder is qualified, whether the bidder understands the requirements of the contract or whether the bid is responsive and may, in its sole discretion, reject the bidder's Proposal.

The giving of such notice to the bidder in connection with any of the foregoing lists, statement or information shall not be construed as an acceptance of his Proposal. However, the Authority reserves the right in its sole and absolute discretion, to accept the Proposal of a bidder despite the fact that said bidder has not submitted any information, list or statement required pursuant to this Section within the above-stated time period.

4. ACCEPTANCE OR REJECTION OF PROPOSAL

Within sixty (60) days after the opening of the Proposals, the Authority will accept one of the Proposals, if it accepts any. The acceptance of a Proposal will be only by mailing to or delivering at the office designated in the Proposal a notice in writing specifically indicating acceptance signed by an authorized representative on behalf of the Authority who is at present the Authority's Director of Procurement. No other act of the Authority, its Commissioners, officers, agents, or employees shall constitute acceptance of a Proposal. Such notice will state whether or not the Authority elects to require the bidder to furnish a Performance and Payment Bond. Rejection of a Proposal will be only by either (a) a notice in writing specifically stating that the Proposal is rejected, signed by an authorized representative on behalf of the Authority who is at present the Authority's Director of Procurement and mailed to or delivered at the office designated in the Proposal or (b) omission of the Authority to accept a Proposal within sixty (60) days after the opening of Proposals; and no other act of the Authority, its Commissioners, officers, agents or employees shall constitute rejection of a Proposal, including any counter offer or other act of the Authority, its Commissioners, officers, agents or employees.

The Authority reserves the unqualified right, in its sole and absolute discretion, to reject all Proposals or to accept that Proposal if any, which in its judgment will under all the circumstances best serve the public interest and to waive defects in any Proposal.

In the event that a successful bidder defaults upon the Contract by failing to furnish a satisfactory Performance and Payment Bond, if required, and the Authority terminates the Contract, the Authority reserves the option to accept the Proposal of any other bidder within sixty (60) days after the opening of Proposals, in which case such acceptance shall have the same effect as to such other bidder as though he were the originally successful bidder.

5. RETURN OF CERTIFIED CHECKS

Within ten (10) days after the opening of the Proposals the Authority will return all certified checks deposited by bidders, except those deposited by three bidders to be selected by the Authority, which will be returned within three days after one Proposal is accepted by the Authority; or if a Performance and Payment Bond is required, within three days after a satisfactory Performance and Payment Bond is furnished to the Authority; or if all Proposals are rejected, not later than three days after such rejection. The return of a bidder's check shall not, however, be deemed to be a rejection of his Proposal.

6. WEBSITE POSTINGS OF CONTRACT DOCUMENTS

Recipients of Contract documents marked Confidential (Privileged) may not post them or any of them to a website except in accordance with the Authority's prior written approval, which may require a written non-disclosure agreement.

Recipients of Contract documents not marked Confidential (Privileged) may not post them or any of them to a website unless the website (1) is non-public, (2) is password protected and (3) is accessible only to the recipient's prospective subcontractors and suppliers. Recipient's prospective subcontractors and suppliers shall also be deemed recipients and shall be required to conform to the terms of this numbered clause. Recipients shall be deemed to include both bidders and those who do not submit bids.

No later than 180 days after the date of receipt of Proposals, all recipients shall remove all Contract Documents from their websites.

7. DISPOSAL OF CONTRACT DOCUMENTS

All recipients of Contract documents, including bidders and those who do not bid and their prospective subcontractors and suppliers who may receive all or a part of the Contract documents or copies thereof, shall make every effort to ensure the secure and appropriate disposal of the Contract documents to prevent further disclosure of the information contained in the documents. Secure and appropriate disposal includes methods of document destruction such as shredding or arrangements with refuse handlers that ensure that third persons will not have access to the documents' contents either before, during, or after disposal. Documents may also be returned for disposal purposes to the Contract Desk on the 3rd Floor, 3 Gateway Center, Newark, NJ 07102 or the office of the Director of Procurement, Two Montgomery Street, 3rd Floor, Jersey City, NJ 07302.

8. MINORITY AND WOMEN'S BUSINESS ENTERPRISES PROGRAM (MBE/WBE)

The Authority has a long-standing practice of making its contract opportunities available to as many firms as possible and has taken affirmative steps to encourage Minority Business Enterprises (MBEs) and Women's Business Enterprises (WBEs) to seek business opportunities with it.

"Minority-owned business" or "MBE" means a business entity which is at least 51 percent owned by one or more members of one or more minority groups, or, in the case of a publicly held corporation, at least 51 percent of the stock of which is owned by one or more members of one or more minority groups, and whose management and daily business operations are controlled by one or more such individuals who are citizens or permanent resident aliens.

"Women-owned business" or "WBE" means a business which is at least 51 percent owned by one or more women, or, in the case of a publicly held corporation, 51 percent of the stock of which is owned by one or more women, and whose management and daily business operations are controlled by one or more women who are citizens or permanent resident aliens.

"Minority group" means any of the following racial or ethnic groups:

A. Black persons having origins in any of the black African racial groups not of Hispanic origin;

B. Hispanic persons of Puerto Rican, Mexican, Dominican, Cuban, Central, or South American culture or origin, regardless of race;

C. Asian and Pacific Islander persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent or the Pacific Islands;

D. Native American or Alaskan native persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification.

To ensure meaningful participation of MBEs and WBEs on this Contract, the Authority has set goals of 12 percent for firms owned and controlled by minorities, and 5 percent for firms owned and controlled by women.

In the event that any portion of the Work is subcontracted in accordance with the clause of the Form of Contract entitled "Assignments and Subcontracts", every good faith effort to meet the above goals for MBE and WBE participation in the Work shall be made and documented. Such good faith efforts shall include at least the following:

A. Attendance at pre-bid meetings, if any, scheduled by the Authority;

B. Utilization of the Authority's Directory of certified MBE/WBEs available on-line (see Notification of M/WBE On-line Directory and Forms in back of Contract booklet) and/or proposing for certification other MBE/WBEs which appear to meet the Authority's criteria for MBE/WBE certification and which are technically competent to perform the Work which the bidder plans to subcontract;

C. Active and affirmative solicitation of bids for subcontracts from MBE/WBEs;

D. Advertisement in general circulation media, trade association publications and minority-focused media for a reasonable period before bids or proposals are due;

E. Dividing the work to be subcontracted into smaller portions or encouraging the formation of joint ventures, partnerships or similar arrangements among subcontractorsin order to increase the likelihood of achieving the MBE/WBE goals;

F. Providing a sufficient supply of drawings and specifications of prospective work to MBE/WBEs and providing appropriate materials to each in sufficient time to review; and

G. Utilizing the services of available minority and women's community organizations; contractors' groups; local, State and Federal business assistance/development offices and other organizations that provide assistance to MBE/WBEs.

Subsequent to acceptance by the Authority of the Contractor's Proposal, the Contractor shall use and document every good faith effort to comply with his MBE/WBE Participation Plan and to permit his MBE/WBE subcontractors to perform. Participation percentages shall be monitored throughout the performance of this Contract. Such good faith efforts shall include at least the following:

A. Ensuring that progress payments are made in a timely fashion in accordance with the requirements of this Contract;

B. Not requiring bonds from and/or providing bonds and insurance for subcontractors where appropriate;

C. Soliciting specific recommendations on methods for enhancing MBE/WBE participation from Authority staff responsible for such participation; and

D. Nominating subcontractors for participation in business assistance programs sponsored by the Authority or the Regional Alliance of Small Contractors such as the Loaned Executive Assistance Program (L.E.A.P.).

Subsequent to acceptance by the Authority of the Contractor's Proposal, the Contractor shall also provide the Engineer, at his request, with a trade breakdown schedule showing when the Contractor's MBE/WBE subcontractors are scheduled to perform. The Contractor shall also submit to the Engineer, on a monthly basis, the Statement of Subcontractor's Payments annexed hereto as Schedule D.

In the event that, prior to acceptance by the Authority of the Contractor's Proposal and following review of the MBE/WBE Participation Plan submitted by the bidder pursuant to the clause hereof entitled "Qualification Information", the Chief Engineer determines that the bidder has not made a good faith effort to meet the MBE/WBE participation goals set forth above and that the bidder has not demonstrated that a full or partial waiver of such goals is appropriate, the Chief Engineer may advise the bidder that it is not responsible and may reject the bidder's Proposal.

If, during the performance of the Contract, the Contractor fails to demonstrate good faith in carrying out his MBE/WBE Participation Plan and in permitting his MBE/WBE subcontractors to perform and the Contractor has not demonstrated that a full or partial waiver of the above referenced MBE/WBE participation goals is appropriate, then, upon receipt of a future proposal or proposals from the Contractor, the Chief Engineer may advise the Contractor that he is not a responsible bidder and may reject such proposal(s).

Either prior or subsequent to acceptance of the bidder's Proposal, the bidder may request a full or partial waiver of the above described MBE/WBE participation goals by providing a reasonable demonstration to the Chief Engineer that his good faith efforts will not result in compliance with the goals set forth above because participation by eligible MBE/WBEs could not be obtained at a reasonable price or that such MBE/WBEs were not available or refused to perform as subcontractors. The bidder shall provide such documentation to support his request as the Chief Engineer may require.

Once approved, the MBE/WBE Participation Plan submitted by the bidder may be modified only with the written approval of the Engineer.

Following approval by the Engineer under the clause entitled "Assignments and Subcontracts" of one or more subcontractors who are either MBEs or WBEs and listed in the MBE/WBE Directory or determined to be "eligible" by the Chief Engineer in accordance with this numbered clause, the Authority may, at its sole option, provide to said approved M/WBEs, without charge, whatever appropriate consultant services may be available under the L.E.A.P. Program; provided, however, that such consultant services will only be furnished pursuant to a request in writing from the Director, Office of Business Diversity and Civil Rights of the Port Authority of New York and New Jersey, 233 Park Avenue South - 4th Floor, New York, NY 10003.

Such services will be discontinued following a written request from the Contractor to the Director, Office of Business Diversity and Civil Rights of the Port Authority of New York and New Jersey, to discontinue them.

The L.E.A.P. services include advising on scheduling, purchasing, planning and other aspects of construction to firms to mitigate business or management problems which could negatively impact on their performance. These services do not include engineering or legal advice. The determination as to whether or not to follow the advice given lies solely with the M/WBE subcontractor. Prior to being accepted as a participant in the L.E.A.P. Program, the M/WBE subcontractor will be required to release the Authority and the individuals furnishing consultant advice of all liability and responsibility in connection therewith.

The Authority has compiled and made available on-line an MBE/WBE Directory which specifies the firms the Authority has determined to be (1) MBEs/WBEs and (2) experienced in performing work in the trades and contract dollar ranges indicated in the Directory. The Authority makes no representation as to the financial responsibility of such firms or their ability to perform Work required under this Contract. Subject to the following paragraph, only MBEs/WBEs listed in the Directory will count toward the required MBE/WBE participation.

If the Contractor wishes to perform a portion of the Work through a firm not listed in the Directory [2] but which the Contractor believes should be eligible because it is (1) an MBE/WBE, as defined above and (2) technically competent to perform portions of the Work or the Contractor believes it is such a firm, the Contractor shall submit to the Director, Office of Business Diversity and Civil Rights of the Port Authority of New York and New Jersey, a written request for a determination that the proposed firm is eligible. This shall be done by completing and forwarding a) the form labeled "Schedule A" and, if appropriate, "Schedule B" which are annexed hereto and form a part hereof and b) technical references of jobs completed of similar scope and complexity on the form annexed hereto and made a part hereof labeled "MBE/WBE Approval Request" and such other information as may be necessary to permit the Authority to determine whether the firm is in fact an MBE/WBE and technically competent to perform portions of the Work.

1. Queens Air Services Development Office
   JFK International Airport
   Building #141
   Federal Circle, First Floor
   Jamaica, NY 11430
   (718) 244-6852
   Fax (718) 244-7371
   www.asdoonline.com

2. Chinatown Manpower Project, Inc.
   70 Mulberry Street
   New York, NY 10031
   (212) 571-1690
   www.cmpny.org

3. Association of Minority Enterprises of NY, Inc.
   135-20 Liberty Avenue
   Richmond Hill, NY 11419
   (718) 291-1641
   Fax (718) 291-1641
   www.ameny.org

4. Statewide Hispanic Chamber of Commerce of New Jersey
   150 Warren Street, Suite 110
   Jersey City, NJ 07302
   (201) 451-9512
   Fax (201) 451-9547
   www.shccnj.org

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[2] The following organizations may be able to refer the Contractor to MBEs/WBEs who are technically competent to perform portions of the Work. Any referrals which are not listed in the Directory shall be submitted to the Authority for a determination as to eligibility as provided above.

5. Greater Newark Business
Development Consortium
744 Broad Street, 26th Floor
Newark, NJ 07102
(973) 242-5563
www.gnbdc.org

6. Jamaica Business Resource Center
90-33 160th Street
Jamaica, NY 11432
(718) 206-2255
Fax (718) 206-3693
www.jbrc.org

7. Council for Airport Opportunity
Newark Liberty International Airport
Building 80
Newark, NJ 07014
(973) 961-4382
www.caonj.com

8. National Hispanic Business Group
1230 Avenue of the Americas,
7th Floor
New York, NY 10020
(212) 265-2664
www.nhbg.org

9. Greater Jamaica Development Corp.
90-04 161st Street
Jamaica, NY 11432
(718) 291-0282
Fax (718) 291-7918
www.gjdc.org

10. NYS Assn. Of Minority Contractors
Brooklyn Navy Yard
Building 280, 4th Floor, Suite 414
Brooklyn, NY 11205
(212) 246-8380
Fax (718) 246-8376
www.nysamc.org

11. Professional Women in Construction
315 E. 56th Street, Suite 202
New York, NY 10022
(212) 486-7745
Fax (212) 486-0228
www.pwcusa.org

12. NY/NJ Minority Purchasing Council
330 Seventh Avenue, 8th Floor
New York, NY 10001
(212) 502-5663
www.nynjmsdc.org

13. National Minority Business Council
120 Broadway, 19th Floor
New York, NY 10271
(212) 693-5050
www.nmbc.org

14. Queens Overall Economic Development Office
120-55 Queens Boulevard, Suite 309 Kew Gardens, NY 11424
(718) 263-0546
Fax (718) 263-0594
www.queensny.org

15. York College Small Business Development Center
94-50 159th Street
York College,
Room S 107
Jamaica, NY 11451
(718) 262-2880
Fax (718) 262-2881
www.nyssbdc.org

16. Small Business Development Center - Rutgers University, University Heights
43 Bleeker Street
Newark, NJ 07102
(973) 353-1927
Fax (973) 353-1110
www.msbdc.newark.rutgers.edu

17. New Jersey Association of Women Business Owners (NJAWBO)
186 Princeton Hightstown Road
West Windsor, NJ 08550
(609) 799-5101
www.njawbo.org

18. New Jersey Air Services Development Office
Newark Liberty International Airport Building #80 - Second Floor
Newark, NJ 07114
(973) 961-4278
Fax (973) 961-4282
www.asdonline.com

19. Caribbean-American Chamber of Commerce
Brooklyn Navy Yard
63 Flushing Avenue
Brooklyn, NY 11205
(718) 834-4544
Fax (718) 834-9774
www.caribbeantradecenter.com

20. Northeast Region – Small Business Resource Transportation Center
29-10 Thomson Avenue
Long Island City, NY 11101
(718) 482-5941
www.osdbu.dot.gov/regional/northeast.cfm

21. Asian Women in Business
42 Broadway, Suite 1748
New York, NY 10004
(212) 868-1368
Fax (212) 868-1373
www.awib.org

22. Asian American Business Development Center
80 Wall Street, Suite 418
New York, NY 10005
(212) 966-0100
Fax (212) 966-2786
www.aabdc.com

23. New York State Federation of Hispanic Chambers of Commerce
2710 Broadway
New York, NY 10025
(212) 222-8300
Fax (212) 222-8412
www.nysfhcc.com

24. Orange County Chamber of Commerce
30 Scott Corners Drive
Montgomery, NY 12549
(845) 457-9700 Ext. 1101
www.orangeny.com

25. Regional Alliance For Small Contractors
625 Eighth Avenue, 2nd Floor,
North Wing
New York, NY 10018
(212) 268-2991
www.regional-alliance.org

26 Women Builders Council
500 Hampton Avenue
Brooklyn, NY 11235
(212) 367-2130
www.wbcnyc.org

All such requests shall be in writing addressed to the Chief Engineer. If any such firm is determined to be eligible it shall only be by a writing over the name of the Chief Engineer. In the event that such firm is found not to be eligible, the Chief Engineer will only consider as a substitute for such firm, a firm listed in the Authority's MBE/WBE Directory available on-line.

The Contractor shall submit the names of proposed MBEs/WBEs for work on this Contract if their names do not appear in the Authority's MBE/WBE Directory available on-line in accordance with the requirements of this clause and all other requirements of this Contract. MBEs/WBEs proposed as lessors of equipment or materialmen shall be deemed "subcontractors" for the purpose of this numbered clause and the clause hereof entitled "Assignments and Subcontracts" but shall not be deemed subcontractors for any other purpose. However only 60% of the amounts paid by the Contractor to such materialmen who are MBEs/WBEs, except in the case of firms who themselves manufacture materials for use under the Contract, shall be allowed in computing the percentages of the Contract Price required to be paid to MBEs/WBEs hereunder.

The Contractor shall ensure that all approved MBE/WBE subcontractors maintain a regular on site presence at the construction site for the portions of the Work they are subcontracted to perform and that they exercise financial and operation management and control of such portions of the Work.

Nothing herein shall be deemed to supersede or to otherwise modify the clause of the Form of Contract entitled "Assignments and Subcontracts".

9. INSPECTION OF SITE

Each bidder or his authorized representative must make proper arrangements with the Resident Engineer at the construction site before inspecting the construction site. To make such arrangements call Terrence Mohammed, at (718) 533-4265.

10. QUESTIONS BY BIDDERS

Questions by prospective bidders concerning the Contract may be addressed to Jessamma Vatakencherry, at (201) 395-3453 or email at jvataken@panynj.gov, who however is authorized only to direct the attention of prospective bidders to various portions of the Contract so that they may read and interpret such portions for themselves. Neither Jessamma Vatakencherry nor any other employee or representative of the Authority is authorized to give interpretations of any portion of the Contract or to give information as to the requirements of the Contract in addition to that contained in the Contract. Interpretations of the Contract or additional information as to its requirements, where necessary, shall be communicated to bidders only by written addendum issued over the name of the Chief Engineer, which addendum shall be considered part of this Contract. Accordingly, nothing contained herein and no representation, statement or promise, oral or in writing, of the Authority, its Commissioners, officers, agents, representatives or employees shall impair or limit the effect of the warranties of the Contractor contained in the clause of the Form of Contract entitled "Contractor's Warranties" or elsewhere in this Contract. The provisions of this clause shall apply to questions addressed by prospective bidders both before and after their receipt of Contract Documents.

11. PREVAILING RATE OF WAGE CERTIFICATION

The bidders' attention is directed specifically to the clause of the Form of Contract entitled "Prevailing Rate of Wage" and to the fact that the Authority requires a certification in writing from the successful bidder, in such form as may be required pursuant to such clause, that he has paid and caused his subcontractors to pay at least the prevailing rate of wage and supplements required by such clause. This certification is required prior to his receipt of any payment from the Authority hereunder as provided in the clauses of the Form of Contract entitled "Monthly Advances" and "Final Payment" or at any other time.

12. CERTIFICATION OF NO INVESTIGATION (CRIMINAL OR CIVIL ANTI-TRUST), INDICTMENT, CONVICTION, SUSPENSION, DEBARMENT, DISQUALIFICATION, PREQUALIFICATION DENIAL OR TERMINATION, ETC; DISCLOSURE OF OTHER REQUIRED INFORMATION

By bidding on this Contract, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, that the bidder and each parent and/or affiliate of the bidder has not (a) been indicted or convicted in any jurisdiction; (b) been suspended, debarred, found not responsible or otherwise disqualified from entering into contracts with any governmental agency or been denied a government contract for failure to meet prequalification standards; (c) had a contract terminated by any governmental agency for breach of contract or for any cause related directly or indirectly to an indictment or conviction; (d) changed its name and/or Employer Identification Number (taxpayer identification number) following its having been indicted, convicted, suspended, debarred or otherwise disqualified, or had a contract terminated as more fully provided in (a), (b) and (c) above; (e) ever used a name, trade name or abbreviated name, or an Employer Identification Number different from those inserted in the Proposal; (f) been denied a contract by any governmental agency for failure to provide the required security, including bid, payment or performance bonds or any alternative security deemed acceptable by the agency letting the contract; (g) failed to file any required tax returns or failed to pay any applicable federal, state or local taxes; (h) had a lien imposed upon its property based on taxes owed and fines and penalties assessed by any agency of the federal, state or local government; (i) 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, including an inspector general of a governmental agency or public authority; (j) had any sanctions imposed as a result of a judicial or administrative proceeding with respect to any professional license held or with respect to any violation of a federal, state or local environmental law, rule or regulation; and (k) shared space, staff, or equipment with any business entity.

The foregoing certification as to "(a)" through "(k)" shall be deemed to have been made by the bidder as follows: if the bidder is a corporation, such certification shall be deemed to have been made not only with respect to the bidder itself, but also with respect to each director and officer, as well as, to the best of the certifier's knowledge and belief, each stockholder with an ownership interest in excess of 10%; if the bidder is a partnership, such certification shall be deemed to have been made not only with respect to the bidder itself, but also with respect to each partner. Moreover, the foregoing certification, if made by a corporate bidder, shall be deemed to have been authorized by the Board of Directors of the bidder, 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 bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the signed bid a signed statement which sets forth in detail the reasons therefor. If the bidder is uncertain as to whether it can make the foregoing certification, it shall so indicate in a signed statement furnished with its bid, setting forth an explanation for its uncertainty.

Notwithstanding that the certification may be an accurate representation of the bidder's status with respect to the enumerated circumstances provided for in this clause as requiring disclosure at the time that the bid is submitted, the bidder agrees to immediately notify the Authority in writing of any change in circumstances during the period of irrevocability, or any extension thereof.

The foregoing certification or signed statement shall be deemed to have been made by the bidder with full knowledge that it would become a part of the records of the Authority and that the Authority will rely on its truth and accuracy in awarding this Contract. In the event that the Authority determines at any time prior or subsequent to the award of the Contract that the bidder has falsely certified as to any material item in the foregoing certification; willfully or fraudulently submitted any signed statement pursuant to this clause which is false in any material respect; or has not completely and accurately represented its status with respect to the circumstances provided for in this clause as requiring disclosure, the Authority may determine that the bidder is not a responsible bidder with respect to its bid on this Contract or with respect to future bids and may, in addition to exercising any other rights or remedies available to it, exercise any of the rights or remedies set forth in the clause of the Form of Contract entitled "Rights and Remedies of Authority". In addition, bidders 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.). Bidders are also advised that the inability to make such certification will not in and of itself disqualify a bidder, and that in each instance the Authority will evaluate the reasons therefor provided by the bidder.

Under certain circumstances the bidder may be required as a condition of this 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 shall be charged with, among other things, auditing the actions of the bidder to determine whether its business practices and relationships indicate a level of integrity sufficient to permit it to continue business with the Port Authority.

As used in this clause, the following terms shall mean:

Affiliate - An entity in which the parent of the bidder owns more than fifty percent of the voting stock, or an entity in which a group of principal owners which owns more than fifty percent of the bidder also owns more than fifty percent of the voting stock.

Agency or Governmental Agency - Any federal, state, city or other local agency, including departments, offices, quasi-public agencies, public authorities and corporations, boards of education and higher education, public development corporations, local development corporations and others.

Employer Identification Number - The tax identification number assigned to firms by the Federal government for tax purposes.

Investigation - Any inquiries made by any federal, state or local criminal prosecuting or investigative agency, including an inspector general of a governmental agency or public authority, 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.

Space Sharing - Space shall be considered to be shared when any part of the floor space utilized by the submitting business at any of its sites is also utilized on a regular or intermittent basis for any purpose by any other business or not-for-profit organization, and where there is no lease or sublease in effect between the submitting business and any other business or not-for-profit organization that is sharing space with the submitting business.

Staff Sharing - Staff shall be considered to be shared when any individual provides the services of an employee, whether paid or unpaid, to the bidder and also, on either a regular or irregular basis, provides the services of an employee, paid or unpaid, to one or more other business(es) and/or not-for-profit organization(s), if such services are provided during any part of the same hours the individual is providing services to the bidder or if such services are provided on an alternating or interchangeable basis between the bidder and the other business(es) or not-for-profit organization(s). "The services of an employee" should be understood to include services of any type or level, including managerial or supervisory. This type of sharing may include, but is not limited to, individuals who provide the following services: telephone answering, receptionist, delivery, custodial, and driving.

Equipment Sharing - Equipment shall be considered to be shared whenever the bidder shares the ownership and/or the use of any equipment with any other business or not-for-profit organization. Such equipment may include, but is not limited to, telephones or telephone systems, photocopiers, computers, motor vehicles, and construction equipment. Equipment shall not be considered to be shared under the following two circumstances: when, although the equipment is owned by another business or not-for-profit organization, the bidder has entered into a formal lease for the use of the equipment and exercises exclusive use of the equipment; or when the bidder owns equipment that it has formally leased to another business or not-for-profit organization, and for the duration of such lease the bidder has relinquished all right to the use of such leased equipment.

13. NON-COLLUSIVE BIDDING AND CODE OF ETHICS CERTIFICATION; CERTIFICATION OF NO SOLICITATION BASED ON COMMISSION, PERCENTAGE, BROKERAGE, CONTINGENT FEE OR OTHER FEE

By bidding on this Contract, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, that: (a) 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 bidder or with any competitor; (b) the prices quoted in its bid have not been and will not be knowingly disclosed, directly or indirectly, by the bidder prior to the official opening of such bid to any other bidder or to any competitor; (c) no attempt has been made and none will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition; (d) this organization has not made any offers or agreements, or given or agreed to give anything of value (see definition of "anything of value" appearing in the clause of the Form of Contract entitled "No Gifts, Gratuities, Offers of Employment, etc.") 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 and Financial Disclosure dated as of April 11, 1996 (a copy of which is available upon request to the individual named in the clause hereof entitled "Questions by Bidders"), 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; (e) no person or selling agency, other than a bona fide employee or bona fide established commercial or selling agency maintained by the bidder for the purpose of securing business, has been employed or retained by the bidder 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; (f) the bidder 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 certification as to "(a)", "(b)", "(c)", "(d)", "(e)" and "(f)" shall be deemed to have been made by the bidder as follows: if the bidder is a corporation, such certification shall be deemed to have been made not only with respect to the bidder itself, but also with respect to each parent, affiliate, director and officer of the bidder, as well as, to the best of the certifier's knowledge and belief, each stockholder of the bidder with an ownership interest in excess of 10%; if the bidder is a partnership, such certification shall be deemed to have been made not only with respect to the bidder itself, but also with respect to each partner. Moreover, the foregoing certification, if made by a corporate bidder, shall be deemed to have been authorized by the Board of Directors of the bidder, 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 bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the signed bid a signed statement which sets forth in detail the reasons therefor. If the bidder is uncertain as to whether it can make the foregoing certification, it shall so indicate in a signed statement furnished with its bid, setting forth in such statement the reasons for its uncertainty. As a result of such disclosure, the Port Authority shall take appropriate action up to and including a finding of non-responsibility.

Failure to make the required disclosures shall lead to administrative actions up to and including a finding of non-responsibility.

Notwithstanding that the bidder may be able to make the foregoing certification at the time the bid is submitted, the bidder shall immediately notify the Authority in writing during the period of irrevocability of bids on this Contract or any extension of such period, of any change of circumstances which might under this clause make it unable to make the foregoing certification or required disclosure. The foregoing certification or signed statement shall be deemed to have been made by the bidder with full knowledge that it would become a part of the records of the Authority and that the Authority will rely on its 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 bidder has falsely certified as to any material item in the foregoing certification 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 certification required to be disclosed, the Authority may determine that the bidder is not a responsible bidder with respect to its bid on this Contract or with respect to future bids on Authority contracts and may, in addition to exercising any other rights or remedies it may have, exercise any of the rights or remedies set forth in the clause of the Form of Contract entitled "Rights and Remedies of Authority".

In addition, bidders 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.). Bidders are also advised that the inability to make such certification will not in and of itself disqualify a bidder, and that in each instance the Authority will evaluate the reasons therefor provided by the bidder.

Under certain circumstances the bidder may be required as a condition of this 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 shall be charged with, among other things, auditing the actions of the bidder to determine whether its business practices and relationships indicate a level of integrity sufficient to permit it to continue business with the Port Authority.

14. BIDDER ELIGIBILITY FOR AWARD OF CONTRACTS - DETERMINATIONS BY AN AGENCY OF THE STATE OF NEW YORK OR NEW JERSEY CONCERNING ELIGIBILITY TO RECEIVE PUBLIC CONTRACTS

Bidders 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 bidder is not eligible to bid on or be awarded public contracts because the bidder has been determined to have engaged in illegal or dishonest conduct or to have violated prevailing rate of wage legislation.

The policy permits a bidder 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 the contract on which it has bid because (i) the state agency determination relied upon does not apply to the bidder, or (ii) the state agency determination relied upon was made without affording the bidder the notice and hearing to which the bidder 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 a 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.

15. THE EDWARD J. MALLOY CONSTRUCTION INITIATIVE FOR CONSTRUCTION SKILLS - APPRENTICESHIP PROGRAM

The Authority is a participant in the Edward J. Malloy Construction Initiative for Construction Skills (formerly known as Construction Skills 2000), a cooperative program among New York City schools, unions and public agencies. The Edward J. Malloy Construction Initiative for Construction Skills creates career opportunities in the construction industry for high school graduates by providing a systematic pathway into union-sponsored, skilled trade apprenticeship programs. The Authority encourages contractors and their subcontractors to maximize the use of apprentices under the applicable collective bargaining agreements or as contained in the applicable program approved by the New York State Department of Labor. The Contractor's plan for utilizing apprentices will be discussed at the pre-construction meeting.

Each subcontractor proposed for approval under the Contract whose total amount of subcontracts under this Contract is greater than $1 million and each bidder (except as set forth in the certification below) will be required to certify as to their participation in a New York State-registered apprenticeship program.

16. CERTIFICATION OF PARTICIPATION IN A STATE-REGISTERED APPRENTICESHIP PROGRAM

By bidding on this Contract, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, that the bidder participates in an apprenticeship program registered by the New York State Department of Labor. Participation in such an apprenticeship program shall mean that the bidder either (a) is a signatory to a collective bargaining agreement with a labor organization which sponsors an apprenticeship program registered with the New York State Department of Labor or (b) individually sponsors an apprenticeship program registered by the New York State Department of Labor and, in the case of both (a) and (b) above, such apprenticeship program shall be in the trade(s) in which Work is to be performed. This clause shall not apply to bidders who will perform all Work at the construction site through the use of subcontractors.

The foregoing certification, if made by a corporate bidder, shall be deemed to have been authorized by the Board of Directors of the bidder, 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 bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the signed bid a signed statement which sets forth in detail the reasons therefor. If the bidder is uncertain as to whether it can make the foregoing certification, it shall so indicate in a signed statement furnished with its bid, setting forth an explanation for its uncertainty.

Notwithstanding that the certification may be an accurate representation of the bidder's status with respect to the enumerated circumstances provided for in this clause as requiring disclosure at the time that the bid is submitted, the bidder agrees to immediately notify the Authority in writing of any change in circumstances during the period of irrevocability, or any extension thereof.

The foregoing certification or signed statement shall be deemed to have been made by the bidder with full knowledge that it would become a part of the records of the Authority and that the Authority will rely on its truth and accuracy in awarding this Contract. In the event that the Authority determines at any time prior or subsequent to the award of the Contract that the bidder has falsely certified as to any material item in the foregoing certification; willfully or fraudulently submitted any signed statement pursuant to this clause which is false in any material respect; or has not completely and accurately represented its status with respect to the circumstances provided for in this clause as requiring disclosure, the Authority may determine that the bidder is not a responsible bidder with respect to its bid on this Contract or with respect to future bids and may, in addition to exercising any other rights or remedies available to it, exercise any of the rights or remedies set forth in the clause of the Form of Contract entitled "Rights and Remedies of Authority". In addition, bidders 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.).

17. JOB MIX SUBMITTAL

A bidder may be directed by the Chief Engineer in writing to proceed with design of the asphalt concrete mix specified in the Section of the Specifications entitled "Asphalt Concrete Paving" prior to acceptance of one of the Proposals. If so directed by the Chief Engineer, the bidder shall immediately prepare the design of the asphalt concrete mix and submit it to the Engineer for approval as specified in the aforementioned Section of the Specifications.

All drawings, data and written materials of any type whatsoever which are prepared in connection with the preparation of such design and submitted to the Authority shall be subject to the Section of the Specifications entitled "Shop Drawings, Catalog Cuts and Samples". All materials submitted to the Authority shall be subject to the Section of the Specifications entitled "Workmanship and Materials" and upon submission to the Authority, they shall become the property of the Authority.

None of the requirements of the Contract shall be altered in any way as a result of a bidder being or not being so directed by the Chief Engineer prior to acceptance of one of the Proposals.

In the event that the Proposal of the bidder who was so directed by the Chief Engineer is accepted then no compensation other than that provided in the Form of Contract shall be paid to said bidder.

In the event design of the asphalt concrete mix has been prepared and for any reason thereafter the Proposal of the bidder who was directed by the Chief Engineer to prepare such design is not accepted, then such bidder shall be reimbursed for the cost of the preparation of the design in the amount to be agreed to by the Chief Engineer and the bidder but not to exceed a total amount of Five Thousand Dollars ($5,000.00) regardless of the actual cost to such bidder connected with the preparation of such design.

As used in this numbered clause the term "cost of the preparation of the design" means the cost to the Contractor of materials submitted, the initial design submitted, any resubmittals required by the Engineer and all testing and analysis of the design.

PROPOSAL

To The Port Authority of New York and New Jersey:

The undersigned[3] Tully Construction Co. Inc a corporation organized under the laws of the State of New York

(hereinafter called "the Contractor") hereby offers to perform all the obligations and to assume all the duties and liabilities of the Contractor provided for in the annexed Contract, at the prices inserted by the undersigned in the clause of the Form of Contract entitled "Unit Prices and Lump Sum".

This offer shall be irrevocable for sixty (60) days after the date on which The Port Authority of New York and New Jersey opens this Proposal.

To induce the acceptance of this Proposal, the undersigned hereby makes each and every certification, statement, assurance, representation and warranty made by the Contractor in said Contract. Moreover as a condition to receipt and consideration by the Authority of the Proposal whether or not it is accepted, the undersigned agrees that all information of any nature whatsoever, regardless of the form of the communication, received from the undersigned (including its officers, agents, or employees) by the Authority, its Commissioners, officers, agents or employees, and notwithstanding any statement therein to the contrary, has not been given in confidence and may be used or disclosed by or on behalf of the Authority without liability of any kind except as may arise under letters patent of the undersigned, if any.

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[3] Insert bidder's name at the top of the page. After the bidder's name, insert one of the following phrases:

If a corporation, give state of incorporation, using the phrase, "a corporation organized under the laws of the State of ."

If a partnership, give full names of partners, using also the phrase, "co-partners doing business under the firm name of ."

If an individual using a trade name, give individual name, using also the phrase, "an individual doing business under the trade name of ."

If a joint venture, give the information required above for each participant in the joint venture.

Unless expressly stated otherwise, the Information for Bidders, all papers required by it and submitted in connection herewith at any time, said Form of Contract, and all papers made part of the Contract by the terms of the Form of Contract are made part of this Proposal.

The undersigned hereby designates the following as the bidders office[4]: 127-50 Northern Blvd
Flushing, NY 11368

The telephone number of the bidder is: (718) 446-7000

The fax number of the bidder is: (718) 446-6072

The E-Mail address of the bidder is: dphilips@tullyconstruction.com

[4] Insert office address.

SIGNATURE AND CERTIFICATE OF AUTHORITY[5]

Dated, August 17, 2012

(Signature of individual or name of corporation or partnership) Tully Construction Co. Inc

(Signature of agent, partner or corporate officer) By[6] [7] Peter K. Tully - President

(Acknowledgment of signature to be taken on proper form on following page(s)) Peter K. Tully, President

CERTIFICATE OF AUTHORITY, IF BIDDER IS A CORPORATION

I, the undersigned, as Secretary of the corporation submitting the foregoing Proposal, hereby certify that under and pursuant to the by-laws and resolutions of said corporation, each officer who has signed said Proposal on behalf of the corporation is fully and completely authorized so to do.

(Corporate Seal)

Kenneth W. Tully - Secretary

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5 If bidder is a joint venture, insert signatures as appropriate for one participant of the joint venture on this page and attach and complete an additional signature sheet in the same form as appears on this page for each other participant as required.

6 If Proposal is signed by an officer or agent, give title.

7 NOTE: The foregoing signature shall be deemed to have been provided with full knowledge that the foregoing Proposal, the accompanying Contract booklet, as well as any certification, statement, assurance, representation, warranty, schedule or other document submitted by the bidder with the Proposal will become a part of the records of the Authority and that the Authority will rely in awarding the Contract on the truth and accuracy of such Proposal and each such certification, statement, assurance, representation, warranty and schedule made therein by the Contractor. Knowingly submitting a false statement in connection with any of the foregoing may be the basis for prosecution for offering a false instrument for filing (see, e.g., N.Y. Penal Law, Section 175.30 et seq.).

ACKNOWLEDGMENT[8]

ACKNOWLEDGMENT OF BIDDER, IF A CORPORATION

State of New York

SS:

County of Queens

DESPINA PHILIPS
Notary Public, State of New York
No. 01PH5003152
Qualified in Queens County
Commission Expires Oct. 19, 20 14

On this 17 day of August, 2012 before me personally came and appeared Peter K. Tully, to me known, who, being by me duly sworn, did depose and say that he resides at [redacted], that he is the President of Tully Construction Co. Inc., the corporation described in and which executed the foregoing instrument; that he knows the seal of said corporation; that one of the seals affixed to said instrument is such seal; that it was so affixed by order of the directors of said corporation; and that he signed his name thereto by like order.

(Notary Seal)

Despina Philips
(Notary Signature)

ACKNOWLEDGMENT OF BIDDER, IF A PARTNERSHIP

State of _____

SS:

County of _____

On this _____ day of _____, 20 , before me personally came and appeared _____, to me known and known to me to be one of the members of the firm of _____, described in and who executed the foregoing instrument and he acknowledged to me that he executed the same as and for the act and deed of said firm.

(Notary Seal)

_____
(Notary Signature)

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ACKNOWLEDGMENT OF BIDDER, IF AN INDIVIDUAL

State of _____

SS:

County of _____

On this _____ day of _____, 20 , before me personally came and appeared _____ to me known and known to me to be the person described in and who executed the foregoing instrument and he acknowledged to me that he executed the same.

(Notary Seal)

_____
(Notary Signature)

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8 If bidder is a joint venture, insert signature as appropriate for one participant of the joint venture on this page and attach and complete an additional Acknowledgment sheet in the same form as appears on this page for each other participant as required

STATEMENT ACCOMPANYING PROPOSAL[9]

Names and Residences of Officers, If Bidder is a Corporation

Name	Title	Residence[10]
Peter K. Tully	President	[redacted]
Kenneth W. Tully	Secretary	
James M. Tully	Treasurer	
Thomas E. Tully	V.P.	

Names and Residences of Partners, If Bidder is a Partnership

Name	General or Limited Partner	Residence[11]

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Bidder's Residence, If an Individual[12]

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9 If bidder is a joint venture, insert signature as appropriate for one participant of the joint venture on this page and attach and complete an additional Statement Accompanying Proposal sheet in the same form as appears on this page for each other participant as required.

10 Give Street and Number of Residence. Do not give business address.

11 Give Street and Number of Residence. Do not give business address.

12 Give Street and Number of Residence. Do not give business address.

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned[13]
Tully Construction Co., Inc., a corporation organized under the laws of the State of New York,
127-50 Northern Boulevard, Flushing, New York 11368
as principal(s); and[14]
Federal Insurance Company
15 Mountain View Road, Warren, New Jersey 07059
as surety are hereby held and firmly bound unto The Port Authority of New York and New Jersey (herein called the "Authority") in the penal sum of Two Hundred Thousand Dollars ($200,000), for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed this 21st day of August , 2012

The condition of the above obligation is such that whereas the above named principal(s) has submitted to the Authority a certain Proposal, bound herewith and hereby made a part hereof, to perform the obligations of the Contractor under a contract in writing, known as Contract JFK-924.105, "John F. Kennedy International Airport - Rehabilitation of 148th Street and Three JFK Expressway Ramps", now therefore:

A. If said Proposal shall not be accepted, or

B. If said Proposal shall be accepted and the Authority does not require the principal(s) to furnish a Performance and Payment Bond, or

C. If said Proposal shall be accepted and the Authority requires the principal(s) to furnish a Performance and Payment Bond and either the principal(s) furnishes a Performance and Payment Bond satisfactory to the Authority in accordance with the requirements of said Proposal or the Authority does not terminate the Contract as provided therein on account of the failure to furnish such a bond,

Then, this obligation shall be void, otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

08-21-12 P03:

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13 Insert bidder's name. If a corporation, give the state of incorporation using the phrase "a corporation organized under the laws of the ".

If a partnership, give full names of partners, using also the phrase, "co-partners doing business under the firm name of ".

If an individual using a trade name, give individual name, using also the phrase, "an individual doing business under the trade name of ".

If a joint venture, give the information required above for each participant in the joint venture.

14 Insert name of surety.

The surety, for value received, hereby stipulates and agrees that the obligations of said surety and its bond shall be in no way impaired or affected by any extensions of the times within which the Authority may receive or accept such Proposal or within which the principal(s) may furnish a Performance and Payment Bond or by any waiver by the Authority of any of the requirements of said Proposal; and said surety does hereby waive notice of any such extensions or waivers.

IN WITNESS WHEREOF, the principal(s) and surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

Tully Construction Co., Inc.

Principal [15]

(Seal)

By[16]

Peter K. Tully, President

Federal Insurance Company

Surety

(Seal)

By[17]

Timothy M. Tyrrell, Attorney-in-Fact

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[15] If bidder is a joint venture, insert signature and information required as appropriate for one participant of the joint venture on this page and attach and complete an additional sheet in the same form as appears on this page for each other participant as required.

[16] If bond is signed by an officer or agent, give title; if signed by a corporation, affix corporate seal.

[17] If bond is signed by an officer or agent, give title; if signed by a corporation, affix corporate seal.

Federal Insurance Company
Warren, NJ 07059

ATTORNEY-IN-FACT JUSTIFICATION
PRINCIPAL'S ACKNOWLEDGMENT - IF A CORPORATION

State of New York,
County of Queens} ss

On this 21st day of August, 2012, before me personally appeared Peter K. Tully, to me known, who, being by me duly sworn, deposes and says: That he/she resides in Lattingtown, New York; that he/she is the President of Tully Construction Co., Inc., the corporation described in and which executed the within instrument; that he/she knows the seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he/she signed his/her name thereto by like order.

Queens County
Comm. Exp.
CAROL R. GORDON
Notary Public, State of New York
No. 01GO4680187
Qualified in Queens County
Commission Expires April 30, 2014

SURETY COMPANY'S ACKNOWLEDGMENT

State of New York,
County of Albany} ss

On this 21st day of August, 2012, before me personally appeared Timothy M. Tyrrell; to me known, who, being by me duly sworn, did depose and say: That he/she resides in Albany, New York; that he/she is Attorney-in-Fact of Federal Insurance Company, the corporation described in and which executed the within instrument; that he/she knows the corporate seal of said Company; that the seal affixed to said instrument is such corporate seal; and that he/she signed said instrument as Attorney-in-Fact by authority of the Board of Directors of said Company; and affiant did further depose and say that the Superintendent of Insurance of the State of New York has, pursuant to Chapter 882 of the Laws of the State of New York for the year 1939, constituting chapter 28 of the Consolidating Laws of the State of New York as the Insurance Law as amended, issued to Federal Insurance Company his/her certificate that said Company is qualified to become and be accepted as surety or guarantor on all bonds, undertakings, recognizances, guaranties, and other obligations required or permitted by law; and that such certificate has not been revoked.

Rensselaer County
Comm. Exp. 01/04/2014

Chubb Surety	POWER OF ATTORNEY	Federal Insurance Company Vigilant Insurance Company Pacific Indemnity Company	Attn: Surety Department 15 Mountain View Road Warren, NJ 07059

Know All by These Presents, That **FEDERAL INSURANCE COMPANY**, an Indiana corporation, **VIGILANT INSURANCE COMPANY**, a New York corporation, and **PACIFIC INDEMNITY COMPANY**, a Wisconsin corporation, do each hereby constitute and appoint **Cynthia E. Antoinette, Eric J. Canterbury, Patrick J. Clyne, Charles C. Leach, Thomas R. Tyrrell and Timothy M. Tyrrell of Albany, New York**----------

each as their true and lawful Attorney- in- Fact to execute under such designation in their names and to affix their corporate seals to and deliver for and on their behalf as surety thereon or otherwise, bonds and undertakings and other writings obligatory in the nature thereof (other than bail bonds) given or executed in the course of business, and any instruments amending or altering the same, and consents to the modification or alteration of any instrument referred to in said bonds or obligations.

In Witness Whereof, said **FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY**, and **PACIFIC INDEMNITY COMPANY** have each executed and attested these presents and affixed their corporate seals on this **3rd** day of **May, 2012.**

Kenneth C. Wendel, Assistant Secretary

David B. Norris, Jr., Vice President

STATE OF NEW JERSEY

County of Somerset ss.

On this **3rd** day of **may, 2012** before me, a Notary Public of New Jersey, personally came Kenneth C. Wendel, to me known to be Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY, the companies which executed the foregoing Power of Attorney, and the said Kenneth C. Wendel, being by me duly sworn, did depose and say that he is Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY and knows the corporate seals thereof, that the seals affixed to the foregoing Power of Attorney are such corporate seals and were thereto affixed by authority of the By- Laws of said Companies; and that he signed said Power of Attorney as Assistant Secretary of said Companies by like authority; and that he is acquainted with David B. Norris, Jr., and knows him to be Vice President of said Companies; and that the signature of David B. Norris, Jr., subscribed to said Power of Attorney is in the genuine handwriting of David B. Norris, Jr., and was thereto subscribed by authority of said By-Laws and in deponent's presence.

Notarial Seal

KATHERINE J. ADELAAR NOTARY PUBLIC NEW JERSEY

KATHERINE J. ADELAAR
NOTARY PUBLIC OF NEW JERSEY
No. 2316685
Commission Expires July 16, 2014

Notary Public

CERTIFICATION

Extract from the By- Laws of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY:

> "All powers of attorney for and on behalf of the Company may and shall be executed in the name and on behalf of the Company, either by the Chairman or the President or a Vice President or an Assistant Vice President, jointly with the Secretary or an Assistant Secretary, under their respective designations. The signature of such officers may be engraved, printed or lithographed. The signature of each of the following officers: Chairman, President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary and the seal of the Company may be affixed by facsimile to any power of attorney or to any certificate relating thereto appointing Assistant Secretaries or Attorneys- in- Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such power of attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding upon the Company with respect to any bond or undertaking to which it is attached."

I, Kenneth C. Wendel, Assistant Secretary of FEDERAL INSURANCE COMPANY, VIGILANT INSURANCE COMPANY, and PACIFIC INDEMNITY COMPANY (the "Companies") do hereby certify that

(i) the foregoing extract of the By- Laws of the Companies is true and correct,
(ii) the Companies are duly licensed and authorized to transact surety business in all 50 of the United States of America and the District of Columbia and are authorized by the U.S. Treasury Department; further, Federal and Vigilant are licensed in Puerto Rico and the U.S. Virgin Islands, and Federal is licensed in American Samoa, Guam, and each of the Provinces of Canada except Prince Edward Island; and
(iii) the foregoing Power of Attorney is true, correct and in full force and effect.

Given under my hand and seals of said Companies at Warren, NJ this **21st** day of **August, 2012**

FEDERAL INSURANCE COMPANY INDIANA · PACIFIC INDEMNITY COMPANY INCORPORATED JAN. 15, 1925 WISCONSIN · VIGILANT INSURANCE COMPANY NEW YORK

Kenneth C. Wendel, Assistant Secretary

IN THE EVENT YOU WISH TO NOTIFY US OF A CLAIM, VERIFY THE AUTHENTICITY OF THIS BOND OR NOTIFY US OF ANY OTHER MATTER, PLEASE CONTACT US AT ADDRESS LISTED ABOVE, OR BY Telephone (908) 903- 3493 Fax (908) 903- 3656
e-mail: surety@chubb.com

FEDERAL INSURANCE COMPANY

STATEMENT OF ASSETS, LIABILITIES AND SURPLUS TO POLICYHOLDERS

Statutory Basis

DECEMBER 31, 2011

(In thousands of dollars)

ASSETS		*LIABILITIES AND SURPLUS TO POLICYHOLDERS*	
Cash and Short Term Investments	$ 151,942	Outstanding Losses and Loss Expenses	$ 12,300,432
United States Government, State and Municipal Bonds	10,312,572	Unearned Premiums	3,395,082
Other Bonds	4,146,378	Ceded Reinsurance Premiums Payable	320,332
Stocks	779,367	Provision for Reinsurance	80,930
Other Invested Assets	1,924,895	Other Liabilities	922,290
TOTAL INVESTMENTS	17,315,154	TOTAL LIABILITIES	17,019,066
Investments in Affiliates:		Special Surplus Funds	222,832
Chubb Investment Holdings, Inc.	3,212,072	Capital Stock	20,980
Pacific Indemnity Company	2,440,763	Paid-In Surplus	3,106,808
Chubb Insurance Investment Holdings Ltd.	1,237,556	Unassigned Funds	10,356,926
Executive Risk Indemnity Inc.	1,076,901		
CC Canada Holdings Ltd.	747,660		
Great Northern Insurance Company	436,665	SURPLUS TO POLICYHOLDERS	13,707,546
Chubb Insurance Company of Australia Limited	404,315		
Chubb European Investment Holdings SLP	251,756		
Vigilant Insurance Company	233,604		
Other Affiliates	409,535		
Premiums Receivable	1,470,010		
Other Assets	1,490,621	TOTAL LIABILITIES AND SURPLUS TO POLICYHOLDERS	$ 30,726,612
TOTAL ADMITTED ASSETS	$ 30,726,612		

Investments are valued in accordance with requirements of the National Association of Insurance Commissioners.
Investments with a carrying value of $431,309,571 are deposited with government authorities as required by law.

State, County & City of New York, — ss:

Yvonne Baker, Assistant Secretary of the Federal Insurance Company being duly sworn, deposes and says that the foregoing Statement of Assets, Liabilities and Surplus to Policyholders of said Federal Insurance Company on December 31, 2011 is true and correct and is a true abstract of the Annual Statement of said Company as filed with the Secretary of the Treasury of the United States for the 12 months ending December 31, 2011.

Subscribed and sworn to before me
this March 31, 2012

Dorothy Baker
Notary Public

DOROTHY M. BAKER
Notary Public, State of New York
No. 31-4904994
Qualified in New York County
Commission Expires Sept. 14, 2013

Yvonne Baker
Assistant Secretary

Form 15-10-0313A (Rev. 3/12)

FORM OF CONTRACT

CHAPTER I

GENERAL PROVISIONS

18. DEFINITIONS

To avoid undue repetition, the following terms whenever they occur in this Form of Contract or any of the other papers forming a part of the Contract shall be construed as follows:

"Contract" shall mean, in addition to this Form of Contract, the Information for Bidders, the Proposal, the Authority's acceptance, the Specifications and the Contract Drawings (including written addenda issued over the name of the Chief Engineer), all of which are made part hereof as though herein set forth in full. The Contract as so defined shall constitute the complete and exclusive statement of the terms of the agreement between the parties and the Contract may not be explained or supplemented by course of dealing, usage of trade or course of performance.

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 "construction site" or words of similar import shall mean various paved areas along 148th St at John F Kennedy International Airport (JFK) and the vicinities thereof in Queens, New York.

"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 performing milling and overlay of existing asphalt pavement, localized full-depth pavement replacement, safety improvements, re-striping and signal improvements, bustop relocation, minor landscaping, drainage improvements, lighting improvements and related Work.; and "performance of Work" and words of similar import shall mean the furnishing of such facilities and the doing of such things.

"Work required by the Contract Drawings and Specifications in their present form" or words of similar import shall include all Work required by the Specifications in their present form (whether or not shown upon the Contract Drawings), all Work shown upon the Contract Drawings in their present form (whether or not mentioned in the Specifications), and all Work involved in or incidental to the accomplishment of the results intended by the Specifications and Contract Drawings in their present form (whether or not mentioned therein or shown thereon).

"Classified Work" shall mean the items of Work set forth in the Schedule of Unit Prices and shall include any Work hereafter required which is of the same general character as that set forth in any of said items. In determining what is of the same general character, there shall be taken into consideration the provisions for measurement for payment appearing in said clause entitled "Unit Prices and Lump Sum", which provisions shall form a part of the items in said Schedules of Unit Prices.

"Unclassified Work" shall mean Work other than Classified Work.

"Extra Work" shall mean Work required by the Chief Engineer, Assistant Chief Engineer for Construction, Engineer of Construction or Engineer pursuant to the clause hereof entitled "Extra Work Orders", other than Classified Work, which is in addition to that required by the Contract Drawings and Specifications in their present form.

"Estimated Total for Classified Work" shall mean the result obtained by applying the prices quoted by the Contractor in the Schedule of Unit Prices to the estimated quantities given therein and totaling the results, whether or not such results are correctly shown in the Contractor's Proposal.

"Lump Sum" shall mean the Lump Sum for Unclassified Work quoted by the Contractor in the clause hereof entitled "Unit Prices and Lump Sum".

"Estimated Total Contract Price" shall mean the result obtained by adding together the Estimated Total for Classified Work and the Lump Sum, whether or not such result is correctly shown in the Contractor's Proposal.

"Contract Drawings" shall mean the Contract Drawings designated in the clause of the Specifications entitled "Contract Drawings" and, except as used in the phrase "Contract Drawings in their present form", shall include any future alterations and revisions of said drawings.

"Shop Drawings" shall mean all drawings, diagrams, illustrations, schedules, including supporting data, which are specifically prepared for this Contract and submitted by the Contractor pursuant to the requirements of the Specifications or the Engineer to illustrate some portion of the Work. The terms "shop drawings", "placing drawings" and "working drawings" are used interchangeably in this Contract.

"Catalog Cuts" shall mean all standard drawings, diagrams, illustrations, brochures, schedules, performance charts and instructions submitted by the Contractor pursuant to the requirements of the Specifications or the Engineer to illustrate some portion of the Work.

"Director of Procurement" shall mean the Director of Procurement of the Authority for the time being, or her successor in duties, acting either personally or through her duly authorized representatives acting within the scope of the particular authority vested in them.

"Chief Engineer" shall mean the Chief Engineer of the Authority for the time being, or his successor in duties, acting personally.

"Director" shall mean the Director of Aviation of the Authority for the time being, or his successor in duties for the purpose of this Contract, acting personally or through his authorized representative for the purpose of this Contract, who is at present the Authority's Director of Aviation Operations.

"Engineer" shall mean the Chief Engineer, acting either personally or through his duly authorized representatives acting within the scope of the particular authority vested in them.

"Assistant Chief Engineer for Construction" shall mean the Assistant Chief Engineer for Construction of the Authority for the time being, or his successor in duties, acting personally.

"Engineer of Construction" shall mean the designated Engineer of Construction for the facility at which the Work is being performed or his successor in duties, acting personally.

"Inspector" shall mean any representative of the Engineer designated by him as Inspector and acting within the scope of the particular authority vested in him.

The term "permanent construction" shall include all construction, installation, structures, equipment and materials (including materials and equipment, if any, furnished by the Authority) to be constructed, installed or left by the Contractor at or about the construction site (or elsewhere in the possession of the Authority) after the completion of the Work (whether or not they are yet delivered or installed), even though they are subsequently to be removed by others. The terms, "permanent installation", "permanent structure", "permanent materials", and words of similar import shall have the same meaning as the term "permanent construction".

"Subcontractor" shall mean anyone who performs Work (other than or in addition to the furnishing of materials, plant or equipment) at or about the construction site, directly or indirectly for or in 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 own personal labor or his own personal services or who performs Work which consists only of the operation of construction equipment of which he is the lessor.

"Materialman" shall mean anyone who furnishes materials, plant or equipment to the Contractor or any subcontractor for use at or about the construction site in the performance of Work.

"Materialman" or "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 himself.

"Workingman" or "workman" shall mean any employee of the Contractor or of a subcontractor who performs personal labor or personal services at the construction site.

"Notice" shall mean a written notice.

Whenever they refer to the 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 Engineer; and "approved", "acceptable", "satisfactory" and words of similar import shall mean approved by or acceptable or satisfactory to the Engineer; and "necessary", "reasonable", "proper", "correct" and words of similar import shall mean necessary, reasonable, proper or correct in the judgment of the Engineer.

Whenever "including", "such as" or words of similar import are used, the specific things thereafter enumerated shall not limit the generality of the things preceding such words.

19. GENERAL AGREEMENT

The Contractor agrees to perform milling and overlay of existing asphalt pavement, localized full-depth pavement replacement, safety improvements, re-striping and signal improvements, bustop relocation, minor landscaping, drainage improvements, lighting improvements and related Work. and to furnish all structures, equipment, plant, labor, materials and other facilities and to do all other things necessary or proper therefor or incidental thereto, all in strict accordance with the Contract Drawings and Specifications and any future changes therein; and the Contractor further agrees to assume and perform *all other duties and obligations imposed upon him by this Contract.*

The Authority agrees to pay to the Contractor and the Contractor agrees to accept from the Authority, in full consideration for the performance by the Contractor of his duties and obligations under this Contract and the whole thereof, a compensation consisting of the following amounts and such amounts only, subject only to the express provisions of this Contract specifically setting forth actual, defined additions to or deductions from such compensation.

A. An amount based upon the Classified Work performed, computed at the rates quoted in the Schedule of Unit Prices, said Classified Work to be measured and said amount to be computed in the manner provided in the clause hereof entitled "Unit Prices and Lump Sum"; and

B. The amount of the Lump Sum quoted in the clause hereof entitled "Unit Prices and Lump Sum".

This Contract is one entire contract for the accomplishment of the results and the doing of the things above specified and is not separable. Similarly, the Contractor's compensation is one entire compensation for entire performance on his part.

The enumeration in this Form of Contract and in the Specifications of particular things to be furnished or done at the Contractor's expense, or without cost or expense to the Authority without additional compensation to the Contractor shall not be deemed to imply that only things of a nature similar to those enumerated shall be so furnished and done, but the Contractor shall perform all Work as required, without other compensation than that specifically provided, whatsoever changes may be made in the Contract Drawings and Specifications whatsoever Work may be required in addition to that required by the Contract Drawings and Specifications in their present form, and whatsoever obstacles or unforeseen conditions may arise or be encountered.

20. 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 of the Form of Contract entitled "Prevailing Rate of Wage" regardless of the method by which the Contractor is compensated under this Contract. 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 year 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 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.

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.

21. RENTAL OF CONSTRUCTION EQUIPMENT

The rental of construction equipment shall be subject to all applicable New York sales and use taxes notwithstanding The Authority's status as an Exempt Organization in New York, as such term is defined in section eleven hundred sixteen of the New York State Sales and Compensating Use Tax Act.

The Contractor shall indemnify the Authority against any claim of any kind whatsoever made against the Authority by a lessor of construction equipment and the Contractor assumes the risk of all claims against him by any lessor of construction equipment, including in both cases, claims in connection with a subcontractor.

22. EXEMPTION FROM NEW YORK STATE AND NEW YORK CITY SALES TAXES

The attention of the Contractor and his subcontractors and materialmen, if any, is directed to the New York State and New York City tax laws, as they apply to the Work of this Contract, and the New York State Department of Taxation and Finance (herein called the "Department") Form ST-120.1, Contractor Exempt Purchase Certificate, available on the Department's website: www.tax.ny.gov/forms/.

Subdivision (a) of section eleven hundred fifteen of the New York State Sales and Compensating Use Tax Act (herein called the "Act") provides contractors with an exemption from sales and compensating use taxes (herein called "Sales Tax") for, among other things:

> (15) Tangible personal property sold to a contractor, subcontractor or repairman for use in erecting a structure or building of an organization described in subdivision (a) of section eleven hundred sixteen, or adding to, altering or improving real property, property or land of such an organization, as the terms real property, property or land are defined in the real property tax law; provided, however, no exemption shall exist under this paragraph unless such tangible personal property is to become an integral component part of such structure, building or real property."

The Authority is an exempt organization of the type described in subdivision (a) of section eleven hundred sixteen of the Act.

In view of the foregoing, the Contractor should not include in his price(s) any amounts for Sales Tax on such tangible personal property (herein called "Exempt Purchases"). The Contractor shall execute and provide his vendors with a properly completed Form ST-120.1 when effectuating such Exempt Purchases.

As provided in the clause hereof entitled "Rental of Construction Equipment", the Contractor's rental of equipment and the Contractor's purchases of tangible personal property that does not become an integral component part of the permanent construction are, in all cases, subject to Sales Tax.

If (i) any claim is made against the Contractor by the State of New York or City of New York for such Sales Tax on Exempt Purchases, or (ii) any claim is made against the Contractor by a materialman or a subcontractor on account of a claim against such materialman or subcontractor by the State of New York or City of New York for such Sales Tax on Exempt Purchases, 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 Act, provided that:

1.) The Contractor's liability for such Sales Tax is caused solely by a finding by the Department that the Authority is not an Exempt Organization of the type described in subdivision (a) of section eleven hundred sixteen of the Act; and

2.) 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 Sales Tax and have furnished to vendors all the forms and certificates required by the applicable laws, rules and regulations in connection therewith; and

3.) 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

4.) the Contractor, or the Contractor and any such subcontractor, as the case may be, give immediate notice to the Authority of any such claim, cooperate with the Authority and its designated attorney in contesting said claim and furnish promptly to the Authority and said attorney all information and documents necessary or convenient for contesting said claim, said information and documents to be preserved for six years after the date of Final Payment or longer if such a claim is pending or threatened at the end of such six years.

If the Authority elects to contest any such claim, it will bear the expense of such contest.

23. PERFORMANCE AND PAYMENT BOND

If the Authority shall in its sole discretion so elect at the time of accepting the Contractor's Proposal, the Contractor shall furnish a bond for the faithful performance of all obligations imposed upon him by the Contract and also for the payment of all lawful claims of subcontractors, materialmen and workmen arising out of the performance of the Contract. Such bond shall be in the form bound herewith entitled, "Performance and Payment Bond", shall be in a penal sum equal to the Estimated Total Contract Price and such bond shall be signed by one or more sureties[19] satisfactory to the Authority. The bond may be executed on a separate copy of such form not physically attached to this Contract booklet. In any case, both the form of bond bound herewith and any unattached executed copy thereof shall form a part of this Form of Contract as though herein set forth in full.

At any time after the opening of Proposals, the Authority may give notice to one or more bidders to advise the Authority as to the names of their proposed sureties. Within forty-eight hours thereafter each bidder so notified shall so advise the Authority. The giving of such notice to a bidder shall not be construed as an acceptance of his Proposal, and omission to give such notice shall not be construed as an election by the Authority not to require a bond.

If the Authority elects to require the Contractor to furnish a bond, he shall deliver such bond to the Authority within seven days after receipt by him of the acceptance of his Proposal, and the sureties thereon shall be as proposed by him, provided, that if the Authority has theretofore given notice to him that his proposed sureties or any of them are not satisfactory, the bond shall be executed by other sureties satisfactory to the Authority.

The Authority shall give notice to the Contractor within ten (10) days after receipt of the Performance and Payment Bond as to whether or not such bond is satisfactory.

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19 Sureties must be corporations (commonly known as "surety companies"), authorized to do business as sureties in the state(s) in which the construction site is located, whose names appear on the current list of the Treasury Department of the United States in effect at the time of submission of the Performance and Payment Bond to the Authority as acceptable as sureties to the Treasury Department. In addition, the aggregate underwriting limitations on any one risk as set forth in the aforementioned list of the Treasury Department of the sureties shall equal or exceed the penal sum of the Performance and Payment Bond.

In the event of a default by the Contractor in his obligation to furnish a satisfactory bond within seven (7) days after he received an acceptance of his Proposal, such default shall entitle the Authority in its discretion to terminate this Contract at any time within forty-five (45) days after the acceptance of the Proposal, without any liability on the part of the Authority. Inasmuch as the damages to the Authority resulting from a termination by it upon the failure of the Contractor to furnish a satisfactory bond will include items whose accurate amount will be difficult or impossible to compute, such damages shall be liquidated in the sum of the following amounts:

A. The excess, if any, of the Estimated Total Contract Price in the Proposal finally accepted over that in the Proposal of the Contractor; and

B. The expense of such new advertisement of the Contract, if any, as may be deemed necessary by the Authority; and

C. The sum of $0 for each day after the receipt by the Contractor of the acceptance of his Proposal that the performance of the Contract is not commenced by reason of the failure of the Contractor to furnish the required bond.

In the recovery of the damages above specified, the Authority may proceed against the sum represented by the certified check deposited with it or against the Bid Bond and take such other action as it may deem best in the public interest.

If the Contractor furnishes a bond in accordance with the requirements of the Authority under this numbered clause, the Authority shall reimburse the Contractor for the net amount actually paid by him to the surety or sureties as the premium on such bond. The Contractor shall deliver to the Engineer receipts from the surety or sureties evidencing such payment and the amount thereof. Within fifteen days after receipt of such evidence satisfactory to the Engineer, the Authority shall pay to the Contractor by check the amount provided in this numbered clause.

If at any time the Authority shall be or become dissatisfied with any surety or sureties then upon any bond furnished in accordance with the requirements of the Authority, or if for any other reason such bond shall cease to be adequate security to the Authority, the Contractor shall, within five days after notice from the Authority so to do, substitute a new bond in such form and sum and signed by such other sureties as may be necessary in the opinion of the Authority to constitute adequate security.

CHAPTER II

COMPENSATION AND PAYMENTS

24. UNIT PRICES AND LUMP SUM

The following Schedule of Unit Prices for Classified Work does not constitute an outline of the Work required by the Contract Drawings and Specifications in their present form, but is merely a list of all the items of Classified Work to be used in computing the Contractor's compensation insofar as it is based upon Classified Work, together with the rates at which such compensation will be computed. In the case of each item of Classified Work, the Work performed will be measured and the Contractor's compensation will be computed as hereinafter provided in this numbered clause. In case of discrepancy between the prices quoted in writing and those quoted in figures, the writing shall control.

The Estimated Total Contract Price is solely for the purpose of fixing the amount of security to be maintained by the Contractor for the faithful performance of the Work. Prior to the signature of the Contract by the parties, it was for the purpose of facilitating the comparison of Proposals and of computing damages in the event of a default by the successful bidder in the agreement created by the acceptance of his Proposal. The estimated quantities are given solely as a basis for the computation of the Estimated Total Contract Price. The Authority makes no representation as to what the actual quantities will be and shall not be held responsible even though the estimated quantities are not even approximately correct. Insofar as the Contractor's compensation is based upon Classified Work, it will be computed from the actual quantities of Work performed, whether greater or less than the estimated quantities.

I. SCHEDULE OF UNIT PRICES FOR CLASSIFIED WORK				
			Figures	
Item No.	Estimated Quantities	Items of Classified Work With Unit Prices Written	Unit Prices	Amounts[20]
1	10 EA.	ADJUST MANHOLE AND CATCH BASIN, PER EACH FIVE HUNDRED DOLLARS NO CENTS	500.00	$ 5,000.00
2	3000 TONS	ASPHALT CONCRETE TOP COURSE PA-5, PER TON ONE HUNDRED FOUR DOLLARS NO CENTS	$ 104.00	312,000.00
3	200 SF	FULL DEPTH CONCRETE PAVEMENT REPAIR, PER SQUARE FOOT ONE HUNDRED FORTY FIVE DOLLARS NO CENTS	145.00	$ 29,000.00
ESTIMATED TOTAL FOR CLASSIFIED WORK[21]				

20 The amount for each item shall be computed by multiplying the estimated quantity of that item by the unit price for the item.

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II. LUMP SUM FOR UNCLASSIFIED WORK	
Writing	Figures
ONE MILLION ONE HUNDRED SIXTEEN THOUSAND .....Dollars NO .....Cents	$ 1,116,000.00

III. RECAPITULATION	
	Figures
ESTIMATED TOTAL FOR CLASSIFIED WORK..... LUMP SUM FOR UNCLASSIFIED WORK.....	$ 346,000.00
ESTIMATED TOTAL CONTRACT PRICE:	$ 1,462,000.00

21 The Estimated Total for Classified Work shall be computed by totaling the amounts inserted in the "Amounts" column.

22 The Estimated Total Contract Price shall be computed by adding the Estimated Total for Classified Work to the Lump Sum for Unclassified Work.

The following provisions are applicable to the Schedule of Unit Prices for Classified Work. The quantity for payment described in the following provisions shall be the quantity of Classified Work furnished, installed, performed and/or placed in accordance with the Specifications, as shown on the Contract Drawings and where ordered by the Engineer.

No quantity of work will be included under more than one item of Classified Work.

In the case of Item No. 1. (Adjust Manhole and Catch Basin), the quantity for payment shall be the number of each existing manhole and/or catch basin rim-cover/grate actually adjusted to match new grade, where finished grade changed.

In the case of Item No. 2. (Asphalt Concrete Top Course PA-5), the quantity for payment shall be the number of tons (one ton equals 2,000 lbs.) of asphalt concrete actually furnished and placed. The weight of this item shall be based on the certified scale weight of material in trucks weighed on approved scales, or at the option of the Engineer, on certified automated printouts at plants using an automatic batching and mixing system. In case of conflict between the printout weight and the scale weight, the scale weight shall control.

In the case of Item No. 3 (Full Depth Concrete Pavement Repair), the quantity for payment shall be the number of square feet of FULL DEPTH CONCRETE PAVEMENT actually replaced in the repair area.

25. ADJUSTMENTS OF LUMP SUM

If any Unclassified Work required by the Contract Drawings and Specifications in their present form shall be countermanded or reduced, the Engineer shall have full authority on behalf of both parties to make such adjustment by way of reduction in the Lump Sum as he may in his sole discretion deem equitable and reasonable, and in making such adjustment, no allowance to the Contractor shall be made for anticipated profits.

The Chief Engineer shall have authority to agree in writing with the Contractor for adjustments by way of reduction in the Lump Sum in lieu of those for which provision is heretofore made in this numbered clause.

26. COMPENSATION FOR EXTRA WORK

The Chief 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 be performed, the Contractor's compensation shall be increased by the following amounts and such amounts only:

1.) 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.

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

   a. 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.

b. 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. "Employees" as used above means only the employees of one employer.

"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:

A.

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 Contract 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.

B. 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.

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

2.) 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.

3.) 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.

C. 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 showing the name and number of each workman employed on such Work, the number of hours which he is employed thereon, the character of his duties, and the wages to be paid to him, (b) a memorandum showing 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 claimed therefor. 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 Chief 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.

27. COMPENSATION FOR PREMIUM TIME

Where the Engineer directs that the Contractor perform Work at times other than those elsewhere specified in the Contract, and the Contractor directly or through a subcontractor is obligated by the provisions of its applicable collective bargaining agreement to pay premium time rates for such Work then, the Contractor shall be compensated for the cost differential between regular time rates and premium time rates at an amount equal to the total of the following:

A. For premium time rates paid by the Contractor to its own forces, an amount equal to the premium time portion of the salaries and wages which the employer is required to pay and actually pays to its employees pursuant to the terms of its applicable collective bargaining agreement for the overtime period or periods described above, plus a proper proportion, if any, computed upon the basis of premium time salaries and wages of (1) taxes actually paid by the employer pursuant to law, (2) vacation allowances, other fringe benefits and union dues and assessments which the employer actually pays pursuant to contractual obligations, and (3) increased premiums paid by the Contractor personally, specifically allocable to the insurance required by this Contract, plus five per cent (5%) of such premium portion.

B. For premium time rates paid by a subcontractor, an amount equal to the premium time portion of the salaries and wages which the employer is required to pay and actually pays to its employees pursuant to the terms of its applicable collective bargaining agreement for the overtime period or periods described above, plus a proper proportion, if any, computed upon the basis of premium time salaries and wages of (1) taxes actually paid by the employer pursuant to law, (2) vacation allowances, other fringe benefits and union dues and assessments which the employer actually pays pursuant to contractual obligations, and (3) increased premiums paid by a subcontractor, specifically allocable to the insurance required by this Contract, plus five per cent (5%) of such premium portion, plus two per cent (2%) of the foregoing cost.

All additions to the Contractor's compensation provided for in this clause require the prior written approval of the Engineer and are conditioned on the Contractor's verifiable by the Authority payment of such amounts to his subcontractor.

The additions to the Contractor's compensation provided in this clause shall not apply where the Engineer directs the Contractor to perform work at times other than those specified elsewhere in the Contract and also determines that such work is required to mitigate previous delays in the Contractor's performance of Work.

28. 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 "Airport Operations And Conditions" 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 clause of the Form of Contract 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.

29. MONTHLY ADVANCES

On or about the first and fifteenth day of each month, the Engineer shall (upon receipt from the Contractor of such information as he may require, including a certification in writing, in such form as may be required pursuant to the clause hereunder entitled "Prevailing Rate of Wage", that he has paid and caused his subcontractors to pay at least the prevailing rate of wage and supplements required by such clause) estimate and certify to the Authority the approximate amount of Work performed and compensation earned by the Contractor up to that time showing separately:

A. The approximate amount of Classified Work performed by the Contractor up to that time and a sum determined from such Work in accordance with the units of measurement and unit prices specified in the Schedule of Unit Prices.

B. The approximate amount of Unclassified Work (other than Extra Work) performed by the Contractor up to that time and a sum bearing the same proportion to the Lump Sum as the Unclassified Work performed (other than Extra Work) bears to the total amount of such Work performed and to be performed (other than Extra Work), and

C. The increases, if any, in the Contractor's compensation for which provision is specifically made elsewhere in this Contract.

As an aid to the Contractor and to facilitate his performance, the Authority shall, within fifteen days after the receipt of each suchmonthly certificate, advance to the Contractor by check the sums so certified, minus, however, five per cent (5%) of the sum certified pursuant to subparagraphs A and B of this numbered clause, and minus all prior advances and payments to the Contractor or for his account.

Within seven days of receipt of any sum attributable to Work performed by a subcontractor or materialman or within such later period as is provided in the subcontract or purchase agreement, the Contractor shall advance to the subcontractor or materialman said sum, less such amount, if any, as the Contractor is authorized to retain under the subcontract or purchase agreement.

Notwithstanding the above, the Authority shall have the right, at its sole discretion, to directly pay the subcontractors and material suppliers who perform Work for or furnish materials to the Contractor in connection with the Work of this Contract.

Prior to certifying any amount for payment hereunder, the Engineer may require that the Contractor submit a certification accurately and fully setting forth the total amount due and payable to each subcontractor and supplier for Work performed or materials provided by such subcontractor or supplier in connection with the Work of this Contract. Any payment made by the Authority to a subcontractor or supplier pursuant to the provisions of this numbered clause shall be made in reliance upon such certification and all such payments shall be considered as advances to the Contractor of the compensation payable hereunder. No such payment shall relieve the Contractor of any of its obligations hereunder.

Furthermore, within fifteen (15) days of the Contractor's receipt of the Authority acceptance of the Contractor's Proposal, the Contractor shall submit to the Engineer a listing of all subcontract and material supply agreements entered into by the Contractor for the performance of Work required by this Contract. Such listing shall include the names and addresses of each such subcontractor and supplier and the amounts payable under each such agreement. As and when any modifications are made to such agreements or any additional subcontracts or supply agreements are entered into, the Contractor shall inform the Engineer of such and shall indicate the amounts payable thereunder.

Nothing contained herein shall be deemed to create any additional rights in such subcontractors or suppliers or to alter the rights of the Authority as such are set forth in the clause hereof entitled "Withholding of Payments".

30. RELEASE OF MONIES PREVIOUSLY WITHHELD FROM MONTHLY ADVANCES UPON RENDITION OF A CERTIFICATE OF SUBSTANTIAL COMPLETION

After the rendition of the Certificate of Substantial Completion and with the approval of the Engineer, an amount up to 80% of the total amount of monies withheld from the Contractor's monthly advances in accordance with the preceding clause may be released to the Contractor. If, in the Engineer's judgment, no monies, or less than 80% of the total amount of monies withheld should be released it will be based on, but not limited to, the estimated value of the remaining Work, unresolved claims by subcontractors, the estimate of possible audit adjustments and an assessment of the risks to the Authority in making such a release of monies. This clause does not create a right to such a release of monies or to any specific percentage release, all of which shall remain purely the discretionary decision of the Engineer.

Prior to the release of any amount withheld from the Contractor's monthly advances by the Authority, the Contractor shall submit to the Engineer a certification of all unresolved requests for additional compensation including all items in dispute and potential claims which the Contractor had actual knowledge of or by reasonable inspection and inquiry should have known of, to the date of the certification. Any such items not made known to the Authority by inclusion in the certification of additional compensation requests submitted by the Contractor will be deemed to have been released by the Contractor. Notwithstanding the above provisions, before making any release of monies the Engineer may require the Contractor to submit further information for the Engineer's review and analysis, and shall require the Contractor to execute a separate written release of claims as described above in a form acceptable to the Authority.

Nothing contained herein shall be deemed to alter or diminish the rights of the Authority as such are set forth in the clauses hereof entitled "Withholding of Payments", "Final Payment", "Monthly Advances" or under any other clause of this Contract relating to compensation to the Contractor, any release of monies hereunder being purely at the discretion of the Engineer.

31. FINAL PAYMENT

After the rendition of the Certificate of Final Completion and upon receipt from the Contractor of such information as may be required, the Engineer shall certify in writing to the Authority and to the Contractor the total compensation earned by the Contractor.

If so required, the Contractor shall thereupon (i) certify to the Authority in writing, in such form as may be required pursuant to the clause hereunder entitled "Prevailing Rate of Wage", that he has paid and caused his subcontractors to pay at least the prevailing rate of wage and supplements required by such clause and (ii) furnish to the Authority a detailed sworn statement of all claims, just and unjust, of subcontractors, materialmen and other third persons then outstanding and which he has reason to believe may thereafter be made on account of the Work.

Within thirty days after issuance of such certificate of total compensation earned (or within thirty days after receipt of the documents provided for in the immediately preceding paragraph, if required), the 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 Contract called the Final Payment.

The acceptance by the Contractor, or by anyone claiming by or through him, of 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 the Contract and for every act and neglect of the Authority and others relating to or arising out of the Contract, including claims arising out of breach of contract and claims based on claims of third persons, excepting only his claims for reimbursement for certain sales taxes as hereinbefore provided. No payment, however, final or otherwise, shall operate to release the Contractor or his sureties from any obligations in connection with this Contract or the Performance and Payment Bond.

The Contractor's agreement as provided in the immediately preceding paragraph above 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 above shall nevertheless be effective. Such release shall include all claims, whether or not in litigation and even though still under consideration by the Authority or the Engineer. 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. In any case in which interest is allowable on the amount of the Final Payment, such interest shall be at the rate of 6% per annum for the period, if any, in which such interest is due.

32. 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 or in connection with this Contract or any other agreement between the Authority and the Contractor or if in the opinion of the Chief Engineer 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 Chief Engineer 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 Chief Engineer may deem proper to secure such protection or 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 materialmen, subcontractors, workmen or other third persons.

Until actual payment to the Contractor, his 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 numbered clause.

In the event that wages and/or supplements have been paid in an amount less than as required by this Contract, the Authority shall also have the right to withhold from the Contractor out of any payment, final or otherwise, on this, or any other open contract that the Contractor has with the Authority, so much as may be necessary to pay to laborers, mechanics, architects, draftsmen, engineers and technical workers, and others employed on the Work, the difference between the sums such persons should have received as wages and/or supplements and the amounts they actually received, and to pay such sums over to such persons. All such payments shall be deemed to be payments for the Contractor's account. In addition, the Contractor shall be required to pay to the Authority an amount equal to the Authority's cost of any investigation conducted by or on behalf of the Authority, that discovers a failure to pay wages and/or supplements as required by this Contract by the Contractor or its subcontractors, the cost of such investigation to be determined by the Chief Engineer personally. If the Contractor fails or refuses to pay for the cost of any such investigation after demand by the Authority, the Authority may deduct from any amount payable to the Contractor by the Authority, under the Contract or under any other open contract between the Contractor and the Authority, an amount equal to the cost of such investigation.

If, however, the payment of any amount due to the Contractor shall be improperly delayed by the fault of the Authority, the Authority shall pay the Contractor interest thereon at the rate of six percent (6%) per annum for the period of delay, it being agreed that such interest shall be in lieu of and in liquidation of any damages to the Contractor because of such delay.

CHAPTER III

PROVISIONS RELATING TO TIME

33. TIME FOR COMPLETION AND DAMAGES FOR DELAY

The Contractor shall complete the performance of all Work under this Contract, as follows:

I. Complete all Work in Stage 1 as shown on Contract Drawing MT002 and as defined in the hours of work and construction staging within thirty (30) consecutive calendar days of commencing Work.

II. Complete all Work in Stage 2 as shown on Contract Drawing MT003 and as defined in the hours of work and construction staging within thirty (30) consecutive calendar days of commencing Work.

III Complete all Work in Stage 2A as shown on Contract Drawing MT004 and as defined in the hours of work and construction staging within thirty (30) consecutive calendar days of commencing Work in Stage 2.

IV. Complete all Work in Stage 3 as shown on Contract Drawing MT005 and as defined in the hours of work and construction staging within thirty (30) consecutive calendar days of commencing Work.

V. Complete all Work within 365 calendar days after receipt by him of the acceptance of his proposal.

The Contractor shall not commence the performance of the Work until the later of the following dates:

A. If a Performance and Payment Bond is required, the date of receipt by him of notice from the Authority that the Performance and Payment Bond furnished by him is satisfactory;

B. The date of receipt by him of notice from the Authority that the insurance procured by him in accordance with the clause hereof entitled "Insurance Procured by Contractor" is satisfactory, as evidenced by the certificate(s) to be furnished in accordance with said clause.

The time for completion shall not be extended on account of the time required to furnish the documents referred to in subparagraphs A and B above, but the Authority shall give notice to the Contractor within ten days after receipt of the Performance and Payment Bond or certificate of insurance as to whether or not such bond or insurance is satisfactory.

The Contractor's obligations for the performance and completion of the Work within the time or times provided for in this Contract are of the essence of this Contract. The Contractor guarantees that he can and will complete the performance of the Work within the time hereinbefore stipulated or within the time as extended in accordance with the clause hereof entitled "Extensions of Time". Inasmuch as the damage and loss to the Authority which will result from delay in completing the performance of the Work within the time herein stipulated will include items of loss whose amount will be incapable or very difficult of accurate estimation, the damages to the Authority for each calendar day by which the Contractor does not complete performance of the Work within the time or times above stipulated or within such time or times as extended in accordance with the clause hereof entitled "Extensions of Time", shall be liquidated in the sum of the following amounts:

A. Five Thousand Dollars ($5,000) for each calendar day by which the Contractor fails to complete the Work in accordance with subparagraph I above.

B. Five Thousand Dollars ($5,000) for each calendar day by which the Contractor fails to complete the Work in accordance with subparagraph II above.

C. Five Thousand Dollars ($5,000) for each calendar day by which the Contractor fails to complete the Work in accordance with subparagraph III above.

D. Five Thousand Dollars ($5,000) for each calendar day by which the Contractor fails to complete the Work in accordance with subparagraph IV above.

E. Five Thousand Dollars ($5,000) for each calendar day by which the Contractor fails to complete the Work in accordance with subparagraph V above.

The liquidated damages under subparagraphs A. through D. above shall be cumulative.

34. EXTENSIONS OF TIME

The time above provided for completion of any part of the Contract shall be extended (subject, however, to the provisions of this numbered clause) only if in the opinion of the Engineer the Contractor is necessarily delayed in completing such part by such time solely and directly by a cause which meets all the following conditions:

A. Such cause is beyond the Contractor's control and arises without his fault;

B. Such cause comes into existence after the opening of Proposals on this Contract and neither was nor could have been anticipated by investigation before such opening.

Variations in temperature and precipitation shall be conclusively deemed to have been anticipated before opening of such Proposals on this Contract except to the extent that the actual monthly average temperature varies from a temperature which is 10 per cent (10%) above or below the monthly normal temperature and except to the extent that the actual number of days of precipitation (of 0.1 inch or more) per month exceeds a number equal to two plus the normal number of days of precipitation per month.

In any case, the variations in temperature and precipitation described in the immediately preceding sentence will be cause for an extension of time only if occurring between the actual time of commencement of the Work at the construction site and the time for completion stipulated in the clause hereof entitled "Time for Completion and Damages for Delay" (or such time as extended as provided for herein). In the case of portions of months the number of days will be pro-rated by the Engineer. Temperature and precipitation shall be as recorded by the U. S. Weather Bureau in its publications, including that entitled "Local Climatological Data with Comparative Data", which is applicable to the area in which the Work is to be performed, and in the case of precipitation, the normal number of days of precipitation (of 0.1 inch or more) per month as abstracted from the aforementioned publications are as follows:

Month	Normal number of days per month on which precipitation exceeds 0.1 inch
January	7
February	7
March	8
April	7
May	6
June	6
July	5
August	7
September	6
October	6
November	7
December	7

In any event, even though a cause of delay meets all the above conditions, an extension shall be granted only to the extent that (i) the performance of the Work is actually and necessarily delayed and (ii) the effect of such cause cannot be anticipated and avoided or mitigated by the exercise of all reasonable precautions, efforts and measures (including planning, scheduling and rescheduling), whether before or after the occurrence of the cause of delay, and an extension shall not be granted for a cause of delay which would not have affected the performance of the Contract were it not for the fault of the Contractor or for other delay for which the Contractor is not entitled to an extension of time.

Any reference herein to the Contractor shall be deemed to include subcontractors and materialmen, whether or not in privity of contract with the Contractor, and employees and others performing any part of the Contract and all the foregoing shall be considered as agents of the Contractor.

The period of any extension of time shall be that necessary to make up the time actually lost, subject to the provisions of this numbered clause, and shall be only for the portion of the Contract actually delayed. The Engineer may defer all or part of his decision on an extension and any extension may be rescinded or shortened if it subsequently is found that the delays can be overcome or reduced by the exercise of reasonable precautions, efforts and measures.

As a condition precedent to an extension of time, the Contractor shall give written notice to the Engineer within 48 hours after the time when he knows or should know of any cause which might under any circumstances result in delay for which he claims or may claim an extension of time (including those causes which the Authority is responsible for or has knowledge of), specifically stating that an extension is or may be claimed, identifying such cause and describing, as fully as practicable at the time, the nature and expected duration of the delay and its effect on the various portions of the Contract. Since the possible necessity for an extension of time may materially alter the scheduling, plans and other actions of the Authority, and since, with sufficient opportunity, the Authority might if it so elects attempt to mitigate the effect of a delay for which an extension of time might be claimed, and since merely oral notice may cause disputes as to the existence or substance thereof, the giving of written notice as above required shall be of the essence of the Contractor's obligations and failure of the Contractor to give written notice as above required shall be a conclusive waiver of an extension of time.

It shall in all cases be presumed that no extension, or further extension, of time is due unless the Contractor shall affirmatively demonstrate to the satisfaction of the Engineer that it is. To this end the Contractor shall maintain adequate records supporting any claim for an extension of time, and in the absence of such records, the foregoing presumption shall be deemed conclusive.

35. 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 the opening of Proposals on this Contract, 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 of the Form of Contract 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.

36. 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 Contract, regardless of the length thereof, arising from all causes whatsoever, whether or not relating to this Contract, including wrongful acts or omissions of the Authority, its officers, agents, employees and contractors, except only to the extent, if any, that compensation or an extension of time may be due as expressly provided for elsewhere in this Contract for such suspension or delays and except to the extent, if any, that compensation may be agreed to by the Chief 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 Contract, shall conclusively be deemed to have been within the contemplation of the parties.

Notwithstanding any provisions of this Contract, 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 Contract or as to whether conditions at the construction site will be such as to permit the Contract to be performed thereon without interruption or by any particular sequence or method or as to whether the performance of the Contract can be completed by the time required under this Contract or by any other time.

Wherever in connection with this Contract it is required, expressly or otherwise, that the Authority shall perform any act relating to the Contract, 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 Contract.

37. CANCELLATION FOR DELAY

If the performance of the Contract or any portion of it shall, in the opinion of the Chief Engineer, be materially delayed, whether or not through the fault of the Contractor, by any cause which affects the Contractor's ability to perform the Contract without affecting to the same degree the Authority's own ability to perform it, either directly or through others, the Authority shall have the right at any time during the existence of such delay to cancel this Contract as to any portion not yet performed, without prejudice to the rights, liabilities and obligations of the parties under this Contract arising out of portions already performed, provided, however, that such right of cancellation shall not exist if the delay be due to any wrongful act or omission of the Authority. In the event of such cancellation, no allowance shall be made for anticipated profits.

CHAPTER IV

CONDUCT OF CONTRACT

38. AUTHORITY OF DIRECTOR

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, he shall have authority to suspend performance of any part or all of the Contract until such time as he 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 whether or not for reasons beyond the control of the Authority, he 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 performed, but no allowance shall be made for anticipated profits.

39. AUTHORITY OF CHIEF ENGINEER

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 Chief Engineer, deems best, the Chief Engineer shall have absolute authority to determine what is or is not necessary or proper for or incidental to the portion thereof specified in the clause hereof entitled "General Agreement" and the Contract Drawings and Specifications shall be deemed merely his present determination on this point. In the exercise of this authority, he shall have power to alter the Contract Drawings and Specifications; to require the performance of Work not required by them in their present form, even though of a totally different character from that now required; and to vary, increase and diminish the character, quantity and quality of, or to countermand, any Work now or hereafter required. Such variation, increase, diminution or countermanding need not be based on necessity but may be based on convenience.

To resolve all disputes and to prevent litigation the parties to this Contract authorize the Chief Engineer 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 his decision shall be conclusive, final and binding on the parties. His decision may be based on such assistance as he may find desirable. The effect of his decision shall not be impaired or waived by any negotiations or settlement offers in connection with the question decided, whether or not he participated therein himself, or by any prior decision of the Engineer or others, which prior decisions shall be deemed subject to review, or by any termination or cancellation of this Contract provided, however, that notwithstanding the decision reached by the Chief Engineer in a review of determinations by the Assistant Chief Engineer for Construction or Engineer of Construction or Engineer that a particular item of Work is not Extra Work the Contractor shall be compensated therefor as provided in written orders of the Assistant Chief Engineer for Construction or Engineer of Construction or Engineer expressly and unmistakably indicating his intention to treat Work described therein as Extra Work issued in accordance with the provisions of the clause hereof entitled "Extra Work Orders" for amounts not in excess of $250,000.

All such questions shall be submitted in writing by the Contractor to the Chief Engineer for his decision, together with all evidence and other pertinent 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 his 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 Chief Engineer.

This numbered clause shall be governed by and construed in accordance with the law of the State of New York, without giving effect to its choice of law provisions.

40. AUTHORITY AND DUTIES OF ENGINEER

In the performance of the Contract, the Contractor shall conform to all orders, directions and requirements of the Engineer and shall perform the Contract to the satisfaction of the Engineer at such times and places, by such methods and in such manner and sequence as he may require, and the Contract shall at all stages be subject to his inspection. The Engineer shall determine the amount, quality, acceptability and fitness of all parts of the Work and shall interpret Contract Drawings, Specifications and any orders for Extra Work. The Contractor shall employ no equipment, materials, methods or men to which the Engineer objects, and shall remove no materials, equipment or other facilities from the construction site without permission. Upon request, the Engineer shall confirm in writing any oral order, direction, requirements or determination.

The Contractor is requested to orally advise the Engineer of questions as they arise. Although such advice will not substitute for the written notice and information for which requirements are set forth elsewhere herein, it is anticipated that it will facilitate prompt decisions on the part of the Engineer and others.

The enumeration herein or in the Specifications of particular instances in which the opinion, judgment, discretion or determination of the Engineer shall control or in which the Contract shall be performed to his satisfaction or subject to his 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 so performed.

41. 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, unless the Contractor shall have complied with all requirements relating to the giving of written notice of the information with respect to such claim as provided in this numbered 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, 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) for damages, payment or compensation of any nature or for extension of any time for performance of any part of this Contract.

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 Extra Work, extension of time for completion, idle salaried men and equipment, or any other matter for which requirements are set forth elsewhere in this Contract as to notice and information, such requirements shall apply.

B. In the case of all other types of claim, notice shall have been given to the Engineer, personally, as soon as practicable, and in any case, within 48 hours, after occurrence of the act, omission, or other circumstance 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 Engineer, personally.

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 circumstances as they occur, and the requirements herein for such notice and information are essential to this Contract and are in addition to any notice required by statute 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.

No act, omission, or statement of any kind shall be regarded as a waiver of any of the provisions of this numbered clause or may be relied upon as such waiver except only either a written statement signed by the Executive Director of the Authority or a resolution of the Commissioners of the Authority expressly stating that a waiver is intended as to any particular provision of this numbered clause, and more particularly no discussion, negotiations, consideration, correspondence, or requests for information with respect to a claim by any Commissioner, officer, employee or agent of the Authority shall be construed as a waiver of any provision of this numbered clause or as authority or apparent authority to effect such a waiver.

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 numbered clause shall be deemed to fulfill the Contractor's obligation under this Contract.

42. EQUAL EMPLOYMENT OPPORTUNITY

During the performance of this Contract, the Contractor agrees as follows:

A. The Contractor will not discriminate against any employee or applicant for employment because of race, creed, sex, color or national origin, and will take affirmative action to insure that they are afforded equal employment opportunities without discrimination because of race, creed, sex, color or national origin. Such action shall be taken with reference, but not be limited to: recruitment, employment, job assignment, promotion, upgrading, demotion, transfer, layoff or termination, rates of pay or other forms of compensation, and selection for training or retraining, including apprenticeship and on-the-job training.

B. The Contractor shall send to each labor union or representative of workers with which he has or is bound by a collective bargaining or other agreement or understanding, a notice, to be provided by the State Commission for Human Rights, advising such labor union or representative of the Contractor's agreement under A. through H. of this numbered clause (hereinafter called "non-discrimination requirements"). If the Contractor was directed to do so by the Authority as part of the bid or negotiation of this Contract, the Contractor shall request such labor union or representative to furnish him with a written statement that such labor union or representative will not discriminate because of race, creed, sex, color or national origin and that such labor union or representative either will affirmatively cooperate, within the limits of its legal and contractual authority, in the implementation of the policy and provisions of these non-discrimination requirements or that it consents and agrees that recruitment, employment, and the terms and conditions of employment under this Contract, shall be in accordance with the purposes and provisions of these non-discrimination requirements. If such labor union or representative fails or refuses to comply with such a request that it furnish such a statement, the Contractor shall promptly notify the State Commission for Human Rights of such failure or refusal.

C. The Contractor shall post and keep posted in conspicuous places, available to employees and applicants for employment, notices to be provided by the State Commission for Human Rights setting forth the substance of the provisions of A. and B. herein and such provisions of the State's laws against discrimination as the State Commission for Human Rights shall determine.

D. The Contractor shall state, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, that all qualified applicants will be afforded equal employment opportunities without discrimination because of race, creed, sex, color or national origin.

E. The Contractor shall comply with the provisions of Sections 291-299 of the Executive Law and the Civil Rights Law, shall furnish all information and reports deemed necessary by the State Commission for Human Rights under these non-discrimination requirements and such sections of the Executive Law, and shall permit access to his books, records and accounts by the State Commission for Human Rights, the Attorney General and the Industrial Commissioner for the purposes of investigation to ascertain compliance with these non-discrimination requirements and such sections of the Executive Law and Civil Rights Law.

F. This Contract may be forthwith canceled, terminated or suspended, in whole or in part, by the Authority upon the basis of a finding made by the State Commission for Human Rights that the Contractor has not complied with these non-discrimination requirements, and the Contractor may be declared ineligible for future contracts made by or on behalf of the State, the Authority or other public authority or agency of the State, until he has satisfied the State Commission for Human Rights that he has established and is carrying out a program in conformity with the provisions of these non-discrimination requirements. Such finding shall be made by the State Commission for Human Rights after conciliation efforts by the Commission have failed to achieve compliance with these non-discrimination requirements and after a verified complaint has been filed with the Commission, notice thereof has been given to the Contractor by the Commission and an opportunity has been afforded him to be heard publicly before the State Commissioner of Human Rights or his designee. Such sanctions may be imposed and remedies invoked independently of or in addition to sanctions and remedies otherwise provided by law.

G. The Contractor shall include the provisions of A. through F. above in every subcontract or purchase order in such a manner that such provisions will be binding upon each subcontractor or vendor as to operations to be performed within the State of New York. The Contractor shall take such action in enforcing such provisions of such subcontract or purchase order as the Authority may direct, including sanctions or remedies for non-compliance. If the Contractor becomes involved in or is threatened with litigation with a subcontractor or vendor as a result of such direction by the Authority, the Contractor shall promptly so notify the General Counsel to the Authority, requesting him to intervene and protect the interests of the Authority.

H. The provisions of this numbered clause which refer to the State Commission for Human Rights, the Attorney General and the Industrial Commissioner are inserted in this Contract for the benefit of such parties, as well as for the benefit of the Authority, and said Commission, Commissioner and the Attorney General shall have a direct right of action against the Contractor to effectuate the intent of this clause.

43. AFFIRMATIVE ACTION REQUIREMENTS - EQUAL EMPLOYMENT OPPORTUNITY

The Contractor shall comply with the provisions set forth hereinafter. These provisions are modeled on the conditions for bidding on federal government contracts adopted by the Office of Federal Contract Compliance in 1978.

The Contractor and each subcontractor must fully comply with the clause entitled "Equal Employment Opportunity" and the requirements in this numbered clause. The Contractor commits himself to the goals for minority and female utilization set forth below and all other requirements, terms and conditions of this numbered clause by submitting a properly signed Proposal.

The Contractor shall appoint a company executive to assume the responsibility for the implementation of the requirements, terms and conditions of this numbered clause.

A. The goals for minority and female participation, expressed in percentage terms, for the Contractor's workforce at the construction site under this Contract are as follows:

Minority, except laborers	30%
Minority, laborers	40%
Female, except laborers	6.9%
Female, laborers	6.9%

These goals are applicable to all construction Work performed at the construction site under the Contract.

The Contractor's compliance with this numbered clause shall be based on his implementation of the clause entitled "Equal Employment Opportunity", and specific affirmative action obligations required herein of minority and female employment and training must be substantially uniform throughout the length of the Contract and in each trade. The transfer of minority or female employees or trainees from contractor to contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the Contract. Compliance with the goals will be measured against the total work hours performed.

B.

1.) The Contractor shall provide written notification to the Director, Office of Business Diversity and Civil Rights of the Port Authority of New York and New Jersey, within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under this Contract. The notification shall list the name, address and telephone number of the subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated start and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

2.) The Contractor shall submit a Workforce Projection Schedule, which shall be correlated to the progress schedule, within thirty days after acceptance of the Contractor's Proposal, for the approval of the Engineer. The Contractor shall maintain and periodically update it at intervals as required by the Engineer. The Workforce Projection Schedule shall include the time period in which each trade shall be utilized, the average number of workers required per trade on a weekly basis, the peak period for each trade, and the number of workers required per trade for the peak period on a weekly basis.

C.

1.) As used in this numbered clause:

a. "Director" means Director, Office of Business Diversity and Civil Rights of the Authority;

b. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U. S. Treasury Department Form 941;

c. "Minority" includes:

(i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

(ii) Hispanic persons of Puerto Rican, Mexican, Dominican, Cuban, Central or South American culture or origin, regardless of race;

(iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2.) Whenever the Contractor, or any subcontractor at any tier, subcontracts a portion of the Work involving any construction trade, he shall physically include in each subcontract in excess of $10,000 such provisions as are necessary for the Contractor to achieve the aggregate goals set forth above.

3.) The Contractor shall implement the specific affirmative action standards provided in 6.) a. through p. hereof. The goals set forth above are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in the total workforce at the construction site under the Contract including employees of the Contractor and the subcontractors. The Contractor is expected to make substantially uniform progress toward his goals in each craft during the period specified. These goals may be achieved through utilization of journeyworkers and apprentices. In the event they are not achieved through the utilization of journeyworkers, the maximum number of apprentices provided for in the applicable collective bargaining agreement may be utilized to achieve said goals.

4.) Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations hereunder.

5.) In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

6.) The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these provisions shall be based upon his effort to achieve maximum results from his actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or his unions have employment opportunities available, and maintain a record of the organizations' responses.

b. Develop maximum job opportunities for apprentices appropriate to the conditions of the Work and subject to the applicable collective bargaining agreement, in conjunction with training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 6.) a. above.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet his obligations.

e. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting his EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations hereunder with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and subcontractors with whom the Contractor does or anticipates doing business.

i. Direct his recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth.

k. Tests and other selection requirements shall comply with 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations hereunder are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

7.) Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (6.) a. through p.). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the Contractor is a member and participant, may be asserted as fulfilling any one or more of his obligations under 6.) a. through p. hereof provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet his individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's non-compliance.

8.) Goals for minorities and for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation hereof if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved his goals for women generally, the Contractor may be in violation hereof if a specific minority group of women is under-utilized).

9.) The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

10.) The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

11.) The Contractor shall carry out such sanctions and penalties for violation of this clause and of the clause entitled clause entitled "Equal Employment Opportunity", including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered by the Authority. Any Contractor who fails to carry out such sanctions and penalties shall be in violation hereof.

12.) The Contractor, in fulfilling his obligations hereunder shall implement specific affirmative action steps, at least as extensive as those standards prescribed in 6.) hereof so as to achieve maximum results from his efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of these provisions, the Authority shall proceed accordingly.

13.) The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports, including the Monthly Employment Utilization Report, relating to the provisions hereof as may be required and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g. mechanic, apprentice, trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

14.) Nothing herein provided shall be construed as a limitation upon the application of any laws which establish standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

44. AFFIRMATIVE ACTION PROGRAMS

The Contractor assures that he will undertake an affirmative action program as required by 14 CFR Part 152, Subpart E, to insure that no person shall on the grounds of race, creed, color, national origin, or sex be excluded from participating in any employment activities covered in 14 CFR Part 152, Subpart E. The Contractor assures that no person shall be excluded on these grounds from participating in or receiving the services or benefits of any program or activity covered by this subpart. The Contractor assures that he will require that his covered suborganizations provide assurances to the Contractor that they similarly will undertake affirmative action programs and that they will require assurances from their suborganizations, as required by 14 CFR Part 152, Subpart E, to the same effect.

45. PREVAILING RATE OF WAGE

The Contractor shall pay or provide (and shall cause all subcontractors to pay or provide) to his or their workmen, laborers and mechanics (who are employed by him or them to work on an hourly or daily basis at any trade or occupation at or about the construction site) at least the prevailing rate of wage and supplements for others engaged in the same trade or occupation at the time and in the locality in which the Work is being performed as determined by the Engineer and notwithstanding that such rate may be higher than the rate in effect on the date of opening of Proposals.

For purposes of this Contract, the Engineer has determined that the prevailing rates of wage and supplements are those established by the Commissioner of Labor of the State of New York for the locality and for the period of time in which the Work is performed. The currently prevailing rates of wage and supplements are set forth in the Prevailing Rate Schedule annexed hereto and made a part hereof. These rates are subject to annual adjustment effective July 1st of each year and a Prevailing Rate Schedule reflecting all adjustments will be available for the Contractor's inspection on or about July 15th of each year on the 3rd Floor, 3 Gateway Center, Newark, New Jersey 07102 during regular business hours.

The provisions of this numbered clause are inserted in this Contract for the benefit of such workmen, laborers and mechanics as well as for the benefit of the Authority; and if the Contractor or any subcontractor shall pay or provide any such workman, laborer or mechanic less than the rates of wages and supplements above described, such workman, laborer or mechanic 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 is entitled under this clause. If such workman, laborer or mechanic 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 subcontractor's failure to pay or provide such wages and supplements) such workman, laborer or mechanic 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, laborer or mechanic 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 of wages or providing higher supplements than the minimum hereinbefore prescribed; and nothing herein contained shall be construed to constitute a representation or guarantee that the Contractor or any subcontractor can obtain workmen, laborers and mechanics for the minimum herein before prescribed. All wages actually paid that are in excess of the prevailing wages in the performance of Extra Work and Net Cost Work, if applicable, shall be subject, on each occasion, to the initial and continuing approval of the Engineer in advance of the performance of such Extra Work and Net Cost Work, if applicable.

The Contractor shall post at the Work site, in a place that is prominent, accessible and visible to all employees of the Contractor and its subcontractors during the daily time period that the Contractor and/or subcontractor performs Work at the site, the appropriate prevailing wage and supplement schedules. The Contractor must inform all employees, including those of its subcontractors, that they may obtain a copy of the prevailing wage and supplement schedule from the Contractor.

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. 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) of all his payroll records and those of each of his subcontractors as the Authority may require with the Contractor's monthly 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 Contract, 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 such representatives 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.

46. EXTRA WORK ORDERS

No Extra Work of a cost in excess of $250,000 shall be performed except pursuant to written orders of the Chief Engineer expressly and unmistakably indicating his intention to treat the Work described therein as Extra Work; and, no Extra Work of a cost of $250,000 or less shall be performed except pursuant to written orders of the Chief Engineer, Assistant Chief Engineer for Construction, Engineer of Construction or Engineer expressly and unmistakably indicating his intention to treat the Work described therein as Extra Work.

In the absence of such an order signed by the Chief Engineer in the case of Extra Work of a cost in excess of $250,000 and by the Chief Engineer or Assistant Chief Engineer for Construction or Engineer of Construction or Engineer in the case of Extra Work of a cost of $250,000 or less, if the Engineer shall direct, order or require any Work, whether orally or in writing, which the Contractor deems to be Extra Work, the Contractor shall nevertheless comply therewith, but shall within twenty-four (24) hours give written notice thereof to the Chief Engineer and the Engineer, stating why he deems it to be Extra Work, and shall moreover furnish to the Engineer time slips and memoranda as required by the clause hereof entitled "Compensation for Extra Work". Said notice, time slips and memoranda are for the purpose of affording to the Chief Engineer an opportunity to verify the Contractor's claim at the time and (if he desires so to do) to cancel promptly such order, direction or requirement of the Engineer, of affording to the Engineer an opportunity of keeping an accurate record of the materials, labor and other items involved, and generally of affording to the Authority an opportunity to take such action as it may deem desirable in light of the Contractor's claims. Accordingly, the failure of the Contractor to serve such notice or to furnish such time slips and memoranda shall be deemed to be a conclusive and binding determination on his part that the direction, order or requirement of the Engineer does not involve the performance of Extra Work, and shall be deemed to be a waiver by the Contractor of all claims for additional compensation or damages by reason thereof, such written notice, time slips and memoranda being a condition precedent to such claims.

47. PERFORMANCE OF EXTRA WORK

The provisions of this Form of Contract relating generally to Work and its performance shall apply without exception to any Extra Work required and to the performance thereof. Moreover, the provisions of the Specifications 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.

48. TITLE TO MATERIALS

All materials to become part of the permanent construction shall be and become the property of the Authority upon delivery at the construction site or upon being especially adapted for use in or as a part of the permanent construction, whichever may first occur, subject however to the Contractor's assumption of risk under the clause hereof entitled "Risks Assumed by the Contractor", subparagraph A.

The Contractor shall promptly furnish to the Authority such bills of sale and other instruments as may be required by it, properly executed, acknowledged and delivered, assuring to it title to such materials, free of encumbrances and shall mark or otherwise identify all such materials as the property of the Authority.

49. 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 consent in writing of the Authority 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 Engineer 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 "Information For Bidders" entitled "Certification of No Investigation (Criminal or Civil Anti-Trust), Indictment, Conviction, Suspension, Debarment, Disqualification, Prequalification Denial or Termination, Etc; Disclosure of Other Required Information", "Non-Collusive Bidding and Code of Ethics Certification; Certification of No Solicitation Based on Commission, Percentage, Brokerage, Contingent Fee or Other Fee" and "Certification of Participation in a State-Registered Apprenticeship Program". The Certification of Participation in a State-Registered Apprenticeship Program shall only be applicable to each subcontractor whose total amount of subcontract under this Contract is greater than $1 million. All further subcontracting by any subcontractor shall also be subject to such approval of the Engineer. Approval of a subcontractor may be conditioned on (among other things) the furnishing, without expense to the Authority, of a surety bond guaranteeing payment by the subcontractor of claims of materialmen, subcontractors, workmen and other third persons arising out of the subcontractor's performance of any part of the Work. Approval of a subcontractor may be rescinded for, among other things, failure of the Contractor to furnish the subcontractor's certificate of insurance, as required by the Form of Contract clause entitled "Insurance Procured by Contractor", within the time set forth in said clause.

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 Engineer 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 subcontracts and all approvals of subcontractors shall be and, 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 Engineer, the Engineer 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.

50. 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.

51. CERTIFICATES OF PARTIAL COMPLETION

If at any time prior to the rendition of the Certificate of Final Completion, any portion of the permanent construction has been satisfactorily completed, and if in the judgment of the Engineer such portion of the permanent construction is not necessary for the operations of the Contractor but will be immediately useful to and is needed by the Authority for other purposes, the Engineer may render to the Authority and to the Contractor a certificate in writing to that effect (herein called a Certificate of Partial Completion), and thereupon or at any time thereafter the Authority may take over and use the portion of the permanent construction described in such Certificate and exclude the Contractor therefrom.

The rendition of a Certificate of Partial Completion shall not be construed to constitute an extension of the Contractor's time to complete the portion of the permanent construction to which it relates in the event that he has failed to complete the same in accordance with the terms of this Contract. Moreover, the acceptance of a Certificate of Partial Completion by the Authority shall not operate to release the Contractor or his sureties from any obligations under or upon this Contract or the Performance and Payment Bond.

52. CERTIFICATE OF SUBSTANTIAL COMPLETION

Prior to the rendition of the Certificate of Final Completion, the Engineer may deem the entire Work to be substantially completed when, in the judgment of the Engineer, the permanent construction has been satisfactorily completed to the point where the Work is fit for its intended purpose and use. The Engineer may, if such a determination of substantial completion is made and at such time, render to the Authority and to the Contractor a certificate in writing to that effect (herein called the Certificate of Substantial Completion), and thereupon or at any time thereafter the Authority may take over and use the permanent construction described in such Certificate and exclude the Contractor therefrom. Whether to make a determination of a substantial completion as to any portion of the Work, and whether to render such a Certificate, shall be the discretionary determination of the Engineer based upon an examination and appraisal of the completed Work, and no right to such a determination or certification is established in the Contractor by this provision.

The rendition of such Certificate of Substantial Completion shall not relieve the Contractor of his obligation hereunder to complete the Work of this Contract nor shall it be construed to constitute an extension of the Contractor's time to complete the portion of the permanent construction to which it relates in the event that he has failed to complete the same in accordance with the terms of this Contract. Moreover, the acceptance of a Certificate of Substantial Completion by the Authority shall not operate to release the Contractor or his sureties from any obligations under or upon this Contract or the Performance and Payment Bond.

When the Contractor is of the opinion that the Work is substantially complete as described above, the Contractor may submit to the Engineer a written request that the Engineer inspect the Work so as to determine, in the Engineer's sole opinion, whether substantial completion has been achieved. The Contractor's written request shall list the specific items of Work that are incomplete. Upon such a request, the Engineer will respond within 30 days with a Certificate of Substantial Completion or provide a written explanation of the reasons why the Work is not substantially complete including a list of open items necessary to achieve substantial completion. Nothing contained herein shall be deemed to preclude the Engineer from making a determination of substantial completion in the absence of a request therefor by the Contractor.

53. CERTIFICATE OF FINAL COMPLETION

After the satisfactory completion of all Work whatsoever required and the making of such tests and inspections as may be necessary or desirable, the Engineer shall render to the Authority and to the Contractor a certificate in writing (herein called the Certificate of Final Completion) certifying that in his opinion all Work under this Contract including Extra Work, has been completed in accordance with the Contract Drawings and Specifications and the requirements of the Engineer, and certifying the date as of which it was so completed.

The rendition of the Certificate of Final Completion shall not be construed to constitute an extension of the Contractor's time for performance in the event that he has failed to complete the Work in accordance with the terms of this Contract. Moreover, the acceptance of the Certificate of Final Completion by the Authority shall not operate to release the Contractor or his sureties from any obligations under or upon this Contract or the Performance and Payment Bond.

54. NO GIFTS, GRATUITIES, OFFERS OF EMPLOYMENT, ETC.

During the term of this Contract, the Contractor shall not offer, give or agree to give anything of value either to an Authority employee, agent, job shopper, consultant, construction manager or other person or firm representing the 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 Authority of duties involving transactions with the Contractor on behalf of the Authority, whether or not such duties are related to this Contract or any other 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 Authority contract), etc., which might tend to obligate the Authority employee to the Contractor, 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 Authority contract.

Where used in this clause, the term "Authority" shall be deemed to include all subsidiaries of the Authority. Currently, those subsidiaries are the Port Authority Trans-Hudson Corporation (PATH), the Newark Legal and Communications Center and the New York and New Jersey Railroad Corporation.

In addition, during the term of this Contract, the Contractor shall not make an offer of employment or use confidential information in a manner proscribed by the Code of Ethics and Financial Disclosure dated as of April 11, 1996 (a copy of which is available upon request to the Office of the Secretary of the Authority).

The Contractor shall include the provisions of this clause in each subcontract entered into under this Contract.

CHAPTER V

WARRANTIES MADE AND LIABILITY

ASSUMED BY THE CONTRACTOR

55. CONTRACTOR'S WARRANTIES

The Contractor represents and warrants:

A. That he is financially solvent, that he is experienced in and competent to perform the type of services contemplated by 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 and inspected the construction site, 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; and

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, surface or subsurface, which may be encountered at the construction site; (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.

Moreover, the Contractor accepts the conditions at the construction site 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, unless specifically provided for elsewhere in this Contract.

Nothing in the Contract Drawings or Specifications 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 Contract Drawings and Specifications 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 opening of Proposals on 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 numbered 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.

56. RISKS ASSUMED BY THE CONTRACTOR

The Contractor assumes the following distinct and several risks, whether they arise from acts or omissions (whether negligent or not) of the Contractor, of the Authority, or of third persons, or from any other cause, and whether such risks are within or beyond the control of the Contractor, excepting only risks which arise solely from affirmative acts done by the Authority subsequent to the opening of Proposals on this Contract with actual and wilful intent to cause the loss, damage and injuries described in subparagraphs A through C below:

A. The risk of loss or damage to the permanent construction prior to the rendition of the Certificate of Final Completion (other than loss or damage to the portions of the permanent construction with respect to which Certificates of Partial Completion have been issued), and the Contractor shall forthwith repair, replace and make good any such loss or damage to the permanent construction without cost to the Authority;

B. The risk of claims, fines or penalties, just or unjust, made by third persons or assessed by courts or governmental agencies or entities against the Contractor or the Authority on account of injuries (including wrongful death), loss, damage or liability of any kind whatsoever arising or alleged to arise out of or in connection with the performance of the Work (whether or not actually caused by or resulting from the performance of the Work) or out of or in connection with the Contractor's operations or presence at or in the vicinity of the construction site or Authority premises, including claims against the Contractor or the Authority for the payment of workers' compensation, whether such claims, fines or penalties are made or assessed and whether such injuries, damage, loss and liability are sustained at any time both before and after the rendition of the Certificate of Final Completion;

C. The risk of loss or damage to any property of the Contractor, and of claims made against the Contractor or the Authority for loss or damage to any property of subcontractors, materialmen, workmen and others performing the Work, occurring at any time prior to completion of removal of such property from the construction site or Authority premises or the vicinity thereof.

The Contractor shall indemnify the Authority against all claims described in subparagraphs B and C above and for all expense incurred by it in the defense, settlement or satisfaction thereof, including expenses of attorneys, except where indemnity would be precluded by New York State General Obligations Law, Section 5-322.1 or by other applicable law. If so directed, the Contractor shall defend against any claim described in subparagraphs B and C above, in which event he 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 statutes respecting suits against the Authority . Unless a claim is one which the Contractor is not required to indemnify the Authority against as described in the first sentence of this paragraph, 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 by action of its Board of 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 issuance of a Certificate of Completion nor the making of Final Payment shall release the Contractor from his 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 he 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 he 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 he would assume or the claims for which he would be responsible in the absence of such enumerations.

Inasmuch as the Authority has agreed to indemnify the City of New York against claims of the types described in subparagraph B above made against said city, the Contractor's obligation under subparagraph B above shall include claims by said city against the Authority for such indemnification, including those arising from acts or omissions (whether negligent or not) of said city.

57. NO THIRD PARTY RIGHTS

Nothing contained in this Contract is intended for the benefit of third persons, except to the extent that the Contract specifically provides otherwise by use of the words "benefit" or "direct right of action".

58. INSURANCE PROCURED BY THE AUTHORITY

In order to reduce the cost of this Contract, the Authority will procure and will maintain in force and pay the premiums on:

A. A policy of public liability (Comprehensive - Commercial General Liability, including Contractual) insurance on which the Contractor and the subcontractors will be insureds issued by an insurance company satisfactory to the Authority, with current coverage limits of $50 million per occurrence for bodily injury and property damage liability.

B. A policy of workers' compensation and employer's liability insurance fulfilling the Contractor's and the subcontractor's obligations under the applicable State Workers' Compensation Law for those employees of the Contractor and the subcontractors employed pursuant to this Contract in operations conducted at the site of the Work hereunder. Coverage under this policy may, as appropriate, include one or more of the following endorsements:

1.) Longshore and Harbor Workers' Compensation Act Coverage Endorsement. (Applies when performing work on or around navigable waters).

2.) Maritime Coverage Endorsement (Applies to masters or members of the crews of vessels, if vessels are used).

3.) Federal Employer's Liability Act Coverage Endorsement. (May apply to railroad related Work).

Determination in any instance as to the appropriateness of the included coverage described in B.1, 2 and 3 above will be made based upon information to be provided by the Contractor relating to the mode of performance of Work to be done under the Contract.

The policy described in B above will not provide coverage for any workers' compensation for the Contractor and/or subcontractors who perform any asbestos work. In such cases, the Contractor or subcontractors shall procure and maintain, at their own expense, the workers' compensation insurance in accordance with the requirements of law in the state(s) where the Work will take place, including employer's liability insurance (in limits of not less than $1 million per occurrence).

Should the Contractor and/or subcontractors be required to procure the workers' compensation insurance, within ten days after the acceptance of his Proposal the Contractor shall deliver to the General Manager, Risk Financing, The Port Authority of NY & NJ, Treasury Department, 225 Park Avenue South, 12th Floor, New York, N.Y. 10003 (Attn: Contract Insurance Review), an original certificate, stating the Contract number, from the insurer. A duplicate certificate evidencing the above insurance shall also be delivered to the Engineer. With regard to insurance required to be procured by a subcontractor, the Contractor shall deliver the certificate described above at least ten days before the subcontractor commences Work.

The requirements for insurance procured by the Contractor or subcontractors shall not in any way be construed as a limitation on the nature or extent of the obligations of the Contractor or subcontractors.

C. A policy of builder's risk insurance, covering the improvements or other Work to be effectuated by the Contractor and the subcontractors, with coverage limits of $50 million per occurrence for all locations combined (subject to a $50 million annual aggregate for flood and earthquake damage and a limit of $10 million per occurrence for damage to off-site storage and property in-transit). The deductible is $10,000 per occurrence for all losses except those caused by flood and earthquake, where a $50,000 deductible per occurrence with respect to flood, and a $25,000 deductible per occurrence with respect to earthquake are in effect. The policy form contains various exclusions, including but not limited to the following property exclusions: automobiles; aircraft; and Contractors' and subcontractors' machinery, tools, and equipment and property of a similar nature, including forms, shoring, scaffolding, temporary structures, rental property/equipment and similar property, not intended to become a permanent part of a building or structure. The Contractor and the subcontractors must refer to the policy form to determine all properties and perils included and excluded and to determine their rights and responsibilities as insureds under the policy form. The Contractor and the subcontractors are responsible for payment for all losses within the deductibles and losses not covered by the builder's risk policies.

The current policies described in A, B and C of this numbered clause are available for examination by appointment in the office of the General Manager, Risk Financing, The Port Authority of NY & NJ, Treasury Department, 225 Park Avenue South, 12th Floor, New York, N.Y. 10003. The policies under A above are subject to certain liability coverage exclusions, which include, but are not limited to, exclusions from liability from claims arising from pollution and exposure to asbestos.

The Contractor and subcontractors shall comply with all obligations of the insured under or in connection with all of the policies described in A, B and C above.

The Authority shall have the right at any time and from time to time at its option to procure insurance substituting in whole or in part for any or all of the policies described in A, B and C above or to require that the Contractor and the subcontractors themselves obtain insurance substituting in whole or part for that above referred to, provided always, however, that the Contractor and the subcontractors shall be afforded coverage as stipulated by the Authority and the Authority shall either pay the premiums on such substitute insurance or reimburse the Contractor and the subcontractors therefor.

Neither the procurement of the above insurance or any substitute insurance nor the extent of the coverage or the limits of liability thereunder shall be construed to be a limitation on the nature or extent of the Contractor's obligations, or to relieve the Contractor of any such obligations, and the procurement of the above insurance is only for the purpose of reducing the cost of the Contract without constituting any representation by the Authority as to the adequacy of the insurance to protect the Contractor against the obligations imposed on the Contractor by law (except the applicable State Workers' Compensation Law) or by this or any other contract.

Notwithstanding any provision of this clause, however, no subcontractor shall be or have the right to be covered under the policies of insurance above referred to until the subcontractor has been expressly approved in writing by the Engineer, as required under this Contract, and such approval may be withheld, among other reasons, until execution by the subcontractor of agreements affirming his obligations provided in this clause with respect to the above insurance.

The provisions of this numbered clause are not intended to create any rights for the Contractor other than rights which may be available to the Contractor under said policies themselves, whatever such rights may be. Moreover, the Authority makes no representation or guaranty, either by the provisions of this numbered clause or otherwise, as to the effect of or the coverage under said policies, and no employee or agent of the Authority is authorized to make any such representation or guaranty, either by the provisions of this numbered clause or otherwise, as to the effect of or the coverage under said policies, and no employee or agent of the Authority is authorized to make any such representation or guaranty or to offer any interpretation of or information on said policies. The Contractor warrants and represents that he has examined and is familiar with the above stated coverages and that in submitting his Proposal he has relied solely on his own interpretation thereof and not on any representations or statements, oral or written, of the Authority, its Commissioners, officers, agents, employees, consultants or contractors.

All negotiations and adjustments with any insurer concerning payment for any loss, the risk of which is borne by the Contractor under this Contract, shall be the responsibility of and shall be conducted by the Contractor unless the applicable policy provides otherwise. The Contractor shall, however, inform the Engineer of the progress of all such negotiations and notify the Engineer sufficiently in advance of all meetings thereon so that the Engineer or designated representatives may attend said negotiations if they so desire.

The Authority shall be entitled to all returned premiums, dividends and credits which may become payable at any time for any reason whatsoever in connection with the aforementioned insurance. The Contractor hereby assigns to the Authority all such returned premiums, dividends and credits and the subcontractors shall be deemed to have assigned to the Authority all such returned premiums, dividends and credits by becoming subcontractors under this Contract. The Contractor shall execute and cause the subcontractors to execute any instrument necessary or convenient to evidence the Authority's right to such returned premiums, dividends and credits.

Notwithstanding any payment by the Authority of any insurance premiums, the Authority shall not be deemed the employer of any employees hired by the Contractor or any subcontractor covered by such insurance nor shall it be liable for any of the obligations of such employer.

The Contractor and the subcontractors shall cooperate to the fullest extent with the Authority in all matters relating to the aforementioned insurance and shall comply with all requirements of all insurance policies procured by the Authority. They shall also at their own expense furnish the Engineer or a duly authorized representative with copies of all payrolls, correspondence, papers, records and other things necessary or convenient for dealing with or defending against any claims and for procuring or administering the aforementioned insurance including furnishing the name of any of their employees, officers, or agents whose presence or testimony is necessary or convenient in any negotiations or proceedings involving such insurance.

59. INSURANCE PROCURED BY CONTRACTOR

The Contractor, in his own name as insured, shall maintain and pay the premiums on the policy or policies of insurance for coverage(s) as hereinafter described, which shall cover his operations hereunder, shall be effective throughout the effective period of this Contract, and shall afford coverage(s) in not less than the amounts set forth below:

A. Commercial Automobile Liability Insurance: covering "any" vehicles on the broadest commercially available form:

1.) Combined single limit for bodily injury and property damage liability - $2 million each accident.

The Authority shall be named as an additional insured in the liability policy or policies and evidenced by the certificate(s) of insurance set forth above. The liability policy(ies) and the certificate(s) of insurance shall show coverage for cross-liability/severability of interests as provided under the standard ISO "separation of insureds" condition.

The Contractor shall deliver certified copies of the policy(ies) described above or certificate(s) of insurance evidencing the existence thereof to the Engineer at the location where the Work will be performed, within ten (10) days after the acceptance of his Proposal. Such policy(ies) or certificate(s) shall state the Contract number and shall contain a valid provision or endorsement that the policy(ies) may not be canceled, terminated, changed or modified without giving thirty (30) days written advance notice thereof to the Authority. Such policy(ies) and certificate(s) of insurance shall contain an additional endorsement providing that "the insurance carrier shall not, without obtaining express advance 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, raise any defense involving in any way the jurisdiction of the Authority, its Commissioners, officers, agents or employees, the governmental nature of the Authority or the provisions of any statute respecting suits against the Authority". Certified copies of all renewal policies or certificates evidencing their existence shall be delivered to the Engineer at the location where the Work will be performed at least ten (10) days prior to the expiration date of each expiring policy. If at any time any of the certificates or policies shall be or become unsatisfactory to the Authority as to form or substance, or if the carrier issuing any such certificate or policy shall be or become unsatisfactory to the Authority, the Contractor shall promptly obtain a new and satisfactory certificate and policy. Upon request of the General Manager, Risk Financing, the Contractor shall furnish the Authority with a certified copy of each policy stated above.

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 Contract. 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 him by law or by this or any other contract.

CHAPTER VI

RIGHTS AND REMEDIES

60. RIGHTS AND REMEDIES OF AUTHORITY

The Authority shall have the following rights in the event the Chief Engineer shall deem the Contractor guilty of a breach of any term whatsoever of this Contract:

A. The right to take over and complete the Work or any part thereof as agent for and at the expense of the Contractor, either directly or through other contractors.

B. The right to cancel this Contract as to any or all of the Work yet to be performed.

C. The right to specific performance, an injunction or any other appropriate equitable remedy.

D. The right to money damages.

For the purpose of this Contract, breach shall include but not be limited to the Contractor's failure to procure insurance satisfactory to the Authority within the time limit specified in the Clause hereof entitled "Insurance Procured by Contractor" and 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 any one 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 any one 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 any one 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 of the Information For Bidders entitled "Certification of No Investigation (Criminal or Civil Anti-Trust), Indictment, Conviction, Suspension, Debarment, Disqualification, Prequalification Denial or Termination, Etc; Disclosure of Other Required Information", "Non-Collusive Bidding and Code of Ethics Certification; Certification of No Solicitation Based on Commission, Percentage, Brokerage, Contingent Fee or Other Fee", and "Certification of Participation in a State-Registered Apprenticeship Program", any false certification at any time by the Contractor or a subcontractor pursuant to the clause "Prevailing Rate of Wage Certification" set forth in the Information for Bidders, 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 estop it from exercising such other rights or remedies.

61. RIGHTS AND REMEDIES OF 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 Engineer shall so direct) to suspend or abandon performance.

62. 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 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.

In the certificate of total compensation earned, for which provision is made in the clause hereof entitled "Final Payment", the Engineer will separately state the amount of Work performed by the Authority as agent for the Contractor, credit to the Authority the cost thereof, and credit to the Contractor the compensation earned thereby; and the difference between them shall be payable by the Contractor to the Authority, or vice versa as the case may be. If such difference is in its favor, the Authority may deduct it from any moneys due the Contractor, and if such moneys be insufficient, the balance thereof shall be payable to it on demand; if in the Contractor's favor, it shall constitute part of the Final Payment.

The exercise by the Authority of its right to take over the Work shall not release the Contractor or his sureties from any of his or their obligations or liabilities under this Contract or the Performance and Payment Bond.

63. 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 Engineer, 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 moneys which may be paid to him or for his account in excess of those to which he is lawfully entitled.

Neither the acceptance of the Work or any part thereof, nor any payment therefor, nor any order or certificate issued under this Contract or otherwise issued by the Authority, the Engineer, or any officer, agent or employee of the Authority, nor any permission or direction to continue with the performance of Work, nor any performance by the Authority of any of the Contractor's duties or obligations, nor any aid lent 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 Contract or of any rights or remedies to which the Authority may be entitled because of any breach thereof, 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 Contract shall be deemed to be a waiver of any other or any subsequent breach.

CHAPTER VII

MISCELLANEOUS

64. SUBMISSION TO JURISDICTION

The Contractor hereby irrevocably submits himself to the jurisdiction of the Courts of the State of New York and to the jurisdiction of the Courts of the State of New Jersey in regard to any controversy arising out of, connected with, or in any way concerning the Proposal or this Contract. The Contractor agrees that service of process on the Contractor in relation to such jurisdiction may be made, at the option of the Authority, either by registered or certified mail addressed to the applicable office as provided for in the clause hereof entitled "Service of Notices on the Contractor", by registered or certified mail addressed to any office actually maintained by the Contractor or by actual personal delivery to the Contractor if the Contractor be an individual, to any partner if the Contractor be a partnership or to an officer, director or managing or general agent if the Contractor be a corporation.

Such service shall be deemed to be sufficient when jurisdiction would not lie because of the lack of basis to serve process in the manner otherwise provided by law. In any case, however, process may be served as stated above whether or not it might otherwise have been served in a different manner.

65. 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.

66. 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.

67. 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 to him under any term or provision of this Contract, or because of its execution or attempted execution, or because of any breach hereof.

68. SERVICE OF NOTICES 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 or post office box, enclosed in a postpaid wrapper addressed to the Contractor at his office, or its delivery to his 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 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.

69. 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.

The authority of any person to order Extra Work or to alter the Contract Drawings and Specifications does not include the power to cancel, modify or waive any provision of the Form of Contract, and no officer or other representative of the Authority shall have the power so to do unless and until hereafter so authorized by or pursuant to a resolution of the Commissioners of the Authority or by or pursuant to a resolution of their appropriate Committee.

70. PUBLIC RELEASE OF INFORMATION

The Contractor and all his subcontractors shall not issue or permit to be issued any press release, advertisement, or literature of any kind, which refers to the Authority or the services performed in connection with this Contract, without first obtaining the written approval of the Chief Engineer. Such approval may be withheld if for any reason the Chief Engineer believes that the publication of such information would be harmful to the public interest or is in any way undesirable. This provision shall survive termination or expiration of this Contract.

PERFORMANCE AND PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS that we, the undersigned[23] Contractor and surety company (or companies), as principal and surety (or sureties), respectively,

Contractor	Surety

[23] Insert names of the Contractor and surety company (or companies) in the appropriate columns. If space is insufficient add rider.

If the Contractor is a corporation, give the state of incorporation, using also the phrase "a corporation organized under the laws of _____".

If the Contractor is a partnership, give full names of partners, using the phrase "co-partners doing business under the firm name of _____".

If the Contractor is an individual using a trade name, give individual name, using also the phrase "an individual doing business under the trade name of _____.".

are hereby held and firmly bound unto The Port Authority of New York and New Jersey (herein called the "Authority") in the penal sum of _____ Dollars

and _____ Cents ($ _____.), for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, representatives, executors, administrators, successors and assigns. Each surety, however, if there is more than one, shall be jointly and severally liable for said penal sum.

Signed this _____ day of _____ 20

The condition of the above obligation is that

WHEREAS, the above named principal has entered into a Contract in writing with the Authority, a copy of which is hereby made a part of this bond as though herein set forth in full and which is designated Contract JFK-924.105 - "John F. Kennedy International Airport - Rehabilitation of 148th Street and Three JFK Expressway Ramps", and

WHEREAS, the Authority has required this bond for the faithful performance of all obligations imposed by said Contract and also for the payment of all lawful claims of subcontractors, materialmen and workmen arising out of the performance of said Contract;

NOW, if the said principal shall well and faithfully do and perform the things agreed by him to be done and performed according to the terms and true intent and meaning of said Contract and if all lawful claims of subcontractors, materialmen and workmen arising out of the performance of said Contract are paid, then this obligation shall be void, otherwise the same shall remain in full force and effect; it being expressly understood and agreed that, provided the sureties shall comply with the provisions hereof, the aggregate liability of all sureties for any and all claims hereunder shall in no event exceed the penal amount of this obligation as hereinbefore stated.

This undertaking is for the benefit of the Authority and all subcontractors, materialmen and workmen having lawful claims arising out of the performance of said Contract, and all such subcontractors, materialmen and workmen (as well as the Authority itself) shall have a direct right of action upon this bond; but the rights and equities of such subcontractors, materialmen and workmen shall be subject and subordinate to those of the Authority.

The sureties, for value received, hereby stipulate and agree that the obligations of said sureties and their bond shall be in no way impaired or affected by any extensions of time, modification, omission, addition or change in or to the said Contract or the construction to be performed thereunder, or by any supervision or inspection or omission to supervise or inspect the construction, or by any payment thereunder before the time required therein, or by any waiver of any provision or condition thereof (whether precedent or subsequent), or by any assignment, subletting or other transfer thereof or of any part thereof or of any construction to be performed or any moneys due or to become due thereunder; and said sureties do hereby waive notice of any and all of such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts and transfers, and hereby expressly stipulate and agree that any and all things done and omitted to be done by and in relation to assignees, subcontractors and other transferees shall have the same effect as to said sureties as though done by or in relation to said principal.

The sureties shall give the General Counsel of the Authority the following notices:

A. Written notice of an intent to pay any claim of a subcontractor, materialman or workman hereunder;

B. Written notice within five days of the institution of an action by a subcontractor, materialman or workman hereunder.

The sureties shall not pay the claim of any subcontractor, materialman or workman hereunder until the expiration of thirty days after receipt by said General Counsel of notice under either subparagraph A or B above, describing the claim to be paid.

IN WITNESS WHEREOF, the principal and the sureties have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

_____

Principal

(Seal) By [24] _____

_____

Surety

By[25] _____

APPROVED AS TO ACCEPTABILITY OF SURETIES:

_____

Credit Manager

_____20

---

24 If bond is signed by an officer or agent, give title; if signed by a corporation, affix corporate seal.

25 Add signatures of additional sureties, if any.

ACKNOWLEDGMENT OF PRINCIPAL, IF A CORPORATION

State of _____

_____ SS:

County of _____

On this _____ day of _____, 20 , before me personally came and appeared _____, to me known, who being by me duly sworn, did depose and say that he resides at _____; that he is the _____. of _____ the corporation described in and which executed the foregoing instrument; that he knows the seal of said corporation; that one of the seals affixed to said instrument is such seal; that it was so affixed by order of the directors of said corporation, and that he signed his name thereto by like order.

(Notary Seal) _____

(Notary Signature)

ACKNOWLEDGMENT OF PRINCIPAL, IF A PARTNERSHIP

State of _____

_____ SS:

County of _____

On this _____ day of _____, 20 , before me

personally came and appeared _____, to me known, and known to me to be one of the members of the firm of _____ _____ described in and who executed the foregoing instrument and he acknowledged to me that he executed the same as and for the act and deed of said firm.

(Notary Seal) _____

(Notary Signature)

ACKNOWLEDGMENT OF PRINCIPAL, IF AN INDIVIDUAL

State of _____

_____ SS:

County of _____

On this _____ day of _____, 20 , before me personally came and appeared _____, to me known and known to me to be the person described in and who executed the foregoing instrument and he acknowledged to me that he executed the same.

(Notary Seal) _____

(Notary Signature)

AFFIX ACKNOWLEDGMENT AND JUSTIFICATION OF SURETY

SPECIFICATIONS

DIVISION 1

GENERAL PROVISIONS

71. CONSTRUCTION REQUIRED BY THE SPECIFICATIONS

These Specifications relate generally to performing milling and overlay of existing asphalt pavement, localized full-depth pavement replacement, safety improvements, re-striping and signal improvements, bustop relocation, minor landscaping, drainage improvements, lighting improvements and related Work..

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 shown on the Contract Drawings in their present form. In addition, all things shown on the Contract Drawings even though not expressly mentioned in these Specifications, all things mentioned in these Specifications even though not shown on the Contract Drawings, and all things not specified either on the Contract 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 Contract 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 Contract Drawings, the requirement of the Contract 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 Specifications and Contract 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 Contract 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 Form of Contract unless the Specifications or Contract 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 Contract 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 Contract.

In all cases the provisions of the second paragraph of this numbered Section shall control.

72. 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, together with an area shown on Contract Drawing No. G003 and designated "Area Available For Contractor's Use".

Work to be performed requiring full roadway closure shall start after Labor Day, September 3, 2012.

Any additional property which 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 Contract, and he must at all times so conduct his operations as not to encroach upon or block the portions used by others. The 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 Contract.

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.

73. 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 Contract, 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 Contract. 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 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 Contract 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 Contract. 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 Contract 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 Form of 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.

74. OPERATIONS OF OTHERS

During the time that the Contractor is performing the Contract, other persons will be engaged in other operations on or about the construction site including work on Authority contract JFK-1033 – Cargo Area C & D Communications Vaults and normal 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 interferewith the operations of the 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. 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.

75. LABOR ACTIONS

Whenever any labor strike, slowdown, work stoppage, picketing or other labor action which might interfere with the performance of the Contract, 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 Contract, the Contractor shall pursue all remedies which are appropriate and available to him to avoid such interference.

76. 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.

77. CONTRACT DRAWINGS

The Contract Drawings which accompany and form a part of these Specifications bear the general title "The Port Authority of NY & NJ - John F. Kennedy International Airport - Rehabilitation of 148th Street and Three JFK Expressway Ramps - Contract JFK-924.105" and are separately numbered and entitled as follows:

G001	TITLE SHEET	General
G002	LOCATION MAP	General
G003	LOCATION PLAN	General
G004	INDEX OF DRAWINGS	General
G005	GENERAL NOTES	General
N001	SOIL EROSION AND SEDIMENT CONTROL PLAN, DETAILS AND NOTES	Environmental
C001	LEGEND AND ABBREVIATIONS	Civil
C002	CIVIL NOTES	Civil
C003	REFERENCE PLAN	Civil
C004	REMOVAL PLAN -1-	Civil
C005	REMOVAL PLAN -2-	Civil
C006	REMOVAL PLAN -3-	Civil
C007	REMOVAL PLAN -4-	Civil
C008	REMOVAL PLAN -5-	Civil
C009	REMOVAL PLAN -6-	Civil
C010	ALIGNMENT AND PAVING PLAN -1-	Civil
C011	ALIGNMENT AND PAVING PLAN -2-	Civil
C012	ALIGNMENT AND PAVING PLAN -3-	Civil
C013	ALIGNMENT AND PAVING PLAN -4-	Civil
C014	ALIGNMENT AND PAVING PLAN -5-	Civil
C015	ALIGNMENT AND PAVING PLAN -6-	Civil
C016	GRADING PART- PLANS -7-	Civil
C017	UTILITIES PART – PLANS -8-	Civil
C018	DETAILS -1-	Civil
C019	DETAILS -2-	Civil
C020	DETAILS -3-	Civil
C021	DETAILS -4-	Civil
C022	DETAILS -5-	Civil
C023	DETAILS -6-	Civil
ES001	GENERAL NOTES	Electrical

ES002	CCTV COMMUNICATIONS PLAN	Electrical
ES003	COMMUNICATIONS VAULT C EQUIPMENT PLAN	Electrical
ES004	CCTV DETAILS	Electrical
SG001	NOTES, LEGEND, AND ABBREVIATIONS	Traffic
SG002	TRAFFIC SIGNAL WIRING PLAN AND DIMENSION DIAGRAM	Traffic
SG003	REMOVALS PLAN	Traffic
SG004	TRAFFIC SIGNAL COMMUNICATIONS PLAN	Traffic
SG005	TRAFFIC SIGNAL DETAILS -1-	Traffic
SG006	TRAFFIC SIGNAL DETAILS -2-	Traffic
SG007	TRAFFIC SIGNAL DETAILS -3-	Traffic
SG008	TRAFFIC SIGNAL DETAILS -4-	Traffic
SG009	TRAFFIC SIGNAL DETAILS -5-	Traffic
SG010	TRAFFIC SIGNAL DETAILS -6-	Traffic
SG011	TRAFFIC SIGNAL DETAILS -7-	Traffic
MT001	MAINTENANCE OF TRAFFIC NOTES, LEGEND, ABBREVIATIONS	Traffic
MT002	MAINTENANCE OF TRAFFIC STAGE 1	Traffic
MT003	MAINTENANCE OF TRAFFIC STAGE 2	Traffic
MT004	MAINTENANCE OF TRAFFIC STAGE 2A - JFK EXPRESSWAY EXIT RAMP CLOSURE	Traffic
MT005	MAINTENANCE OF TRAFFIC STAGE 3	Traffic
MT006	MAINTENANCE OF TRAFFIC STANDARD DETAILS - 1 OF 2	Traffic
MT007	MAINTENANCE OF TRAFFIC STANDARD DETAILS - 2 OF 2	Traffic
T001	GENERAL NOTES, LEGEND AND ABBREVIATIONS	Traffic
T002	PAVEMENT MARKING INSTALLATION PLAN - SHEET 1 OF 6	Traffic
T003	PAVEMENT MARKING INSTALLATION PLAN - SHEET 2 OF 6	Traffic
T004	PAVEMENT MARKING INSTALLATION PLAN - SHEET 3 OF 6	Traffic
T005	PAVEMENT MARKING INSTALLATION PLAN - SHEET 4 OF 6	Traffic
T006	PAVEMENT MARKING INSTALLATION PLAN - SHEET 5 OF 6	Traffic

T007	PAVEMENT MARKING INSTALLATION PLAN - SHEET 6 OF 6	Traffic
T008	GUIDE RAIL INSTALLATION PLAN	Traffic
T009	REMOVAL PLAN - SHEET 1 OF 2	Traffic
T010	REMOVAL PLAN - SHEET 2 OF 2	Traffic
T011	SIGN INSTALLATION PLAN - SHEET 1 OF 2	Traffic
T012	SIGN INSTALLATION PLAN - SHEET 2 OF 2	Traffic
T013	REMOVAL SIGN DATA TABLE	Traffic
T014	INSTALLATION SIGN DATA TABLE	Traffic
T015	PAVEMENT MARKING DETAILS	Traffic
T016	GUIDE RAIL DETAILS -1-	Traffic
T017	GUIDE RAIL DETAILS -2-	Traffic
T018	GUIDE RAIL DETAILS -3-	Traffic
T019	GUIDE RAIL DETAILS -4-	Traffic
T020	SIGN MOUNTING DETAILS -1-	Traffic
T021	SIGN MOUNTING DETAILS -2-	Traffic
T022	RUMBLE STRIPS, DELINEATION DEVICE AND MARKER DETAILS	Traffic
E001	ELECTRICAL LEGEND, ABBREVIATIONS, AND NOTES	Electrical
E002	LIST OF APPROVED MANUFACTURERS & LIGHTING FIXTURE SCHEDULE	Electrical
E003	148TH STREET ROADWAY LIGHTING REMOVAL PLAN - 1	Electrical
E004	148TH STREET ROADWAY LIGHTING REMOVAL PLAN - 2	Electrical
E005	148TH STREET ROADWAY LIGHTING REMOVAL PLAN - 3	Electrical
E006	148TH STREET ROADWAY LIGHTING PLAN - 1	Electrical
E007	148TH STREET ROADWAY LIGHTING PLAN - 2	Electrical
E008	148TH STREET ROADWAY LIGHTING PLAN - 3	Electrical
E009	148TH STREET ROADWAY LIGHTING PLAN - 4	Electrical
E010	148TH STREET ROADWAY POWER PLAN - 1	Electrical
E011	148TH STREET ROADWAY POWER PLAN - 2	Electrical
E012	148TH STREET ROADWAY POWER PLAN - 3	Electrical
E013	PART PLAN, LIGHTING CONTROL, SCHEMATIC AND DUCT BANK DETAILS	Electrical

E014	WIRING SCHEMATIC AND TRAFFIC/CCTV POWER ONE LINE DIAGRAMS	Electrical
E015	POWER SINGLE LINE DIAGRAM & PANEL SCHEDULE	Electrical
E016	DETAILS - 1	Electrical
E017	DETAILS - 2	Electrical
S001	STRUCTURAL NOTES, LEGEND AND ABBREVIATIONS	Structural
S002	STRUCTURAL NOTES, LEGEND AND ABBREVIATIONS	Structural
LS001	HARDSCAPE PLAN	Landscape Architecture
LS002	DETAILS	Landscape Architecture

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 may be supplemented during the performance of the Work by the Engineer or by the Contractor subject to the approval of the Engineer, to the extent necessary to further illustrate the Work.

An indication on the Contract 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.

After the Contract has been executed, the Contractor will be furnished six (6) copies of the Specifications and Contract Drawings without charge.

78. SHOP DRAWINGS, CATALOG CUTS AND SAMPLES

The Contractor shall specifically prepare for this Contract all Shop Drawings which may be required in addition to the Contract Drawings or in addition to any other drawings which the Engineer may issue in supplementing the Contract Drawings.

The specific requirements elsewhere set forth in the Specifications for furnishing Shop Drawings, Catalog Cuts and samples for any particular portion of the Contract shall not limit the obligation of the Contractor to furnish 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 Shop Drawings, Catalog Cuts, pages of calculations and samples within 30 days after receipt by the Contractor of the acceptance of the 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 Shop Drawing submissions, or for other action if so indicated by the Engineer, six copies, unless otherwise requested, of all Shop Drawings which will bear a specific written indication that the Contractor has reviewed the submission for conformance to the requirements of the Contract Drawings and Specifications.

The Port 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 Contract Drawing numbers or Specification section numbers for which the item pertains. The data shown on the 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 Contract 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 Contract 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 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 Shop Drawing or Catalog Cut with other 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 Shop Drawing, Catalog Cut and sample from the requirements of the Contract 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 Shop Drawings, Catalog Cuts or samples shall not relieve the Contractor from responsibility for any variation from the requirements of the Contract 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 Shop Drawing, Catalog Cut or sample approval. Approval of Shop Drawings, Catalog Cuts and samples which are inconsistent with the requirements of the Contract 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 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 Shop Drawings prepared by the Contractor shall be as follows: 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. 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 border lines and one and one-half inch from the left border line. The inside borders on these drawings shall be 20 inches by 31 inches. A title block shall be shown on the right side of the drawing adjacent to the inside border identifying the Contractor's Name, Contract Title, Contract Number, cross-referenced Contract 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 Shop Drawing, Catalog Cut or sample for conformance to the design information and materials shown on the Contract 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 Contract 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 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 Shop Drawing prints, the Engineer shall approve or not approve the same or require corrections or additions to be made thereon. When a 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 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 shop 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 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 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 Shop Drawings, which have been revised by field changes.

The Contractor shall mark-up the approved and approved as noted 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 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 Contract 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.

79. SUBSTITUTION

Where a proprietary item or make is specified or mentioned herein or called for or mentioned on the Contract 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 Contract 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 Contract, 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 therefor.

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 Contract 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 Contract 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 Contract 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.

80. 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 Contract 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 Contract 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 Chief 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 Contract Drawings, whether specific or by implication, shall mean for such standards which are part of the building code in effect for Work of this Contract, 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 opening of Proposals upon the present Contract 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 opening Proposals upon the present Contract.

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 Contract Drawings or Specifications.

In case of a discrepancy between a description or requirement in the Contract 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 Contract 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 Contract Drawings contain confidential information which is disclosed only to enable this Contract 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 Contract so requires, furnish said information to others for the purpose of engaging or informing subcontractors and materialmen.

If, in accordance with this Contract, the Contractor furnishes research, development or consultative services in connection with the performance of the Contract 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 Contract 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 Contract.

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 Contract 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.

81. 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 Shop Drawings are to be prepared, a brief description of the material and the statement "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 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.

82. 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.

83. NO RELEASE OF CONTRACTOR

Any provision of this Contract 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 Contract 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 Contract in accordance with the Contract Drawings and Specifications or from any duty, obligation or liability imposed upon him by the Contract or from responsibility for injuries to persons or damage to property.

84. ERRORS AND DISCREPANCIES

If, in the performance of the Contract, the Contractor discovers any errors or omissions in the Contract 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 Contract unless and until approved and accepted.

85. 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 Contract 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 Contract 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 Form of Contract clause entitled "Compensation For Extra Work".

86. 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 Contract, 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 Contract. 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 Contract.

If any claim is made by any third person against the Contractor or any subcontractor on account 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.

87. SAFETY PROVISIONS

In the performance of the Contract, 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 Contract 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 Contract.

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 Contract.

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 such time as 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 Contract, 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 general 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 Contract 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.

88. 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 Contract unless the material is deemed acceptable by the Engineer for on-site re-use or recycling in accordance with the technical requirements of this Contract and remains at the Work site. The Contractor shall transport to recycling facilities or re-use and recycle on-site for this Contract, 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 Contract:

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 Contract 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 Contract or, if shown on the Contract 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 Contract as applicable.

All removals shall be completed promptly upon the completion of construction under this Contract.

89. 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 Contract 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 Contract 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 Contract 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 Contract 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 effectuate 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. Contract 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 Contract, 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. Contract 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.

90. 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 to be a substitute for the notices, time slips, memoranda or other data required under the clauses of the Form of Contract relating to compensation for Extra Work.

91. 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 Contract and the performance thereof and those engaged therein if said Contract were being performed for a private corporation, except where stricter requirements are contained in the Specifications or Contract 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 Contract in the United States are legally present in the United States and authorized to work by means of the federally required I-9 program.

92. 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.

93. 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 Contract and a set of the Contract 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.

94. 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 Contract. 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 Contract.

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.

95. TEMPORARY STRUCTURES

Unless otherwise provided in this Contract, 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 Contract, whether or not of the type enumerated in the Specifications or on the Contract Drawings, including those which would be required by law or regulation if this Contract 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 Contract 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 Contract 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 Contract, 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 Contract.

Temporary structures shall be painted with an approved dark color paint and shall be repainted whenever necessary during the period that the Contract is being performed. Upon completion of all Work under this Contract, the temporary structures shall be removed from the construction site.

96. 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.

97. 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.

98. 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 Contract 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.

99. UTILITY DATA COLLECTION

In order to assist the Authority with the collection of as-built utility data, notify the Engineer within 48 hours prior to the covering of all underground structures, piping, conduit, cable or duct banks.

Do not build-in, backfill, fill over, around, or in any way cover underground structures, piping, conduit, cable or duct banks until given notice to proceed by the Engineer.

Nothing contained herein shall relieve the Contractor from performing the Work in accordance with the Contract Drawings and Specifications nor release the Contractor from any obligations under or upon this Contract.

100. REQUIREMENTS FOR CRANES AND DERRICKS

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 (x) 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.

101. TEMPORARY UTILITY SERVICES

Operate and maintain temporary services and facilities in a safe and efficient manner. Modify as required throughout progress of the Contract, 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 for securing, and pay all costs for heat, light, power, water, and other services which may be required for the performance of the Contract.

102. 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.

103. PROGRESS SCHEDULE

A. Within fifteen calendar days after acceptance of the Contractor's Proposal, the Contractor shall prepare and submit a progress schedule for the approval of the Engineer. The progress schedule shall show the dates for the commencement and completion of the items of work of the Contract and all Contract Milestones. The Contractor shall revise and resubmit the progress schedule until approved by the Engineer.

B. After the approval of such progress schedule, at least once a month or more frequently as directed by the Engineer, the Contractor shall update the progress schedule showing for each such item of work of the Contract the actual start dates, physical percent complete, expected completion dates (for activities in progress), a brief narrative explaining how the planned completion will be achieved, and the actual completion dates. No logic or duration changes shall be made therein without the written approval of the Engineer.

C. Approval of any progress schedule shall not relieve the Contractor of his obligation to complete the work by the time(s) required in the Contract and in accordance with all other Contract provisions, even though the schedule approved may be inconsistent with such completion.

D. 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 anytime it is likely that the Work may not be completed by the time(s) required in the Contract 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 required to ensure the completion of the various operations within the time(s) allotted therefore in the approved schedule or by the Contract completion time(s).

E. In addition to the Authority's other rights, should the Contractor fail to comply with any provision of this Section, the Engineer 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 it deems necessary or desirable, all as more fully provided in the clause of the Form of Contract entitled "Withholding of Payments".

104. ANALYSIS OF BID

Within fifteen calendar days after acceptance of the Proposal, the Contractor shall prepare a detailed analysis of bid on forms furnished by the Authority with all of the spaces filled in without exception, and containing such information as the Engineer may require for each of the items enumerated in such form.

105. AIRPORT OPERATIONS AND CONDITIONS

A. General:

1.) Place "Water" identification signs on all water vehicles or water tanks, which are to be used for the transportation or storage of water during the course of the Work at the airport.

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.) Do not place temporary structures or store materials or equipment required in the performance of the Work within any of the buildings on the airport without specific prior approval of the Engineer.

4.) Do not store petroleum or combustible products, or any other flammable materials, within any buildings or in any part of the airport except as designated by the Engineer.

5.) Do not burn or bury debris of any type on Authority property, or wash waste materials down sewers or into waterways.

6.) Maintain haul routes in a satisfactory condition, and repair damage to such routes, resulting from the Contractor's operations. Unless otherwise approved by the Engineer, clean haul routes each work period and remove earth or other materials, which fall or are otherwise placed on such routes during the performance of Work.

7.) Do not park vehicles on any grass or unauthorized area. Free parking of vehicles in any of the airport parking lots will not be permitted.

8.) Protect against damaging existing lights, pavement, curbs and other fixed items that are to remain. Such items, which are damaged, either directly or indirectly, by the Contractor during the performance of the Contract, whether negligently or not, shall be restored to the condition that existed prior to such damage.

9.) 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 may stain, soil or damage property or injure persons.

10.) 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 U.S. Occupational Health and Safety Administration (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.

11.) Remove on an on-going basis, and before the end of each work period, all paving materials left in the grass shoulder areas, in manholes, catch basins or handholes as a result of the cleaning of the Contractor's equipment.

12.) Food or food related debris shall not to be left on or disposed of on the construction site.

13.) Equipment, vehicles and materials, not being utilized in the current work period shall be removed and stored in the area designated by the Engineer for such purpose, or if there is no such area designated then such items shall be removed from the airport.

B. Construction Site Conditions at Air Operations Areas:

1.) "Air Operations Area" (AOA) means that portion of the airport designed and used for landing, takeoff, parking or surface maneuvering of aircraft, as well as the Restricted Service Roads (RSR).

2.) During the time that the Contractor is performing the Work, the Air Operations Areas will remain in use by aircraft. To the extent feasible and convenient in the opinion of the Engineer, and to the extent permitted by the Federal Aviation Administration (FAA), the use by aircraft of aprons, runways and taxiways adjacent to areas where the Contractor is working will be so scheduled as to reduce disturbance to the Contractor's operations. However, during these periods aircraft may be taxiing through and around the construction areas. In order to minimize conflicts between aircraft operations and construction operations, the Contractor shall proceed with performance of the Work in a safe manner and in accordance with the requirements hereinafter stipulated, at all times coordinating operations with the Engineer, however no representation or guarantee is made that the disturbance can or will be reduced. Also, it is anticipated but not guaranteed that certain aprons, runways, taxiways, and taxilanes will be shut down to aircraft operations for limited periods at the times required by the Contractor. In any event, however, aircraft operations shall always have priority over any and all of the Contractor's operations.

3.) Should the Contractor be specifically directed to suspend operations or be directed as hereinafter described, and if solely because of such direction 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.

a. Should aprons, runways, taxiways or taxilanes be required for the use of aircraft and should the Engineer solely deem the Contractor to be too close to the portion used by aircraft, the Contractor may be directed to suspend operations, remove personnel, plant, equipment and materials to a safe distance and stand by until the aprons, runways, taxiways or taxilanes are no longer required for use by aircraft, at which time the Contractor shall immediately resume operations in the vacated areas when so directed by the Engineer.

4.) The Contractor, subcontractors, materialmen, deliveryman or other persons over whom the Contractor has control shall not enter upon or allow any plant or material to be located upon any part of the Air Operations Areas without specific prior approval of the Engineer.

5.) The Contractor, employees of the Contractor, subcontractors, materialmen and all other persons over whom the Contractor has control shall comply with the following:

a. Clearly display on their person an identification tag indicating their name and company before entry upon any Air Operations Area. The Contractor shall provide tags and holders for such identification. The Contractor is advised that security requirements are subject to change and will be addressed further in the pre-construction meeting.

b. Do not enter upon any Air Operations Area unless accompanied by a representative of the Authority designated by the Engineer to escort the Contractor and equipment to and from the point or points of operation within the limits of such areas, and do not traverse back and forth between points within such areas unless accompanied by said Authority representative.

c. Do not enter or remain upon or allow any plant or materials to be brought or to remain upon any part of the Air Operations Areas if in the opinion of the Engineer they would create a hazard to aircraft or airport operations.

d. Smoking is not permitted in the Air Operations Area.

6.) No two adjacent taxiways shall be closed at the same time unless otherwise directed by the Engineer.

7.) Materials tracked onto movement areas shall be removed continuously during each work period.

a. "Movement Areas" means areas within the AOA comprised of the runways, taxiways and other areas of the airport that are used for taxiing or hover taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and aircraft parking area. The Air Traffic Control Tower or Ground Control typically controls these areas.

8.) At the end of each work period, remove plant, materials, equipment and any other obstructions away from the work area to a non-AOA site as designated by the Engineer.

9.) Information on Visual Flight Rules (VFR) or Instrument Flight Rules (IFR) weather conditions or Category II operations at the airport is available to the Contractor at the Operations Supervisor's Office of the airport. Category II operations only apply at EWR and JFK.

At the following Air Operations Area locations, conform to the following requirements:

a. Approach to Runways: When a runway is active, keep obstructions due to Work below or outside the VFR and IFR approach surfaces.

(i) "Obstruction" shall be defined as any obstacle exceeding the obstruction standards specified by 14 CFR Part 77, subpart C.

b. Adjacent to Runways:

(i) When a runway is active, no construction activities shall be permitted within 250-feet from the runway centerline. Place barricades in accordance with the Section herein entitled "Barricades."

(ii) During VFR weather conditions, obstruction mark all construction equipment, material, or debris penetrating a surface originating along a line 250-feet from the runway centerline at runway elevation, and extending upward and away from the runway at a slope of one foot vertically for every seven feet horizontally, in accordance with the paragraph herein entitled "Obstruction Marking and Lighting". In addition, all penetrations above runway elevation between 200-feet and 250-feet from the runway centerline shall be obstruction lighted with omni-directional lenses.

(iii) During IFR weather conditions; in addition to obstruction marking, provide obstruction lights on fixed obstructions, construction equipment, materials, or debris penetrating a surface originating along a line 500-feet from the runway centerline at runway elevations, and extending upward and away from the runway at a slope of one foot vertically for every seven feet horizontally. For such lighting, provide, locate and operate in accordance with the paragraph herein entitled "Obstruction Marking and Lighting". In addition, all penetrations above runway elevation between 250-feet and 500-feet from the runway centerline shall be obstruction lighted with omni-directional lenses.

(iv) When Category II landing operations are being conducted on runways during IFR weather conditions, as defined by Federal Aviation Administration United States Terminal Procedures, no construction operations, equipment, materials or debris shall be within the Category II Touchdown Area, the Missed Approach Area and Transitional Surfaces as hereinafter defined.

(a.) "Touchdown Area" means an area longitudinally centered on the runway centerline, extending from a point 200-feet in advance of the runway approach threshold (normal or displaced) for a distance of 3,200-feet in the direction of landing, and having a total width of 1,000-feet.

i. "Threshold" is defined as the beginning of that portion of the runway available for landing. In some instances, the landing threshold may be displaced.

ii. "Displaced Threshold" is the portion of pavement behind a threshold that may be available for takeoffs in either direction or landing from the opposite direction.

(b.) "Missed Approach Area" means an area, which begins at the end of the touchdown area at the height of the runway and extends upward at a slope of one foot vertically for each 40-feet horizontally. In plan view, it has the same width as the touchdown area at the point of beginning with the width increasing uniformly to 3,100-feet at 6,000-feet from the point of beginning.

(c.) "Transitional Surfaces" means surfaces sloped at 7:1 extending outward and upward from the edges of the touchdown area or the missed approach area to a height of 150-feet above the elevation of the runway centerline or the end of the Touchdown Area.

(v) Perform Work so that when the runway is being made available for aircraft operations, the maximum grade difference in any paved surface within the Safety Area shall not exceed 1 inch on runway surface and 3 inches within any part of the Safety Area.

(a.) "Runway Safety Area" means surfaces within 250-feet measured from and parallel to the centerline of the runway, and extending 1,000-feet beyond and parallel to the end of the runway. It is a defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway, in accordance with AC 150/5300-13.

(vi) On active runways, open excavations, debris, construction equipment, personnel or materials are not permitted within the Safety Area.

(a.) "Open Excavation" means any trench in unpaved areas exceeding 6" in width or 3" in depth; and in paved areas, a drop of 3" or greater within a 6" horizontal measure.

(vii) Do not permit material capable of being dislodged by aircraft blast within 250-feet from the runway centerline. Remove or stabilize such loose materials in this area as approved by the Engineer.

c. Adjacent to Taxiways (T/W) or Taxilanes (T/L):

(i) Neither construction activity nor personnel are permitted within the Object Free Area (OFA),

(a.) "Object Free Area" means an area on the ground centered on the runway, taxiway, or taxilane centerline provided to enhance safety of aircraft operations by having the area free of objects except for those objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.

(ii) Perform Work within the specified limits shown in Table I below only when the taxiway/taxilane is closed to air operations.

(iii) Open excavations as close as the edge of the taxiway are permitted provided they are delineated by placing obstruction marked and lighted collapsible barricades, in accordance with "Barricades" hereof, along the edge of the taxiway.

(iv) Do not permit loose material capable of being dislodged by aircraft blast and becoming a hazard within the Taxiway Safety Area (TSA), shown in Table 1 when the T/W or T/L is active. Remove or stabilize such loose materials in this area as approved by the Engineer.

(a.) "Taxiway Safety Area" means a surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway.

(v) Waste and loose material shall not be placed in active movement areas.

Table 1					
	TEB	LGA	EWR	SWF	JFK
T/W OFA	186 feet	259-feet	320-feet	386-feet	386-feet
(From centerline)	(93 feet)	(129.5-feet)	(160-feet)	(193-feet)	(193-feet)
T SA	118 feet	171-feet	214-feet	262-feet	262-feet
(From centerline)	(59 feet)	(85.5-feet)	(107-feet)	(131-feet)	(131-feet)
T/L OFA	162 feet	225-feet	276-feet	334-feet	334-feet
(From centerline)	(81 feet)	(112.5-feet)	(138-feet)	(167-feet)	(167-feet)

C. Construction Site Conditions Outside Airport Operations Areas:

1.) During the time the Contractor is performing the Work, it may at times be necessary because of emergency or abnormal traffic conditions to suspend the Contractor's operations, or to postpone the time at which traffic lanes, parking or other areas become available for performance of Work. Should the Contractor be specifically directed to suspend operations in traffic lanes, parking or other areas, and remove personnel, and obstructing plant, equipment and materials from such lanes or areas, or should such lanes or areas not be available by the times specified, and if solely because of such suspension of operations or late availability of traffic lanes, parking, or other areas 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.) Limit the maximum height of construction equipment to 25-feet unless otherwise shown on the Contract Drawings or expressly approved by the Engineer, obstruction light in accordance with the paragraph herein entitled "Obstruction Marking and Lighting" and obstruction mark and light that portion of equipment which exceeds 25-feet in height in accordance with FAA Advisory Circular 70/7460-1K Current Revision.

3.) Perform such duties as the Engineer may direct and as may be necessary in the opinion of the Engineer for the rerouting of traffic in the performance of the Work.

4.) Restrict smoking to areas designated by the Engineer for this purpose.

D. Obstruction Marking and Lighting:

1.) Material, temporary construction and facilities for obstruction marking and lighting constitute temporary facilities that are and shall remain the property of the Contractor unless otherwise shown on the Contract Drawings or specifically directed by the Engineer to be turned over to the Authority.

2.) Provide new materials, or undamaged previously used materials in serviceable condition conforming to the requirements specified herein.

3.) In Air Operations Areas or airport areas where obstructions occur within navigable airspace provide obstruction lights, Model UF-60-7-75A-PE-BI as manufactured by Julian A. McDermott Corp., Ridgewood, N.Y., or approved equal.

a. Unless otherwise shown on the Contract Drawings, mount an obstruction light on the highest point of construction equipment or obstruction.

b. Ensure that obstruction lights are maintained in proper operating condition throughout Work of this Contract, and operate at night seven (7) days a week and during IFR weather conditions.

(i) "Night" means the time between the end of evening civil twilight, and the beginning of morning civil twilight, as published in the American Air Almanac, converted to local time.

E. Night Illumination of Paving and Surfacing Operations:

1.) Paving and surfacing operations conducted at Night shall, in addition to the requirements of the paragraph entitled "Obstruction Marking and Lighting" hereof, conform to the following requirements:

a. In Air Operations Areas, locate and shield night illumination to prevent interference with air traffic control or impairment of safe aeronautical operations.

b. Outside Air Operations Areas, locate and shield night illumination to prevent interference with motorists and pedestrians or impairment of traffic and pedestrian movement.

2.) Illumination of Area of Work: Provide and operate portable floodlight units similar and equal to "Maxi-Lite 695" as manufactured by Allmand Brothers Inc., Holdredge, NE.

3.) Equipment Illumination: Provide and operate electric beam lights with a capacity of not less than 3,000 watts affixed to paving machines, rollers, distribution trucks and other vehicles to provide not less than twenty foot candles of illumination on the following horizontal surfaces:

a. During operation of paving machines, an area 12-feet by 12-feet immediately behind the machine;

b. During operation of rolling equipment, an area 12-feet wide by 30-feet long immediately in front of and behind the machine; and

c. During application of tack coat, an area 12-feet by 12-feet on the area being coated.

F. Existing Airport Lights in Air Operations Areas:

1.) Various types of lights are installed in the areas in which the Work is to be performed. Prior to the commencement of operations, note the exact number and location of lights in such areas and provide adequate protection therefor. Any light fixture which is damaged by the Contractor, whether negligently or not, during the performance of the Work shall be repaired or replaced in an approved manner before the end of each work period. Should the Contractor not repair or replace any such damaged lights by the end of each work period, the Authority will undertake such restoration and the cost thereof, as determined by the Engineer, will be deducted from the Contractor's compensation hereunder. The number and locations of lights shown on the Contract Drawings are approximate only and the Authority does not guarantee their accuracy.

G. Subsurface Structures:

1.) Attention is called to the fact that some of the manholes, chambers or other subsurface structures, in which Work is to be performed under this Contract, contain energized high and low voltage cables, and that various insects, snakes, spiders and rodents may be present.

2.) Apply to the Engineer in writing at least 24-hours in advance of the time of: a. entry into existing manholes, handholes, or other subsurface structure or, b. interruption or disruption of utility services. Perform interruptions of electrical services, and entry into subsurface structures in accordance with the provisions of the Section hereof entitled "PERMIT AND REQUIREMENTS FOR ELECTRICAL DISTRIBUTION WORK". Service shall not be cut off on existing installations until all operations have been completed except for connections or reconnections to power source of wiring to be installed under this Contract. Notice to the Engineer shall specifically state which utilities will be affected and the time and the duration of such interruption. Keep all such interruptions to a minimum. No interruption of utility services shall be made without approval of the Engineer whose decision in all cases shall be final.

3.) Test each subsurface structure for combustible, toxic or otherwise harmful, gases or vapors in accordance with NFPA No. 328 "Recommended Practice for the Control of Flammable and Combustible Liquids and Gases in Manholes, Sewers and Similar Underground Structures" before permitting personnel to enter. If such gases or vapors are detected, ventilate the subsurface structure until the gases have dissipated to an acceptable level as determined by the OSHA Air Quality regulations prior to entry.

4.) Manholes and other subsurface structures in which Work is to be performed under this Contract may contain water. Remove water encountered in such locations and keep the floors of such locations free of standing water at all times workers are in such locations.

5.) Verify the exact locations of underground utilities and subsurface structures in the field, and assume all risks of whatever nature, if any, as to the locations of such utilities and structures.

H. No requirement of or omission to require any precautions under this Contract shall be deemed to limit or impair any responsibility or obligation assumed by the Contractor under or in connection with this Contract 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.

106. PERMIT AND REQUIREMENTS FOR ELECTRICAL DISTRIBUTION WORK

A. Notify the Engineer at least 24 hours prior to the commencement of operations at the construction site which in any way may affect existing electrical circuits or require entry into any electrical manhole at the airport, and obtain from the Engineer, Authority Form PA 2497A entitled, "Electrical Work Permit". Execute such form in triplicate each morning prior to commencement of Work on existing electrical circuits or entry into manholes. The Authority will issue this form to the Contractor without payment of a fee.

B. Allow sufficient time for loads to be transferred to other circuits from the circuits upon which Work is to be performed and for lock out of circuits which are within existing load centers. Comply with other requirements contained on the back of the "Electrical Work Permit" insofar as they are applicable to the Work to be performed under this Contract. In any event, reconnect and place back in operation electrical circuits activating parking field, roadway, runway operations, apron and taxiway lights prior to the close of operations on each day, and in any event before sunset of each day. Overtime operations or premium time required to be paid by the Contractor for or in connection with this numbered Section shall be borne by the Contractor without separate or additional compensation therefor.

107. AIRPORT CONSTRUCTION SAFETY REQUIREMENTS

A. General Safety Requirements:

1.) The Contractor shall adhere to all safety precautions described in the current edition of the U. S. Department, Federal Aviation Administration Advisory Circular AC 150/5370-2, current edition, Operational Safety on Airports During Construction. The Contractor is to strictly conduct all activities as not to violate safety standards contained in said Advisory Circular.

2.) Throughout the construction period, the following safety and operational practices shall be followed:

a. Operational safety shall be a standing agenda item during work progress meetings throughout the duration of the Contract.

b. The Contractor shall perform onsite inspections of the construction site throughout the duration of the Contract, with immediate remedy of any safety deficiencies.

c. The Contractor, employees of the Contractor, subcontractors, materialmen or any other support workers over whom the Contractor has control, who are required to enter the Aircraft Operations Area will be required to wear a reflective safety vest, day or night.

d. Construction that is within the safety area of an active runway, taxiway, or apron must be performed when the runway, taxiway, or apron is closed or use-restricted and initiated only with prior permission from the Engineer.

e. The Engineer may order the Contractor to suspend operations and move personnel, equipment, and materials to a safe location at any time he deems it necessary.

B. Maintenance of Construction Site:

1.) Inspect all construction and storage areas as often as necessary to be aware of conditions.

2.) Promptly take all actions necessary to prevent or remedy any unsafe or potentially unsafe conditions as soon as they are discovered.

3.) Provide continuous clean-up operations including a mechanical sweeper for all haul operations or other related traffic to and from the construction site.

4.) The Contractor, at the direction of the Engineer, may be required to provide and maintain an emergency response route through the work area, for Airport Emergency Vehicles. Construction vehicles accessing this road will give way to emergency vehicles at all times. Parking or staging of any construction equipment or stockpiling of materials blocking the road or access to the road will not be permitted.

C. Approach Clearance to Runways:

1.) Runway thresholds must provide an unobstructed approach surface over equipment and materials. (Refer to Contract Drawings for construction clearance surfaces.)

2.) Ensure all personnel, materials, and/or equipment are clear of the applicable runway end slope criteria (Refer to Contract Drawings for construction clearance surfaces.)

D. Runway and Taxiway Safety Area (RSA and TSA):

1.) Limit construction to outside of the approved RSA and TSA, as defined elsewhere in this section—unless the runway is closed or restricted to aircraft operations, requiring a lesser standard RSA that is equal to the RSA available during construction.

2.) Procedures for Protecting Runway Edges:

a. Limit construction to no closer than 250 feet from the runway centerline—unless the runway is closed to aircraft operations.

b. Personnel, material, and/or equipment shall not penetrate the Obstacle Free Zone (OFZ) as defined in the U. S. Department, Federal Aviation Administration Advisory Circular AC 150/5300-13, current edition, Airport Design, Paragraph 306, "Obstacle Free Zone"

(i) "Obstacle Free Zone" means the airspace below 150 feet above the established airport elevation and along the runway and extended runway centerline that is required to be clear of all objects, except for frangible visual Navaids that need to be located in the OFZ because of their function, in order to provide clearance protection for aircraft landing or taking off from the runway and for missed approaches.

3.) Procedures for Protecting Runway Ends.

a. Maintain the RSA as it existed before construction activity—unless the runway is closed to aircraft operations.

b. Prevent personnel, material, and/or equipment, from penetrating the OFZ.

E. Closed Runways:

1.) For work that necessitates the closure of a runway or runways, the Contractor shall furnish and install and subsequently remove or relocate a lighted "X" as per FAA Advisory Circular 150/5345-55 "Lighted Visual Aid to Indicate Temporary Runway Closure", at each end of the closed runway on or near each of the runway designation numbers as directed by the Engineer. The Contractor shall be responsible for the storage, mobilization, and demobilization of the lighted "X's" for each runway closure period and they remain the property of the Contractor unless otherwise noted on the Contract Drawings.

2.) The lighted "X's" shall be the Sweepster Lighted Runway Closure Marker Model LXD06, or approved equal conforming to NTSB Safety Recommendation A-03-05 and 06.

F. Barricades

1.) Use barricades to indicate construction locations in non-movement areas, which no part of an aircraft may enter. Barricades may be of different shapes and made from various materials, including railroad ties, sawhorses, jersey barriers, or barrels and shall be marked with diagonal, alternating orange and white stripes. During reduced visibility or night hours, supplement the barricades with red lights, flashing or steady burning, meeting the luminance requirements of the State Highway Department.

a. "Non-movement areas" are areas within the AOA not controlled by the Air Traffic Control Tower or Ground Control. These areas are typically aircraft ramp and parking areas as well as vehicular service roads.

2.) Indicate construction locations in movement areas in which aircraft may enter with orange traffic cones, red lights (either flashing or steady burning), and collapsible barricades marked with diagonal, alternating orange and white stripes. All barricades, temporary markers, and other objects left in the safety area associated with the open runway, taxiway, and taxi lanes must be as low as possible to the ground, of low mass and easily collapsible upon contact with an aircraft or any of its components. The barricade shall be properly weighted or attached to the surface to prevent displacement by prop wash, jet blast, wing vortex or other surface wind currents. If affixed to the surface, they must be frangible at grade level or as low as possible, not to exceed 3-inches in height. Barricades shall be Neubert Aero Corp., Model NAC-PC2410 or Model NAC-PC9642, Multi-Barrier Safety Barricade Corp., Model AR-10X96, YODOCK APC or an approved equal.

3.) Barricades shall be spaced no greater than 10 feet apart.

G. Temporary Lighting and Markings

1.) The Contractor will be required to provide and maintain temporary pavement markings, remove existing markings and remove temporary markings, all in accordance with the Contract Drawings and Specifications.

H. Airport Air Operations Area Access and Control

1.) The Contractor, staff, employees, subcontractors, delivery and haul operators, or anyone required to enter the Air Operations Area related to the Contract Work, shall produce valid government issued photo identification.

2.) The Contractor shall supply daily lists of all workers as well as list of all planned or anticipated deliveries. All vehicle operators must have, in their possession and produce on request, a valid drivers license.

3.) Individual Contractor Identification is required for each worker. Identification badges are to be displayed on their outermost garment at all times. The Contractor Identification Badge shall be a minimum of 2" x 2" in size and include the following:

a. Minimum 1" x 1" current color photo of the individual

b. Laminated

c. Company name (and/or subcontractor where applicable)

d. Person's name

e. Unique badge number

f. Expiration date in accordance with the Contract

I. Vehicle Operation Marking and Control

1.) All Contractor vehicles (including equipment, subcontractors, delivery vehicles, etc.) that must enter the Air Operations Area for the required Work of the Contract, must be escorted and properly identified. To operate during daylight hours, construction equipment must have a 3' x 3' orange and white "Airfield Vehicle" identification flag (ANNIN & Co. NYL-GLO #319733 or approved equivalent) or flashing beacon. Any vehicle operating on the movement areas during hours of darkness or reduced visibility must be equipped with a flashing amber beacon light. In addition, vehicles must display permanently affixed company identification media acceptable to the Authority.

2.) Neither the Contractor nor any construction support personnel will be permitted access to the AOA or work site in a private or personal vehicle. There is no employee parking on the Air Operations Areas.

3.) At Air Operations Areas provide obstruction marking flags equipped with approved stiffeners as follows:

a. For Marking of Equipment, Material and Debris: 3-feet by 3-feet colored orange and white in a checkerboard pattern, mounted on a staff of not less than 8-feet in length. Maintain flag in a vertical position at all times and display on each fixed obstruction, truck or other piece of equipment, and at each separate group of workers and material or debris stack.

J. Navigational Aids

1.) The Contractor shall not conduct any construction activity within navigational aid critical areas or affect the visual signal, transmitted signal or power supply of any navigational aid. Navigational aid restricted areas affected by the area of work are depicted on Contract Drawings. Work in these restricted areas is subject to availability based on runway configuration and weather conditions at the time, and may be cancelled by the Engineer without advance warning based on the aforementioned conditions. If the Contractor is specifically directed by the Engineer to suspend his operations in these areas, the Contractor will be compensated as stipulated in the provisions of the Contract concerning compensation for emergency delays.

2.) Navigational aids include instrument landing system components and very high-frequency omni-directional range, airport surveillance radar.

3.) Do not operate ultrasonic, X-ray, radio-type transmitter, magnetic or similar electro-magnetic devices, which affect or may affect the operation of airport navigational aids, unless the Engineer has granted specific prior approval for their operation or use.

K. Limitations on Construction

1.) The Contractor shall obtain Authority permits for open-flame welding or torch cutting operations and electrical power shut-downs prior to start of the Work.

2.) All site storage of supplies and equipment requires approval by the Engineer. All site storage must be in containers and must have company name and 24 hour contact telephone number clearly displayed.

L. Radio Communications

1.) The Contractor is not required to have two-way radio communications with the Engineer.

2.) The Contractor is prohibited from having any communications, including two-way radio, with the Airport Air Traffic Control Tower. All movements within the AOA shall be escorted by the Facility Staff.

108. ACCESS TO CUSTOMS SECURITY AREAS

A. The Contractor shall at his own cost provide to each of his employees and cause to be provided to each employee of his subcontractors, materialmen and others performing services for or on behalf of the Contractor hereunder and who are required to enter a Customs Security Area, a customs identification security card, strip or seal meeting the requirements of the U.S. Customs and Border Protection, Department of Homeland Security (U.S. Customs). See 19 Code of Federal Regulations Section 122.14.

B. The Contractor shall also at his own cost post a bond with U.S. Customs in an amount determined by the U.S. Customs Security Area Director assuring compliance with Customs Regulations applicable to Customs Security Areas. See 19 Code of Federal Regulations Part 113, Appendix A.

C. Under U.S. Customs Regulations, each violation of a Customs Security Area Regulation subjects the Contractor to liquidated damages of $1,000 per violation, which may be assessed by U.S. Customs against the bond posted by the Contractor with U.S. Customs.

D. The Contractor shall advise each of his employees, and cause to be advised each of the employees of subcontractors, materialmen, and others performing services for or on behalf of the Contractor hereunder, of the provisions of the U.S. Customs Regulations with regard to Security Areas and shall require them to comply therewith. Violations of U.S. Customs Regulations giving rise to the imposition of liquidated damages by U.S. Customs include, but are not limited to:

1.) Failure to advise employees of provisions of Customs Regulations relative to Security Areas or to require them to familiarize themselves with said provisions or to comply therewith;

2.) Failure to perform background checks;

3.) Failure to return Customs approved identification card, strip, or seal;

4.) Failure to notify Customs that employee(s) no longer require access to the Customs Security Area;

5.) Entry into Customs Security Area without Customs approved identification card, strip, or seal;

6.) Failure to openly display or produce, upon demand, Customs approved identification card, strip, or seal;

7.) Entry into a Customs security area for a purpose other than to perform duties authorized by Customs;

8.) All other violations that in the judgment of the Area Director endanger the revenue or the security of the area.

E. Further information concerning U.S. Customs Security Area Requirements shall be obtained from the U.S. Customs and Border Protection Hologram Office, at 718-553-1653 for New York facilities, and at 973-565-8000 x6581 for New Jersey facilities.

109. HOURS OF WORK AND CONSTRUCTION STAGING

A. Hours of Work

1.) The Contractor will be permitted to perform the Work of this Contract without restrictions as to Work hours with the following exceptions:

a. Stage IIA work shall be performed only during the following hours:

From 9:00PM Monday to 5:00AM Tuesday

From 9:00PM Tuesday to 5:00AM Wednesday

From 9:00PM Wednesday to 5:00AM Thursday

From 9:00PM Thursday to 5:00AM Friday

From 9:00PM Friday to 5:00AM Saturday

From 9:00PM Saturday to 5:00AM Sunday

From 9:00PM Sunday to 5:00AM Monday

2.) The Contractor shall submit to the Engineer, at least one week in advance, his scheduled hours of Work for each week.

3.) Do not perform Work at the construction site on a Federal legal holiday or a holiday of the state(s) in which Work is being performed, unless otherwise permitted by the Engineer.

B. Construction Staging

1.) For Construction Stages 1 through 3, see Contract Drawings MT002 through MT005.

2.) The following Construction Stages shall be performed sequentially beginning with Stage 1. Complete all Work in each Stage prior to commencing Work in succeeding Stages, except as noted below, and in accordance with the aforementioned hours of Work and the conditions set forth below.

a. Perform all Work in Stage 1 as shown on Contract Drawing MT002 within thirty (30) consecutive calendar days of commencing Work, subject to the hours of Work above.

b. Perform all Work in Stage 2 as shown on Contract Drawing MT003 within thirty (30) consecutive calendar days of commencing Work, subject to the hours of Work above.

c. Perform all Work in Stage 2A as shown on Contract Drawing MT004 within thirty (30) consecutive calendar days of commencing Work in Stage 2, subject to the hours of Work above.

d. Perform all Work in Stage 3 as shown on Contract Drawing MT005 within thirty (30) consecutive calendar days of commencing Work, subject to the hours of Work above.

e. Perform all Work requiring full roadway closure after Labor Day, September 3, 2012.

110. 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 between 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 Work on the Roadway is being done by the Contractor.

B. General Requirements

Conform to requirements of this numbered Section, the Contract 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 Contract Drawings and/or sketches to be furnished to the Contractor.

6.) In the event of a technical conflict between a requirement in the publications referenced herein and the Specifications and Contract Drawings, the requirements of the Specifications and Contract 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 Contract Drawings. All said equipment/devices shall remain the property of the Contractor, unless otherwise shown on the Contract 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 Contract Drawings:

a. Portable Changeable Message Signs: Trailer mounted FASU.

b. Plastic Delineator Drums.

c. Type III Barricades.

d. Precast Concrete Barrier - Type 1.

e. 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 Contract Drawings.

(i) Temporary Sign Supports: Wood conforming to requirements of Specification Section 02850.

(ii) Portable Sign Supports: "Windmaster" as manufactured by Marketing Displays, Inc., Farmington Hills, MI.; or approved equal;

f. Temporary Timber Curbs and Concrete Barriers: Conform to the Contract Drawings and Specification Section 02842 "Temporary Traffic Barriers";

g. 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;

h. Temporary Reflectorized Pavement Marking

(i) On Finished Wearing Surfaces: New, unused removable temporary marking tape conforming to the requirements of Specifications Section 02582 "Preformed Removable Retro-Reflective Pavement Marking Tape" shall be furnished, applied and maintained. For removal see paragraph E.3.d.

(ii) On Roadway Surfaces to be Subsequently Resurfaced or Replaced Under This Contract: An approved traffic paint with glass beads applied at the rate of 1.5 pounds per 100 linear feet per 4-inch wide line, unless otherwise shown on the Contract Drawings. For removal see paragraph E.3.d.

i. When required by paragraph E.6 or utilized by the Contractor in paragraph E.7 herein, provide bituminous premixed asphalt concrete cold patch material.

4.) Submit the following to the Engineer in accordance with Division 1 - GENERAL PROVISIONS entitled "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 Contract 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 Contract 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 Contract Drawings Traffic Standard Details and all other requirements included on the Contract 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, 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 Contract no longer require said Work Area protection.

d. All existing permanent and temporary pavement markings and traffic guides that conflict with markings and traffic guides to be installed shall be concurrently removed prior to placement of new pavement markings and traffic guides as follows:

(i) On wearing surfaces that will be subsequently replaced, resurfaced or abandoned during the Work of this Contract, remove obsolete temporary marking tape and remove or obliterate obsolete thermoplastic or paint markings in a manner approved by the Engineer so as to completely obscure all obsolete markings for the duration of the Work.

(ii) On finished wearing surfaces, completely remove temporary marking tape and completely remove obsolete permanent markings in a manner approved by the Engineer. Use of blackout paint or other coating material on any finished wearing surface is prohibited.

(iii) Grind or chip off all adhesive residue resulting from removed or relocated traffic guides.

e. 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 Contract 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 Contract Drawings, the Work of installing and removing temporary signs, traffic control devices and pavement marking shall be protected, as a minimum, in accordance with Contract Drawing Standard Traffic Details and/or the MUTCD Part 6, as applicable.

6.) At excavations within pedestrian walkways including Traffic Lane crosswalks which will be open to walkway pedestrian traffic prior to completion of construction, provide appropriate pedestrian railings and steel plate, wood plank or plywood covers surfaced with an approved heavy duty non-skid paint coating containing a grit additive. Temporary walkway covers over excavations shall be a minimum of 4-feet wide, designed and constructed to carry a minimum of 150 psf. Railings shall be approximately 3 feet 6 inches above the walkway cover and consist of a 2-inch by 4-inch wood top rail, 1-inch by 4-inch intermediate rail and a toe board 5-1/2 inches high all securely fastened to 2-inch by 4-inch wood posts spaced not more than 8 feet apart. Securely fasten wood walkway covers and posts to wood sleepers spanning excavation trench. Chamfer or asphalt ramp exposed edges and secure against displacement. Contractor's installations shall meet the requirements of the ADA laws in all respects.

7.) Use temporary Vehicle-strong Barriers at all times when the Work Area contains open excavations or when materials and/or equipment are left in the Work Area without the presence of workers, unless otherwise shown on the Contract Drawings. Flare exposed ends of the barriers away from the Active Roadway by extending the barriers beyond the roadside recovery area and terminate the barriers with a tapered end section. Where proper flaring of the barriers cannot be obtained, protect the barrier end with Inertial Sand-Filled Barriers or Portable Impact Attenuators. Where Inertial Sand-Filled Barriers or Portable Impact Attenuators are used, do not install tapered barrier end section.

8.) 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 Contact Drawings.

9.) 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 Contact Drawings.

10.) 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.

END OF SECTION

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

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Product Data

02073D01 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.

Construction and Installation Procedures

02073G01 Submit to the Engineer plans, methods, equipment and procedures as applicable for cutting, patching and removal.

END OF APPENDIX "A"

DIVISION 2

SECTION 02221

EXCAVATION, BACKFILLING AND FILLING

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for excavation, backfilling and filling.

B. Definitions

1. As used herein, excavation shall mean the removal of existing pavement, concrete foundations and all materials other than bedrock (ledge rock) encountered within the limits of excavation that are not specified to be removed under the Section entitled "CUTTING, PATCHING AND REMOVAL".

2. As used herein, backfilling shall mean the filling of excavations made for construction purposes and shall extend only to existing grades or design grades, whichever are lower.

3. As used herein, filling shall mean the placement of fill material in conformance with requirements of this Section at or above existing grades.

1.02 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM D 422	Standard Test Method for Particle - Size Analysis of Soils
ASTM D 1556	Standard Test Method for Density of Soil in Place by the Sand-Cone Method
ASTM D 1557	Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)
ASTM D 2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2922	Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

New Jersey Interagency Engineering Committee (NJIEC)

Standard Soil Aggregate Gradations

1.03 JOB CONDITIONS

A. Protect excavations as follows:

1. Prevent water from entering excavated areas and, if it does, remove it immediately to maintain a dry condition at all times.

2. Dispose of water in a manner not to cause injury to the public health or damage to public or private property.

3. If water enters excavated areas and weakens or disturbs underlying soil, remove the weakened or disturbed soil and replace it in conformance with 3.02 A.5.

4. Where shown on the Contract Drawings or where required for protection of adjacent utilities or structures or where required for performance of the Work, secure the sides of excavations against movement as follows:

   a. Install sheet piling or sheeting held in place by waling and bracing members. Top of sheeting shall extend at least six inches above ground.

   b. Do not excavate below the bottom of sheet piling or sheeting except as necessary to install sheeting.

   c. Fill voids behind sheeting immediately with material conforming to I-12 designation defined in 2.01 A.1 or otherwise approved by the Engineer.

   d. Comply with all other provisions of the Specifications that may impose additional or stricter requirements.

5. For excavations extending to a depth of 5 feet or more, and where sheeting is not required to conform with provisions of 1.03 A.4 above, excavate slopes to a safe angle of repose, or protect trench excavations by use of a portable trench shield.

6. Restore all areas impacted by excavation to their original condition, matching pavement types and sections to meet original pavement grades.

B. Do not traverse paved areas with tracked vehicles or equipment such as carry-all scrapers which may damage such pavement unless protected to the satisfaction of the Engineer.

C. Do not place fill or backfill on frozen subgrade.

D. Do not perform rolling or other compaction at any time when the ground water level is above a plane two feet below the surface to be compacted. When the ground water level is above such plane, lower it by approved methods and maintain it below such level prior to and during the compaction operations.

E. Protect from damage trees and other vegetation that are to remain in place.

1.04 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Fill

1. Unless otherwise shown on the Contract Drawings, fill shall consist of clean sand and gravel containing no organic matter, conforming to the following NJIEC Standard Soil Aggregate Gradations:

	Total Percent Passing by Weight NJIEC Designation		
	I-7	I-10	I-12
Sieve Sizes			
4 inch		100	100
2 inch		80-100	
1 inch	100		
3/4 inch		60-100	70-100
1/2 inch	80-100		
No. 4		40-100	
No. 8	35-100		
No. 16	25-90	20-70	
No. 50	5-50	5-40	0-75
No. 100	0-8	0-30	
No. 200	0-2	0-20	0-5

2. The Contract Drawings show the locations in which each designation of fill is required.

B. Backfill

1. Unless otherwise shown on the Contract Drawings, material shall conform to the requirements for I-12 designation, subject to 2.01 B.2 below.

2. Where the entire backfill is above the water table, material conforming to the requirements for I-10 designation may be used in lieu of I-12 designation, except under foundations, aircraft pavement and utilities.

C. Sources

1. When fill and backfill material are provided by the Authority, the location of the stockpile and NJIEC Designation (if applicable) are shown on the Contract Drawings. Samples of material will not be required for testing.

2. Material excavated at the construction site shall be used for fill or backfill to the extent that it conforms with the requirements specified in 2.01 A.1 and 2.01 B.1 as noted on contract drawings. Samples shall be submitted for testing by the Engineer for conformance with the requirements of this Section.

3. If sufficient quantities of material are unavailable from sources described in 2.01 C.1 and 2 above, furnish material from sources off site.

PART 3. EXECUTION

3.01 PREPARATION

A. Clearing and Grubbing

Remove trees, clear and grub areas to be excavated or in which construction is to be *performed, as follows:*

1. Remove trees, stumps, all roots larger than 2 inches in diameter, and all matted root systems.
2. Remove all topsoil, debris, organic matter and any other objectionable material not suitable for use as backfill or fill or for support of structures or pavements.
3. Backfill all holes and other low spots resulting from clearing and grubbing with material conforming with 2.01 B before proceeding with compaction of fill as specified in 3.03 or with other construction in the area.

3.02 EXCAVATION

A. General

1. Excavation shall consist of the removal of materials as defined in 1.01 B.1, and the removed materials shall be segregated as suitable and unsuitable and stockpiled as shown on the Contract Drawings.
2. When excavation of bedrock (ledge rock) is required as shown on the Contract Drawings, the provisions for removal are specified in the Section entitled "ROCK EXCAVATION".
3. Excavate to elevations required for installation of permanent construction in such manner as not to disturb the subgrade below such elevations.
4. Where existing foundations or other existing construction are encountered which may cause hard spots, remove them to a minimum of two feet below subgrade for pavement or structures.
5. Should bottom of excavation be weakened or disturbed or carried below required depth:
   a. Under footings - compact bottom, as specified in 3.03 below and replace over-excavation with concrete of the same Class and Type as that specified for the footing or foundation.
   b. Elsewhere - Compact bottom as approved by the Engineer and refill with material conforming to I-12 designation defined in 2.01 A.1.
6. Perform excavation around and adjacent to existing structures, pipes and conduits which are to remain in place, without damage to or movement of existing construction. Use hand excavation to locate and expose near-surface structures, pipes and conduits. When excavation is to be performed under such structures, pipes and conduits, support them in a manner as approved by the Engineer to ensure uninterrupted operation of the supported items.

B. Dewatering

1. Where excavations are to extend below the water table, prior to placement of any permanent construction or filling or backfilling any excavated area, lower the water table in such an area to two feet below the elevation of the required subgrade and maintain this condition until the construction or pavement is placed thereon.

2. Dewater in a manner to prevent the loss of ground due to the migration of soil fines into the dewatering system.

C. Trenching for Utilities

1. Shape bottom of trench to uniform invert section.

2. When excavating in soft soils which may be subject to lateral movement or bottom heave conform with requirements shown on the Contract Drawings.

D. Disposal of Excavated Material

All debris and all material either unsuitable for or in excess of that required for backfill or fill, shall be disposed of away from the construction site.

E. Restrictions

1. Do not place backfill until the Engineer has inspected and approved the Work and indicated where backfill may be placed.

2. Leave all pipe joints exposed until all tests on such pipe, required by other Sections of the Specifications, have been performed.

3. Remove all temporary structures, sheet piles, sheeting, bracing and forms and all organic materials and debris of every nature, taking care, upon the removal of sheet piling, sheeting and temporary supports, not to cause movement of adjacent ground or structures or create the danger of a slide.

3.03 PLACEMENT AND COMPACTION

A. Equipment

1. Steel vibratory rollers shall have provision for regulation of vibration frequency. The Engineer shall be informed of the type and size of equipment to be used before the start of any compaction efforts.

2. Placement and spreading equipment shall be reviewed and approved by the Engineer.

3. Unless otherwise shown on the Contract Drawings, pneumatic-tired rollers shall have minimum weight of 20 tons and a tire pressure of between 60 and 150 psi as directed by the Engineer. For aircraft pavements, the minimum roller weight shall be 50 tons.

4. When mechanical tampers are to be used, the Engineer shall be informed of the type and size for approval before compaction efforts with this equipment can begin.

B. Compaction Requirements

Backfill and fill shall be compacted to achieve a density of 95 percent of the maximum density as determined by Procedure C of ASTM D 1557, except where alternate density requirements are approved by the Engineer or shown on the Contract Drawings.

C. Subgrade, Excavated and Existing Surfaces

Compaction of subgrade, excavated and existing surfaces will consist of a proof-rolling operation performed as follows:

1. Compact surface with a minimum of six passes of an approved vibratory steel roller operated at a speed not to exceed three miles per hour and at the optimum operating frequency recommended by the manufacturer.
2. In areas where surface consists of a fine grained soil, compact with a minimum of six passes of an approved pneumatic-tired roller.
3. Overlap passes of roller a minimum of six inches.
4. *In areas where use of a roller is impractical, compact surface while at or near* optimum moisture content with mechanical tampers.

D. Backfill and Fill

1. Moisture content of backfill and fill material shall be within a range of plus or minus two percent of optimum, as determined by Procedure C of ASTM D 1557.
2. Backfill, conforming with I-12 gradation, and fill, conforming with I-7 and I-12 gradation, shall be placed in 14-inch, loose layers and compacted with a minimum of six passes of an approved vibratory roller operated at a speed not to exceed three miles per hour.
3. Passes shall be overlapped a minimum of six inches.
4. Backfill and fill, conforming with I-10 gradation, shall be placed in 12-inch, loose layers and compacted with a minimum of six passes of an approved pneumatic-tired roller.
5. In areas where a 14-inch layer over existing material is not adequate to support the construction equipment, increase thickness of first lift as approved by the Engineer.
6. In areas adjacent to structures and utilities as shown on Contract Drawings, compaction equipment shall be restricted and as directed by the Engineer.
7. In areas where use of a roller is impractical, place fill in maximum 8-inch, loose layers and compact with approved mechanical tampers to specified density.
8. Compact backfill as specified in 3.03 D.6 above for fill. In pipe trenches, each layer of backfill shall be not more than eight inches in thickness before compaction. Backfill shall be placed on both sides of the pipe, simultaneously.
9. The surface of filled or backfilled areas, which are to receive pavement or on which a structure is to be placed, shall be within plus or minus 1/2 inch of the elevations shown on the Contract Drawings and shall be free of depressions or projections greater than 1/2 inch when tested with a 16-foot straight edge.
10. The surface of filled areas at other locations shall be within plus or minus one inch of elevations shown on the Contract Drawings unless a closer tolerance is necessary to meet requirements of other Sections of the Specifications or the Contract Drawings.

3.04 FIELD TESTS

A. Inspection and Testing

1. The Engineer will perform Quality Assurance testing on delivered field samples of material submitted from each source, for conformance with 2.01. Gradation and maximum density will be determined in accordance with ASTM D 422 and Procedure C of ASTM D 1557, respectively. If deemed appropriate by the Engineer, Atterberg Limits will be determined on fine-grained soils in accordance with ASTM D 4318.

2. If the sample from a source is approved and if the Engineer requests, conduct the Engineer's representative to that source. Additional samples will be selected and tested.

3. The Engineer will notify the Contractor of approval of material source within seven days after receiving samples. Approval of a source of backfill or fill material shall be subject to material continuing to meet the requirements of 2.01.

4. When performing Quality Assurance testing, the Engineer will determine the density of compacted fill or backfill by in-place density tests or from undisturbed samples cut from the compacted fill or backfill as required. Notify the Engineer 24 hours prior to start of filling or backfilling to allow the Engineer time to make provisions for such testing.

5. To evaluate whether material has been compacted to specified density the Engineer will compare results of in-place density tests with results of control tests on material of the same designation using Procedure C of ASTM D 1557.

6. If fill or backfill have not been sufficiently compacted as determined by in-place density tests, the compaction effort shall be continued and moisture content shall be adjusted as necessary until the specified compaction is obtained.

7. The Engineer will check conformance to elevations shown on the Contract Drawings and required tolerance for surface straightness.

8. Provide labor and equipment to take samples as directed and to assist the Engineer in other tests.

B. Testing Requirements for Fill and Backfill

1. Control Tests

   Fill and backfill material field samples will be tested in the laboratory by the Engineer as part of the Quality Assurance program. These control tests consist of determining maximum density and optimum water content by Procedure C of ASTM D 1557, and gradation by ASTM D 422. When deemed appropriate by the Engineer, Atterberg Limits will be determined on fine-grained soils.

2. In-Place Density Tests

Quality Control consisting of in-place density testing, as a minimum, shall be performed by the Contractor to determine densities achieved after compaction efforts. An in-place Quality Control plan shall be submitted to the Engineer for review and approval. This plan should address, as a minimum, items such as in-place test type and frequencies for different materials; equipment type, calibration and maintenance; operator identity and qualifications, etc.

Quality Assurance testing will be performed by the Engineer after compaction operations, at the standard frequencies already established by Port Authority testing bulletins. Test methods may either sand-cone (ASTM D 1556), rubber balloon (ASTM D 2167), or nuclear device (ASTM D 2922), with moisture content for nuclear method determined by ASTM D 3017. Tests will measure the density of the layer immediately below each compacted layer and the density of the uppermost or final layer.

C. Proofrolling in Pavement areas or under footings

1. After excavation has been performed to the elevation of pavement subgrade, proofroll the area shown on the Contract Drawings with two passes of a pneumatic-tired roller in the presence of the Engineer.

2. If, in the sole determination of the Engineer, the proofrolling produces noticeable weaving of the surface, excavation of unsuitable material may be required below pavement subgrade, within the limits and to the depth ordered by the Engineer.

3. In no case will the depth of such removal of unsuitable material exceed three feet below the pavement subgrade.

4. Remove all such unsuitable material and replace it with suitable backfill material in accordance with the requirements of 2.01 B.

5. The Contractor will be reimbursed for any ordered excavation of unsuitable material below the elevation of pavement subgrade or under footings and subsequent backfilling (but not for the proofrolling specified in 3.04 C.1) at the "Net Cost" for 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 providing compensation for Extra Work. Performance of such Net Cost Work 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.

END OF SECTION

SECTION 02221

EXCAVATION, BACKFILLING AND FILLING

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

02221A01 Where sheet piling or sheeting is required as shown on the Contract Drawings, submit detailed Shop Drawings and design calculations of the sheeting and bracing system to the Engineer for review in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS. Submit such drawings and calculations three weeks prior to commencement of such excavation. Shop Drawings and calculations shall be prepared by a Professional Engineer, licensed in the State in which the work will be performed, who has a minimum of five years experience in the design of soil retaining structures. The Shop Drawings shall be sealed and signed by the Professional Engineer.

Product Data

02221D01 Submit to the Chief of Materials Engineering, Materials Engineering Division, Engineering Materials Laboratory, Port Authority Technical Center, 241 Erie Street, Jersey City, N.J. 07310-1397, proposed material suppliers and sources for each designation of fill or backfill to be used under this contract. The submittal document must contain, as minimum information, the Contract location, title and number; designation of intended material use; source and supplier of material being submitted. Sample submittal paperwork must be received by the Chief of Materials Engineering at least three weeks prior to delivery of material to site. Do not delivery any material until the Engineer has checked an approved material supplier and source. Delivered material must receive on-site approval as per Section 3.04, Paragraph A, prior to use.

Calculations

02221H01 Where sheet piling or sheeting is required as shown on the Contract Drawings, submit detailed design calculations of the sheeting and bracing system to the Engineer for review and approval. Submit calculations three weeks prior to commencement of such excavation. Calculations shall be prepared by a Professional Engineer, licensed in the State in which the work will be performed, who has a minimum of five years experience in the design of soil retaining structures. The calculations shall be sealed and signed by the Professional Engineer.

Quality Assurance-Quality Control

02221L01 The Contractor shall be responsible for Quality Control procedures. Before the actual start of earth work, the Contractor must submit a Quality Control Plan for review and approval by the Engineer.

END OF APPENDIX "A"

DIVISION 2

SECTION 02231

AGGREGATE BASE COURSE

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for dense graded aggregate base course (DGABC) and open graded aggregate base course (OGABC) each where shown on the Contract Drawings including the use of recycled concrete aggregate (RCA) as an alternate for virgin aggregate.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American Society for Testing and Materials (ASTM)
ASTM C 88	Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	Test Method for Material Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregate by Washing
ASTM C 131	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D 1556	Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3(2,700 kN m/m^3))
ASTM D 1883	Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils
ASTM D 2167	Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2434	Test Method for Permeability of Granular Soils (Constant Head)
ASTM D 2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3665	Practice for Random Sampling of Construction Materials
ASTM D 4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Job Conditions

1. Aggregate Base Course shall not be placed or spread unless subgrade is free of frost and standing water.

2. Do not place aggregate base course, or perform any compaction operations when *ground water level is above a plane two feet below the bottom of the base course.* This condition would be indicated by existing water level readings, known site conditions or by the results of probes performed by the Contractor before material placement.

3. When necessary, lower and maintain ground water below the required plane by methods approved by the Engineer.

B. Design and Tolerance

1. The compacted base course, shall have a minimum California Bearing Ratio (CBR) of 80 as determined by ASTM D 1883. In the case of open graded aggregate base course the permeability, as tested in accordance with ASTM D 2434, shall be a minimum of 1.0×10^{-3} centimeters per second.

2. Surface of the base course shall be within plus or minus 1/2 inch of elevations shown on the Contract Drawings and free of depressions or projections greater than 3/8 inch when tested with a 16-foot straight edge applied parallel with or at right angles to the centerline.

3. Thickness of base course at any point shall not be deficient by more than 1/2 inch from the required thickness shown on the Contract Drawings.

4. The field density of the base course after compaction shall be at least 95 percent (100 percent for runways, taxiways and aprons) of the maximum density as determined by Procedure "C" of ASTM D 1557, with the exception that base course material passing the 1-1/2-inch sieve shall be used instead of the material passing the 3/4-inch sieve specified.

1.04 QUALITY CONTROL AND ASSURANCE

A. Provide and maintain quality control plans and procedures that shall ensure all base course materials and completed construction conform to this Section. The Engineer shall be afforded access to the Contractor's plant, equipment and field operations at all times for checking compliance with the approved quality control procedures. Provide labor and equipment to take samples as directed and assist the Engineer in other tests. Repair all areas from which samples are taken to meet all requirements of this Section.

B. The quality control plan shall include as a minimum:

1. Assignment of quality control responsibility to specifically-named individuals.

2. Outline of sampling location procedures and in-place density testing methodologies.

3. Performance of regularly scheduled inspections of the material source in the case of RCA.

4. Provisions for the prompt implementation of control and corrective measures.

5. Provisions for liaison with the Engineer at all times

6. Performance of necessary quality control tests, including use of a nuclear gauge.

C. For RCA, Quality Control procedures shall include performing the following tests on dedicated stockpiles being produced for use under this Contract:

1. Gradation tests (ASTM C 117 and C 136) shall be performed at least once per day.

2. Composition tests shall be a continuous visual inspection and shall include removal of any objectionable material to ensure compliance with 2.01B.

3. Soundness of Aggregates (ASTM C 88) and Resistance to Degradation (ASTM C 131) shall be performed a minimum of once every two weeks, unless otherwise directed by the Engineer.

D. For Contracts requiring over 500 cubic yards of aggregate base course, and where otherwise directed by the Engineer, select an area from the first day's production to be called a control strip. The control strip shall be a minimum of 2500 square feet and shall be constructed to meet the requirements of this section and in the same manner as the remainder of the course it represents. The purpose of the control strip is to have the contractor establish the compaction pattern, methods and effort required to achieve the quality requirements and to calibrate the Contractor's nuclear gage. Additional control strips shall be constructed whenever a significant change occurs in the type or source of the material and whenever a significant change occurs in the composition of the material from the same source.

E. Engineer's Sampling and Testing

1. The Engineer may elect to inspect, test, and approve aggregate base course at the source. At least five days prior to delivery of material to site, the Engineer shall be notified.

2. Base course material delivered to the construction site will be sampled and tested by the Engineer for conformance to the requirements specified in 2.01 A copy of the test analyses will be on file with the Engineer. The samples will be taken from stockpiles on site, prior to material placement operations. Minimum testing frequencies will be as follows:

<u>Aggregate Base Course Using Virgin Aggregate</u>

Gradation	1 test per Lot
Moisture-Density	
Proctor Test	1 test per Lot

A Lot shall be defined as one day's production but no more than 400 cubic yards.

<u>Aggregate Base Course Using Recycled Concrete Aggregate</u>

Gradation	4 tests per Lot (one test from each sublot)
Moisture-Density	
Proctor Test	4 tests per Lot
Composition	4 tests per Lot

3. The Engineer will check base course thickness at least once every 2500 sq. ft.

4. The Engineer will determine field density of compacted base course from in-place density tests. Frequency of testing will be at least one test every 2500 square feet per lift. Locations of random sampling shall be determined in accordance with ASTM D 3665. The in-place field density shall be determined in accordance with ASTM D 2922 and ASTM D 3017, or ASTM D 2167, or ASTM D 1556.

5. The Engineer will check conformance to elevations required by the Contract Drawings and required tolerance for surface straightness.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Virgin aggregate for base course shall be quarry processed, crushed dolomite, limestone, gneiss, or trap rock free from coatings of clay, silt, vegetable matter, and other objectionable materials, and shall contain no clay balls.

B. Recycled concrete aggregate for base course shall be as follows:

1. The RCA shall consist of at least 90 percent, by weight, Portland cement concrete, with the following materials making up the remaining 10 percent:

   Wood-0.1%, maximum
   Brick, Mica schist, or other friable material-4%, maximum
   Asphalt Concrete-10%, maximum

2. Virgin aggregate may be added to meet the 90% minimum concrete requirement.

3. The percentage of asphalt concrete and other deleterious material shall be determined by weighing that material retained on the No. 4 sieve, and dividing by the total weight of RCA material retained on the No. 4 sieve.

C. Gradation for aggregate base course shall be as follows:

1.

	Percentage Passing By Weight	
Sieve Size	DGABC	OGABC
1 1/2"	100	100
3/4"	55-90	60-95
3/8"		40-80
No.4	25-60	15-35
No. 50	5-25	8-20
No. 200	3-12	0-7

2. The portion passing the No. 40 sieve shall be non-plastic when tested in accordance with ASTM D 4318.

3. The aggregate base course shall have not less than 90% by weight with at least two fractured faces and 100% with at least one fractured face, and with a maximum of 7% of flat or elongated pieces. A flat piece is one having a ratio of length to width greater than five.

D. Soundness of Aggregates:

Loss limitation shall not be more than 10% loss by weight, using sodium sulfate for 5-cycle test period, or not more than 15% loss by weight, using magnesium sulfate for a 5-cycle test period as determined by ASTM C 88.

E. Resistance to Degradation:

Percentage loss between the original weight and the final weight of the test sample, shall not exceed 45% as determined by ASTM C 131.

F. Recycled Concrete Aggregate Stockpile Approval:

RCA will be sampled from lots as specified in 1.04 E.2. Each sublot of each lot shall meet all applicable test requirements of this Section. If any one sublot does not meet these requirements, the entire lot will be disapproved and shall not be used for the purposes of this Contract.

The Engineer will approve or disapprove the RCA within 4 days after sampling, unless the Engineer determines that soundness of aggregate or resistance to degradation tests specified in this Section 2.01 are required, in which case 21 days will be required for approval or disapproval. Do not deliver RCA until it has been approved by the Engineer.

After a lot has been approved, no additional material shall be added to the lot stockpile until that stockpile is exhausted. Any new stockpile formed shall be subject to testing and acceptance as described above.

PART 3. EXECUTION

3.01 INSTALLATION

A. Equipment

1. Placing and spreading equipment shall be approved by the Engineer and be capable of spreading material without segregation of aggregate sizes.
2. Steel vibratory rollers to be used for compaction, shall have provision for regulation of vibration frequency. Pneumatic rubber-tired rollers shall have a minimum weight of 20 tons and tire pressure of between 60 and 150 psi, as directed by the Engineer. All compaction equipment, including mechanical tampers when proposed, is subject to review an approval by Engineer.

B. Preparation of Subgrade

1. Verify that job conditions specified in 1.03 A have been met and there are no high points in the subgrade which would interfere with meeting the tolerance requirements specified in 1.03 B.
2. For granular subgrades, compact subgrade with a minimum of 6 passes of an approved vibratory steel roller, operating at the optimum operating frequency as recommended by the manufacturer.
3. For fine-grained soil subgrades, compact subgrade with a minimum of 6 passes of an approved pneumatic rubber-tired roller.

4. Rollers shall be operated at a speed not to exceed 3 miles per hour. Roller passes shall be overlapped a minimum of 6 inches.

5. All subgrade compaction operations shall be performed at or near optimum moisture content. In areas where use of a roller is impractical, compact subgrade with approved mechanical tampers.

6. Provide grade control as follows:

   a. Set grade stakes on a rectangular grid not more than 25 feet on centers.

   b. After firmly driving stakes, offset mark each 6 inches above the top of base course.

   c. Maintain stakes during placement and compaction of base course.

C. Placement and Compaction

1. Place base course materials evenly over the prepared subgrade with approved spreading equipment. In multi-layer construction, the previously constructed layer should be cleaned of loose of foreign material prior to placing the next layer. The surface of the compacted material shall be kept moist until covered by the next layer.

2. When spread, base course materials shall be at or near optimum moisture content and of a thickness such that the maximum depth of a compacted layer shall be 6 inches. In multi-layer construction, the base course shall be placed in approximately equal-depth layers.

3. Compact immediately after spreading, while at or near optimum moisture content, by rolling. The number, type and weight of rollers shall be sufficient to compact the material to the required density.

4. In areas where use of rollers is impractical, compact with manually operated equipment while at or near optimum moisture content.

5. The base course shall be maintained in a condition that will meet all specification requirements until the Work is accepted. Equipment used in the construction of an adjoining section may be routed over completed portions of the base course, provided no damage results and provided that the equipment is routed over the full width of the base course to avoid rutting or uneven compaction.

6. If, in the opinion of the Engineer, the compacted base course softened due to exposure to the elements, drain off all freestanding water and recompact the base course until density requirements are met.

D. Adjustment of Deficiencies

1. Scrape, add or remove material or replace deficient material, and recompact to meet specified density, grade or smoothness criteria.

2. In no case will the addition of thin layers of material be added to the top layer of base course to meet grade. If the elevation of the top layer is 1/2 inch or more below grade, the top layer of base shall be scarified to a depth of at least 3 inches, new material added, and the layer shall be cut back to grade and rerolled.

END OF SECTION

SECTION 02231

AGGREGATE BASE COURSE

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Samples

02231C01 In the case of RCA, an actual material submittal from the proposed source may be required as the result of a new, unfamiliar or unsatisfactory supplier submittal. Two 75 pound representative samples from a dedicated stockpile proposed for use under this contract must then be supplied as follows:

a. Submit RCA samples in clean, sturdy containers or bags that shall not permit loss of any of the material.

b. Clearly label samples with the Contract location, title, and number; identification of the material supplied; and the location of the source.

The Engineer will approve or disapprove within 21 days after receipt of sample. When an actual sample is required, do not deliver material to the site until Engineer has approved of the sample.

Product Data

02231D01 Submit to the Engineer of Materials, Engineering Materials Laboratory, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397, all of the following:

The proposed source of material. Material must come from a source approved by either NYDOT or NJDOT. The Engineer will approve or disapprove within 10 working days after receipt of submittal. Do not deliver material until the Engineer has approved of the source.

02231D02 If the source and/or the supplier of the aggregate base course material changes, resubmittals for approval must be made in accordance with 1.05, above.

Certificates

02231E01 In the case of RCA, the name of the intended supplier and certified test data demonstrating the supplier's compliance with the material requirements of 2.01, at least 21 days prior to delivery of any RCA to the construction site. The Engineer will approve or disapprove within 10 working days after receipt of submittal. Do not deliver material until the Engineer has approved of the source.

END OF APPENDIX "A"

DIVISION 2

SECTION 02507

PAVEMENT CRACK SEALING

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for sealing cracks in asphalt pavement.

B. Crack repair shall be performed where directed by the Engineer, unless otherwise noted on the drawings.

1.02 REFERENCES

The following publications are referenced in this Section:

	American Society for Testing and Materials (ASTM)
ASTM D3405	Joint Sealants, Hot Poured, for Concrete and Asphalt Pavements
	Federal Specification
SS-S-1401	Sealant Joint, Non-Jet-Fuel-Resistant, Hot Applied for Portland Cement and Asphalt Concrete Pavements
SS-S-200	Two Component Joint Sealant, Jet Fuel Resisant, Cold Applied for Portland Cement Concrete

1.03 ENVIRONMENTAL REQUIREMENTS

A. Do not apply any sealant during rain conditions.

B. Do not apply rubberized asphalt concrete when ambient or pavement temperature is 50 degrees F, or below.

C. Do not apply silicone sealant when ambient or pavement temperature is 40 degrees F, or below.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver silicone sealant to the construction site in unopened containers with the manufacturer's lot numbers clearly marked on the containers. Include with the delivery a manufacturer's invoice stating the date(s) of shipment and lot numbers of the silicone sealant to be used.

B. Store silicone sealant at ambient temperatures at or below 90 degrees F.

C. Silicone sealant which has been in storage more than six months shall not be used in the construction and shall be removed from the construction site immediately.

1.05 SUBMITTALS

See Appendix "A" for Submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Rubberized Asphalt Sealant

1. Road Saver 221 - manufactured by Crafco Inc., Chandler, AZ.
2. Hi-Spec - manufactured by W. R. Meadows, Eljin, IL.
3. Koch 9005 - manufactured by Koch Materials Company, Pensauken, NJ.

No substitution will be permitted.

B. Silicone Sealant

"Dow Corning 890", manufactured by Dow Corning Corp., Midland, MI; or approved equal meeting ASTM D 3405 and Federal Specification SS-S-200.

PART 3. EXECUTION

3.01 INSTALLATION EQUIPMENT

A. Router

Rotary-impact router with carbide router bits as manufactured by Crafco, Inc., Chandler, AZ., Tennant Company, Minneapolis, MN., or approved equal.

B. Hot air lance - capable of furnishing air heated to 3000°F and blast velocity of 3000 feet per second as manufactured by Cimline, Inc., Eden Praire, MN., L/A Manufacturing, Covington, KY., or approved equal.

C. Air Compressor

Capable of furnishing not less than 150 cubic feet of air per minute of not less than 100 pounds per square inch pressure. Suitable traps shall be employed to maintain the compressed air free of oil and moisture. Presence of oil or moisture in the compressed air shall necessitate cessation of operations until suitable adjustments are made.

D. Double Boiler Indirect Fired Kettle Sealing Compound Applicator

The sealing compound shall be melted in a double-boiler indirect-fired kettle. The space between the inner and outer shells shall be filled with suitable heat transfer oil having a flash point of not less than 550 degrees F. The kettle shall be equipped with satisfactory means of agitating the sealant at all times without excessive incorporation of air. The kettle shall be equipped with thermostatic control for automatic regulation of the temperature of the oil bath and sealant and have a recording thermometer for recording the temperature of the sealant. A hose shall be directly connected to the melting kettle in such a manner as to permit pumping the melted sealant through the hose to a shoe-type applicator that shall direct and control the filling of the joints. The hose and applicator shall be insulated.

E. Compressed Air-Driven Extrusion Pump/Silicone Sealant Applicator

1. The applicator shall be one of the following, or approved equal:

   a. "700 series Teflon Packed Pumping System" with teflon lined hoses, manufactured by Pyles Industries, Inc., Wixom, MI.

   b. "King" or "Bulldog" Model pumping systems with teflon lined hoses, manufactured by Graco, Inc., Minneapolis, MN.

2. The silicone sealant applicator nozzle shall be shaped to fit inside cracks to introduce the sealant between the crack faces.

3.02 INSTALLATION

A. Using a mechanical joint router, rout cracks to the dimensions shown on the Contract Drawings.

B. Clean routed cracks with a heated oil-free compressed air jet using a hot air lance connected to a compressor.

C. Rubberized Asphalt Installation

1. Heat sealing compound using a double boiler indirect fired kettle/applicator. The sealant shall be applied to cleaned cracks at the manufacturer's recommended application temperature.

2. At the start of each days sealing operations 1 gallon of heated sealant shall be flushed through the applicator into a 1 gallon container and shall become the property of the Contractor and be disposed of away from Authority property.

3. Install sealing compound as shown on the Contract Drawings and such that in-place sealant shall be well bonded to the pavement and free of voids or entrapped air. In addition, the cracks shall be sealed in a neat and workmanlike manner. The period of cure shall be in accordance with the manufacturer's recommendations. Vehicular or heavy equipment traffic shall not be permitted on the pavement in the area of the cracks during the curing period.

D. Silicone Sealant Installation

1. Seal cracks immediately following, and during the same work period as, the cleaning operation.

2. Apply silicone sealant to cleaned cracks using a compressed air driven extrusion pump/silicone sealant applicator.

3. Apply sealant as shown on the Contract Drawings in such a manner that the in-place sealant will adhere to the pavement and be free of voids. Seal the cracks so that material shall be flush with the pavement surface. Refill or "spot up" all low areas before final approval. Remove excess material on the surface of the pavement and leave the pavement surface in a clean condition.

4. If the silicone sealant is not self-leveling, the sealant material shall be tooled in a manner that causes it to wet the crack surfaces.

5. Allow silicone sealant to cure in accordance with the manufacturer's installation instructions before reopening to traffic. Protect surface of sealer from dirt for one to three hours, until tack-free.

END OF SECTION

SECTION 02507

PAVEMENT CRACK SEALING

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Samples

02507C01 Submit to the Engineer of Materials, Engineering Materials Laboratory, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397, the following samples for approval:
1. Rubberized Asphalt Sealant - 10 pounds from each lot.
2. Silicone Sealant - one 10.3 fluid ounce cartridge.

END OF APPENDIX "A"

DIVISION 2

SECTION 02520

ASPHALT BLOCK PAVERS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for furnishing and installing asphalt block pavers over prepared sub-base material.

1.02 REFERENCES

The following is a list of publications referenced in this Section:

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M81 Cutback Asphalt (Rapid Curing)

American Society for Testing and Materials (ASTM)

ASTM C33	Concrete Aggregates
ASTM C150	Portland Cement
ASTM D312	Asphalt Used in Roofing
ASTM D1073	Fine Aggregate for Bituminous Paving Mixtures
ASTM D2028	Cutback Asphalt (Rapid-Curing Type)
ASTM D3381	Viscosity-Graded Asphalt Cement for Use in Pavement Construction

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Installation shall be performed by an installer with at least three year's experience in placing asphalt block pavers.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Protection

1. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace block paver work damaged by frost or freezing.

B. Where block pavers are shown on the Contract Drawings to be installed directly over a concrete base slab or asphalt binder base: Apply asphalt primer coat when ambient temperature is above 50°F and when temperature has not been below 35°F for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

C. Install bituminous setting bed only when atmospheric temperature is above 40°F and when base is dry.

1.05 QUALITY ASSURANCE

A. Installer Qualifications

An entity who has successfully completed within the last 3 years at least 3 asphalt block paver installations similar in type and size to that of this project and who will assign mechanics from these earlier installations to this project, of which one will serve as lead mechanic.

B. Field-Constructed Mock-Up

Prior to installation of block pavers, fabricate mock-up using materials, pattern and joint treatment shown on the Contract Drawings including special features for expansion joints and contiguous Work. Build mock-up in form of panel at the site, in location shown on the Contract Drawings or approved by the Engineer, of full thickness and approximately 5' x 5', unless otherwise shown on the Contract Drawings. Provide range of color, texture and workmanship to be expected in the completed Work. Obtain Engineer's acceptance of visual qualities of mock-up before start of unit paver Work. Retain mock-up during construction as a standard for judging completed block paver Work. Do not move or destroy mock-up until Work is completed.

C. Do not change source of brands for block pavers, setting materials, or grout during progress of Work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle all material in a manner to prevent damage by breakage, water, or moisture, or the inclusion of foreign particles.

B. No materials shall be dumped or stored on the ground.

C. Store materials on a clean surface or platforms as required and protect them from deterioration and foreign matter.

D. Protect block pavers and aggregate during storage and construction against wetting by rain, snow or ground water and against soilage or intermixture with earth or other types of materials.

E. During freezing weather protect all materials with tarpaulins or other suitable material.

F. Deliver bituminous materials plant mixed ready for use.

1.07 SUBMITTALS

See Appendix A for Submittal Requirements

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements of this Section, provide products of the following manufacturer or an approved equal:

Hanover Architectural Products, Hanover, PA 17331.

2.02 MATERIALS

A. Asphalt Block Pavers

Provide manufacturer's standard solid units consisting of coarse aggregate, inorganic dust as filler and asphalt cement as follows:

1. Coarse Aggregate: Clean, hard, unweathered stone crushed into cubicle-shaped particles varying in size up to 3/8 inch.
2. Filler: Dust produced from limestone or other material as standard with manufacturer.
3. Asphalt Cement: ASTM D 312, Type III.
4. Dimensional Tolerances: Manufacture unit to standard dimensions indicated with deviations in any direction not exceeding plus or minus 1/16 inch.

B. Asphalt Block Pavers shall have the following color and finish:

1. Asphalt Block Paver shall be 8" hexagonal paver, 2" thickness and as follows:
   a.) 50% shall be color black # A80026 with ground Tudor finish.
   b.) 50% shall be color red # A80011 with ground Tudor finish.
   c.) Install both colors in a random pattern as shown on the Contract Drawings.
2. Asphalt Block Pavers shall be as manufactured by Hanover Architectural Products, Hanover, PA 17331, telephone (800)-426-4242, or an approved equal.

C. Setting Materials

1. Primer for Base: Cut-back asphalt complying with ASTM D 2028, or AASHTO M 81; grade as recommended by paving manufacturer.
2. Aggregate for Setting Bed: Fine aggregate complying with ASTM D 1073, Grading No. 2 or 3.
3. Asphalt Cement: ASTM D 3381, viscosity grading AC-10 or AC-20.
4. Joint Filler Materials: Portland cement, ASTM C 150, Type I; and fine aggregate, ASTM C 33.

D. Flush Concrete Curb

1. See Civil Drawings and Specifications.

E. Steel Edging

1. Steel Edging shall be galvanized, ¼" thick x 5" width, fabricated in 16'-0" lengths with anchor stake loops at 32" on-center. Tapered steel stakes 15" long shall be provided for anchoring.

2. Steel Edging shall be as manufactured by Border Concepts, Inc., Charlotte, NC 28247 or an approved equal as supplied by:

   a.) Bissett Nursery, 323 Long Island Ave, Holtsville, NY, 11742 (631)-289-3500

   b.) Shemins Nursery, 100 Weyerhauser Road, Mahwah, NJ (201)-529-0099

   c.) Reed and Perrine Sales, Inc., 396 Tennent Road, Tennent, NJ (732)-446-6363

PART 3. EXECUTION

3.01 INSTALLATION

A. General

1. Do not use block pavers with chips, cracks, voids, discolorations or other defects that might be visible or cause staining in finished work.

2. Cut block pavers with motor-driven saw equipment to provide clean, sharp, unchipped edges. Cut units to fit adjoining work neatly. Use full units without cutting to the greatest extent possible.

3. Set block pavers with uniform joints of 1/16-inch width.

4. Tolerances: Do not exceed 1/32 inch unit-to-unit offset from flush and a tolerance of 1/8 inch in 10 feet from level or slope as shown on the Contract Drawings for finished surface of paving.

5. Install joint filler where sealant type joints are shown on the Contract Drawings. For joint filler and sealant materials and for their installation requirements, refer to Division 7 Section on Joint Sealers.

B. Guide rail Applications

1. Guide rail and supports shall be installed by the Contractor after Asphalt Block pavement sub-base preparation is in place (4" DGABC) and prior to the installation of the 4" asphalt sub-base and 3/4" rolled bituminous setting bed.

2. Any block pavers, chipped, cracked, and broken and any construction activity that displaces, warps, causes defects that visibly mars a neat continuous finish shall be replaced in it's entirety by the Contractor, at no additional cost to the Authority.

3. See Traffic Drawings for coordinating the installation of asphalt block pavement and guide rail and support installation.

C. Impervious Applications

1. Where block pavers are shown on the Contract Drawings to be installed directly over a concrete base slab or asphalt binder base: Apply primer to concrete slab or binder course.

2. Prepare for setting bed placement by locating 3/4-inch deep control bars approximately 11 feet apart and parallel to one another, to serve as guides for striking board (12 feet long, 2 inch by 6 inch board). Adjust bars to subgrades required for accurate setting of block pavers to finished grades indicated for block pavers.

3. Mix bituminous setting bed materials at an asphalt plant in approximate proportion, by weight, of 7% asphalt cement to 93% fine aggregate, unless otherwise indicated. Heat mixture of 300°F.

4. Place bituminous setting bed where asphaltic block pavers are shown on the Contract Drawings, in panels, by spreading bituminous material between control bars and pulling this bed with striking board several times to produce a smooth, firm and even setting bed, not less than 3/4" thick. Add fresh bituminous material to low, porous spots after each pass of striking board. After each panel is completed, advance first control bar to next position in readiness for striking adjacent panels. Carefully fill up any depressions that remain after removing depth control bars.

   a. Roll setting bed with power roller to a nominal depth of 3/4 inch while it is still hot. Adjust thickness as necessary to allow for setting of block pavers to finished grades shown on the Contract Drawings.

5. Place block pavers carefully by hand in straight courses maintaining accurate alignment and uniform top surface. Protect newly laid block pavers with panels of plywood on which workers stand. Advance protective panels as work progresses but maintain protection in areas subject to continued movement of materials and equipment, to avoid creating depressions or disrupting alignment of block pavers. If additional leveling of paving is required, and before treating joints, roll with power roller after sufficient heat has built up in the surface from several days of hot weather.

6. Joint Treatment

   Place block pavers with hand tight joints. Allow a minimum of 0" to 1/16" joints between block pavers for laying out full and half course. Fill hand-tight joints with a dry mixture of one part portland cement and 3 parts sand by sweeping mixture over paved surface until joints are filled. Follow by fogging lightly with water.

3.02 PROTECTION

A. Remove and replace block pavers which are loose, chipped, broken, stained or otherwise damaged, or if block pavers do not match adjoining block pavers as intended. Provide new block pavers to match adjoining block pavers and install in same manner as original units, with same joint treatment to eliminate evidence of replacement.

B. Provide final protection and maintain conditions in a manner acceptable to the Engineer, which ensures block paver work being without damage or deterioration.

END OF SECTION

SECTION 02520

ASPHALT BLOCK PAVERS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Samples

02520C01 3. Samples for Verification Purposes: Submit samples made up of 4 actual pavers in each color, finish and type. Include in each set of samples the full range of exposed colors and textures to be expected in the completed Work.

02520C02 Provide a 5' x 5' mock-up of complete paver pattern shown on the Contract Drawings for inspection and approval by the Engineer.

Product Data

02520D01 Submit manufacturer's technical data for each manufactured product listed in this Section, including certification that each product complies with specified requirements.

Qualifications

02520K01 Submit qualifications of the entity and its workers performing the Work of this Section to the Engineer. Include names of clients, telephone numbers and contract amounts for work performed in the last three (3) years and experience records of workers performing the Work of this Section.

END OF APPENDIX "A"

DIVISION 2

SECTION 02553

ASPHALT CONCRETE PAVING

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for plant mix macadam base course, bottom course, top course, bridge deck membrane, tack coat and overlay of existing pavement with asphalt concrete using performance graded asphalt specified in 2.02 B.

B. Except as in 1.01 C below, recycled asphalt concrete pavement (consisting of reclaimed asphalt pavement blended with new materials) may be used to the maximum percentages specified in 1.04 C.2.b.

C. Recycled asphalt concrete shall not be used in mixes where modified asphalts or "Rosphalt 50" additive are used.

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>	
AASHTO M320	Performance-Graded Asphalt Binder.
AASHTO R028	Practice for Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV).
AASHTO T313	Method of Test for Determining the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR).
AASHTO T315	Method of Test for Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR).
AASHTO T048	Method of Test for Flash and Fire Points by Cleveland Open Cup.
AASHTO T240	Method of Test for Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test).
<u>American Society for Testing and Materials (ASTM)</u>	
ASTM C 88	Test Method For Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
ASTM C 117	Test Method for Materials Finer than 75-micrometres (No. 200) Sieve in Mineral Aggregates by Washing.
ASTM C 127	Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
ASTM C 128	Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.

ASTM C 131	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM C 136	Test Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM C 566	Test Method for Total Evaporable Moisture Content of Aggregate by Drying.
ASTM C 1252	Test Methods for Uncompacted Void Content of Fine Aggregate (as Influenced By Particle Shape, Surface Texture, and Grading).
ASTM D 75	Practice for Sampling Aggregates.
ASTM D 242	Specification for Mineral Filler for Bituminous Paving Mixtures.
ASTM D 692	Specification for Coarse Aggregate for Bituminous Paving Mixtures.
ASTM D 979	Practice for Sampling Bituminous Paving Mixtures.
ASTM D 995	Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
ASTM D 1073	Specification for Fine Aggregate for Bituminous Paving Mixtures.
ASTM D 2041	Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
ASTM D 2172	Test Methods for Quantitative Extraction of Bitumen From Bituminous Paving Mixtures.
ASTM D 2419	Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
ASTM D 2726	Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
ASTM D 3203	Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
ASTM D 3549	Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
ASTM D 3666	Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials.
ASTM D 4125	Test Methods for Asphalt Content of Bituminous Mixtures by the Nuclear Method.
ASTM D 4318	Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
ASTM D 4402	Test Method for Viscosity Determinations of Asphalt at Elevated Temperatures Using a Rotational Viscometer.
ASTM D 4791	Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
ASTM D 4867	Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures.
ASTM D 5444	Test Method for Mechanical Size Analysis of Extracted Aggregate.
ASTM D 5821	Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.
ASTM D 5976	Specification for Type 1 Polymer Modified Asphalt Cement for Use in Pavement Construction.

ASTM D 6084	Test Method for Elastic Recovery of Bituminous Materials by Ductilometer.
ASTM D 6307	Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method.
ASTM D 6926	Practice for Preparation of Bituminous Specimens Using Marshall Apparatus.
ASTM D 6927	Test Method for Marshall Stability and Flow of Bituminous Mixtures.
ASTM E 178	Practice for Dealing With Outlying Observations.
ASTM E 950	Test Method for Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference.
ASTM E 1274	Test Method for Measuring Pavement Roughness Using a Profilograph.
	Asphalt Institute – Manual Series
MS-2	Mix Design Methods for Asphalt Concrete, and Other Hot-Mix Types.
MS-20	Asphalt Hot-Mix Recycling.
	Dept. of Transportation – Federal Aviation Administration (FAA)
ERLPM	Eastern Region Laboratory Procedures Manual.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Job Conditions

1. Apply tack coat only when the base surface is dry and the ambient temperature in shade has not been below 32 degrees F for 12 hours immediately prior to application, unless otherwise approved by the Engineer.

2. Do not place asphalt concrete upon a wet or frozen surface.

3. The minimum laydown temperature shall not be less than 310 degrees F when the base surface temperature is 50 degrees F or less and no less than 275 degrees F when the base temperature is greater than 50 degrees F. The asphalt concrete temperature shall be measured in the truck, at the paver.

4. For asphalt mixes containing "Rosphalt 50", the minimum laydown temperature is 350 degrees F, regardless of the base surface temperature. The asphalt concrete temperature shall be measured in the truck, at the paver.

5. The minimum allowable base temperature for a lift thickness is shown in the following table:

Nominal Lift Thickness (inches)	Minimum Allowable Base Temperature (degrees F)
2 or greater	32
1-1/2 or greater, but less than 2	40
Less than 1-1/2	50

6. If nominal lift thickness is two inches or greater and the base temperature is below 32 degrees F, the Engineer may approve paving operations if the Contractor can demonstrate, prior to commencing with paving, that density and mat texture uniformity can be achieved. All other requirements apply.

7. In case of sudden rain, the Engineer may at his sole discretion permit placing of mixture already in transit from the plant, provided the surface to be paved is free from pools of water and laydown temperatures conform to the above tabulation. Such permission, however, shall not be interpreted as a waiver of any of the quality requirements.

8. When using design mixes containing "Rosphalt 50", arrange for a technical representative of the "Rosphalt 50" manufacturer to be present in the field during the first three days of installation of "Rosphalt 50" paving mix.

B. Asphalt Concrete Mix Design

1. Design asphalt concrete job mix formula based on the "Mix Design Table" specified in 2.03 A and specimen compaction temperature specified in 1.04 E.3.

2. Design top and bottom courses and bridge deck membrane to the following target values: [1]

Marshall Stability at 75 blows (ASTM D 6927) - 2150 lbs., min. except 1,000 lbs, min. for bridge deck membrane

Flow Value, 0.01 inch gradation (ASTM D 6927) - 8 to 16, except 15 to 40[2] for bridge deck membrane

Marshall Air Voids, Percent, (ASTM D 3203)[3]:

Top course (except Mix I-6A, and mixes containing "Rosphalt 50")	2.8 to 4.2
Top course, Mix I-6A	5.3 to 6.7
Bottom course	3.8 to 5.2
Bridge Deck Membrane	1.5 Max.
Mixes containing "Rosphalt 50"	0 to 2.0

Percent Voids Filled with Asphalt:

Mix I-2A; I-4A; I-5A; PA-5	70 to 80
Mix I-4; I-5; I-6A	65 to 80
Bridge Deck Membrane	95 to 100
Mixes containing "Rosphalt 50"	90 to 100

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1 For asphalt concrete mixes with five percent of the aggregate or greater retained on the 1" sieve, the Engineer may require the use of six inch molds to increase the repeatability of Marshall test results. For six-inch molds Marshall stability shall be 4800 lbs. minimum at 113 blows with 22.5 lb. hammer and 18-inch drop and the flow value shall be within the 12 to 24 range.

2 Flow may be higher than 40 if other properties meet section requirements and if approved by the Engineer.

3 Determine by comparing bulk specific gravity (ASTM D 2726) to maximum specific gravity (ASTM D 2041).

Voids in the Mineral Aggregate (VMA), Percent, Minimum:

Mix I-2A	12
Mix I-4A	13
Mix I-4; PA-5	14
Mix I-5; I-5A	16
Mix PA-5 with "Rosphalt 50"	16
Mix I-5A with "Rosphalt 50"	18
Mix I-6A	19
Bridge Deck Membrane	20

3. Plant mix macadam base course (Mix I-1) shall be a mixture designed within the gradation limits specified in 2.03 A. When approved by the Engineer, bottom course (Mix I-2A) may be used in lieu of Mix I-1 provided it meets all requirements for bottom course.

4. The design job mix formula shall indicate definite percentages passing for each sieve fraction of aggregate and the asphalt content.

5. Design new job mix formula for each asphalt plant used, whenever there is a change in material or when field conditions dictate a need for redesign.

6. When required by the Engineer, determine the tensile strength ratio of specimens of the composite paving mixture by procedures specified in ASTM D 4867. The value shall be not less than 80 percent.

C. Plant Production Requirements

1. The asphalt concrete mixture or its components shall not be heated to a temperature outside the limits specified in 3.02 A.

2. Top and bottom courses and bridge deck membrane shall have 100 percent of the material in each lot equal, or exceed or fall within the range for the following acceptance limits*:

   Marshall Stability at 75 blows (ASTM D 6927) - 1800 lbs. min, except 1000 lbs. minimum for bridge deck membrane

   Flow Value, 0.01 inch gradation (ASTM D 6927) - 8 to 16, except 15 to 40** for bridge deck membrane

   If the Percent of Material Within Tolerance Limits (PWL) of the lot is less than 90 percent, corrections for deficiencies in Marshall Stability and Flow shall be made as set forth in 3.03 C.

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* If six-inch molds are required as set forth in 1.03 B.2, Marshall stability shall be 4000 lbs. minimum at 113 blows with 22.5 lb. hammer, 18-inch drop and the flow value shall be within the 12 to 24 range.
** Flow may be higher than 40 if other properties meet Section requirements and if approved by the Engineer.

3. Modified Asphalt Performance Grade

Modified asphalt shall meet the performance grade requirements set forth in 2.02 B, when tested in accordance with 1.04 E.12. When material fails to meet the requirements, make corrections in accordance with 3.03 E.

4. Marshall Air Voids

The target bands for Marshall air voids shall be as set forth in 1.03 B.2. Acceptance shall be on a lot basis as specified in 1.04 E.3. The acceptance of each lot shall be based on the Percent of Material Within Tolerance Limits (PWL) as set forth in 4.03 B.5. Adjustment to Contract compensation shall be made if the PWL of the lot is less than 90 percent as set forth in 4.03 D. If the PWL of the lot equals or exceeds 90 percent and the PWL for pavement joint density for the lot equals or exceeds 90 percent, the percentage adjustment to compensation may be between 100 and 106 as set forth in 4.03 D.

The Tolerance Limits for Marshall air voids, percent, (ASTM D 3203) are:

Top course, (except Mix I-6A)	2.0 to 5.0
Top course, Mix I-6A	4.5 to 7.5
Bottom Course	3.0 to 6.0
Bridge deck membrane	1.5 Max.
Mixes containing "Rosphalt 50"	0 to 2.0

5. Tensile Strength Ratio

The Tensile Strength Ratio shall meet the requirement set forth in 1.04 E.15. When material that is produced fails to meet the requirements, make corrections in accordance with 3.03 F.

6. Arrange for a technical representative of the "Rosphalt 50" manufacturer to be present in the plant during the first three days of production.

D. In-Place Pavement Requirements

1. Surface Smoothness

a. Longitudinal direction for roadways where paving lane lengths equal or exceed 500 linear feet.

The final surface shall have a Profile Index of 15.0 inches per mile or less and no deviations 0.4 inch or greater in 25 feet. Testing and acceptance shall be on a lot basis as set forth in 1.04 E.10.a. Corrections for deficiencies in surface smoothness shall be made as set forth in 3.03 A. Adjustment to Contract compensation shall be made based on the Profile Index of the lot as set forth in 4.03 E.

b. Longitudinal direction for roadways where paving lane length is less than 500 linear feet.

Final surface shall be smooth and free of irregularities greater than 1/8 inch when tested with a 10-foot straight edge. Testing and acceptance shall be on a lot basis as set forth in 1.04 E.10.b. Corrections for deficiencies in surface smoothness shall be made as set forth in 3.03 A. Adjustment to Contract compensation shall be made based on the Profile Index of the lot as set forth in 4.03 E.

c. Longitudinal and transverse direction for parking lots and port container storage areas.

The final surface shall not demonstrate ponding of water and shall be free-draining. Testing and acceptance shall be as set forth in 1.04 E.10.c. Corrections for deficiencies shall be made as set forth in 3.03 A.

2. Density

a. In-Place Mat Density

The target for in-place mat density shall be 98 percent or better (97 percent for pavement on roadway structures). Acceptance shall be on a lot basis as set forth in 1.04 E.5. The acceptance of each lot shall be based on the Percent of Material Within Tolerance Limits (PWL), as set forth in 4.03 B.5. Adjustment to Contract compensation shall be made based on the PWL of the lot as set forth in 4.03 C. The lower tolerance limit for pavement mat density is 96.3 percent (95.7 percent for pavement on roadway structures).

a. In-Place Joint Density

The target for in-place joint density shall be 97 percent or better (96 percent for pavement on roadway structures). Acceptance shall be on a lot basis as set forth in 1.04 E.6. The acceptance of each lot shall be based on the Percent of Material Within Tolerance Limits (PWL), as set forth in 4.03 B.5. Adjustment to Contract compensation shall be made based on the PWL of the lot for surface course only as set forth in 4.03 F. The lower tolerance limit for pavement joint density is 93.3 percent.

b. Plant mix macadam base course shall have stone thoroughly interlocked, interstices reduced to a minimum and creeping of mixture no longer visible and with no further increase in density achievable by additional rolling.

3. Thickness

a. Pavement courses shall conform to thicknesses shown on the Contract Drawings within the following tolerances:

Course or Combination of Courses	Tolerance (in inches) Plus or Minus*
Thickness of top or membrane course	1/4
Total thickness of top course and bottom course	1/4
Total thickness of plant mix macadam base course, bottom course, and top course	1/4
Overlay thickness shall be measured by the tolerance in 1.03 D.4	--

4. Final Surface Grade

The final surface shall conform to the finished grades shown on the Contract Drawings within a target tolerance for vertical deviation of plus or minus 0.04 foot, except where closer tolerance is required for proper functioning of appurtenant structures and drainage. The final surface abutting existing pavements shall smoothly transition to the existing surface grades and shall not demonstrate ponding of water. The Engineer will test the final surface, which will be accepted or rejected on a lot basis as set forth in 1.04 E.11. The Engineer will adjust Contract compensation based on the percentage of grade measurements exceeding the target tolerance as set forth in 4.03 D. For all areas when 15 percent or more of the grade measurements exceed the target grade tolerance or any individual measurement exceeds a 0.06-foot grade tolerance, make corrections for deficiencies in final surface grade as set forth in 3.03 D.

5. In-Place Air Voids

Asphalt concrete shall have in-place air voids between 2.0 percent and 8.0 percent (9.0 percent for bottom course and materials placed on roadway structures). Asphalt concrete containing "Rosphalt 50" additive shall have in-place air voids less than 6.0 percent. The Engineer will test in-place air voids in accordance with 1.04 E.7. When material fails to meet the requirements, make corrections for deficiencies in accordance with 3.03 B.

1.04 QUALITY CONTROL/ASSURANCE

A. General

1. Establish, provide and maintain an effective quality control system which shall ensure that the materials and completed construction submitted for acceptance conform to Contract requirements whether manufactured or processed by the Contractor or procured from subcontractors or vendors.

* All measurements for this purpose shall be to the nearest 1/8th inch.

2. Pre-Paving Construction Meeting

a. A pre-paving meeting will be conducted at the construction site by the Engineer a minimum of 20 days prior to the first day of laydown to discuss Contractor (suppliers) mixes, plant quality control, field quality control, tack coat, control strip, requirements for mat and joint densities, equipment - rollers, Material Transfer Vehicle and paver, smoothness and grade control, segregation, workmanship, quality assurance testing, incentive and disincentive criteria, and any other pertinent specified requirements.

b. Record, type and distribute meeting minutes to all attendees of the meeting within 5 days of the date of the meeting.

c. Do not schedule the pre-paving construction meeting until all submittals pertaining to the paving operation have been submitted and approved.

3. At no additional cost to the Authority, make arrangements for the project superintendent and a qualified representative to be present at every segment of the paving operations, including, but not limited to the following:

a. Asphalt Producer's Quality Control Manager.

b. Contractor's representative for site quality control testing.

c. Paving crew foreman.

d. Smoothness testing personnel.

e. Survey crew chief.

4. Provide the Engineer certification in writing stating that all of the testing equipment to be used is properly calibrated and will meet the specifications applicable for the specified test procedures. Upon Engineer's request, test samples to demonstrate an acceptable level of performance.

5. Perform quality control sampling, testing and inspection during all phases of the Work at rates sufficient to ensure that the Work conforms to the Contract requirements, and at minimum test frequencies required by 1.04 D.

B. Quality Control Plan

1. Establish and maintain a Quality Control Plan (Plan) along with all the personnel, equipment, supplies and facilities necessary to obtain samples, perform and document tests and meet specification requirements. For Contracts requiring 1,000 tons of asphalt concrete or greater, the Plan is required. For Contracts requiring less than 1,000 tons of asphalt concrete, the Plan is optional.

2. Describe the Plan in a written document. Submit the written Plan to the Chief of Materials Engineering, Materials Engineering Unit for review at least 28 calendar days prior to the start of paving operations.

3. In the absence of an approved Quality Control Plan, the Authority will make no payments for materials which are subject to specific quality control.

4. The Plan may be operated wholly or in part by the Contractor or an independent organization but it shall in all cases remain the responsibility of the Contractor.

5. Plan Contents: The Plan shall be organized to address at least the following items:

a. Quality control organization chart.

b. Area of responsibility and authority of each individual.

c. Names and qualifications of personnel as required by 1.04 B.7.d.

d. A listing of any outside organizations such as testing laboratories that will be employed by the Contractor and a description of the services they will provide.

e. A testing plan which lists the tests required to be performed by the Contractor, the frequency of testing, sampling locations and the location of the testing facilities.

f. Procedures for ensuring that tests are taken in accordance with the testing plan, that they are documented and that proper corrective actions are taken when necessary.

g. Procedures for ensuring that testing equipment is available, that it complies with specified standards and that it has been calibrated against certified standards.

h. Procedures for verifying that tests are taken in accordance with the appropriate AASHTO and ASTM standards.

i. Procedures for daily submittal of test results to the Engineer.

j. An action plan detailing procedures to be used to correct unsatisfactory production processes and construction practices, when tests indicate materials are failing to meet specification for the following:

(1) Aggregate gradation.

(2) Mat and joint density.

(3) Marshall air voids.

(4) Surface smoothness.

(5) Grades.

6. Plan Elements: The Plan shall address all elements which affect the quality of the pavement including but not limited to:

a. Mix Design.

b. Aggregate Gradation.

c. Quality of Materials.

d. Stockpile Management.

e. Proportioning / Temperature Control of Mixture Components.

f. Mixing and Transportation.

g. Placing and Finishing.

h. Joints.

i. Compaction.

j. Surface smoothness and grades.

7. Quality Control Organization

a. Implement the Quality Control Plan by the establishment of a separate Quality Control Organization. Develop and submit an organization chart to show all quality control personnel integrated with other management, production, and construction functions and personnel.

b. The organization chart shall identify all quality control staff required to implement all elements of the quality control program, including inspection and testing functions for different items of work.

c. If an outside organization or independent testing laboratory is used for implementation of all or part of the Plan, the personnel assigned will be subject to the qualification requirements of 1.04 B.7.d. The organization chart shall indicate which personnel are Contractor employees and which are provided by an outside organization.

d. The Quality Control Organization shall consist of at least the following personnel:

(1) Plan Administrator

The Plan Administrator shall be an employee of the Contractor. The Plan Administrator shall have prior quality control experience on a project of comparable size and scope. In addition, the Plan Administrator shall meet one of the following requirements:

(a.) Licensed Professional Engineer with one year of asphalt paving experience as approved by the Engineer.

(b.) Engineer-in-Training with two years of asphalt paving experience as approved by the Engineer.

(c.) An individual with three years of highway and/or airport paving experience as approved by the Engineer and with a Bachelor Degree in Civil Engineering, Civil Engineering Technology or Construction.

(d.) Construction Materials Technician certified at Level III by the National Institute for Certification in Engineering Technologies (NICET).

(e.) Highway Materials Technician certified at Level III by NICET.

(f.) Highway Construction Technician certified at Level III by NICET.

(g.) A NICET certified Engineering Technician in Civil Engineering Technology with 5 years of asphalt paving experience as approved by the Engineer.

Certification at an equivalent level by a State or nationally recognized organization will be acceptable in lieu of NICET certification. The Plan Administrator shall have full authority to institute any and all actions necessary for the successful operation of the Plan to ensure compliance with the Specifications. The Plan Administrator shall report directly to a responsible officer in the Contractor's organization. The Administrator may supervise the Plan on more than one project provided that he can upon request be at the construction site within one hour.

(2) Quality Control Technicians

The Contractor shall provide a sufficient number of Quality Control Technicians to adequately implement the Plan. Quality Control Technicians shall be engineers, engineering technicians, or experienced craftsmen holding a current certificate issued by the New Jersey Society of Asphalt Technologists, Inc. (NJSAT) or other Engineer-approved certifying agency or organization. (Information regarding the certification procedure can be obtained by contacting NJSAT.)

The Quality Control Technicians shall report directly to the Plan Administrator and shall perform the following functions:

(a.) Inspection of all plant equipment used in proportioning and mixing to ensure proper calibration and operating conditions.

(b.) Performance of quality control tests necessary or desirable to adjust and control mix proportioning in accordance with the job mix formula.

(c.) Inspection of all equipment used in placing, finishing and compacting material to ensure proper operating condition.

(d.) Inspection during construction to ensure placement, joint construction and compaction is in conformance with the Specifications and will produce a finished product that meets Specification requirements.

(e.) Performance of all quality control testing as required by 1.04 D, including density monitoring.

8. Testing Laboratory

a. The Plan must provide for a fully equipped asphalt laboratory located at the plant or construction site. It shall be available for joint use by the Contractor for quality control testing and by the Engineer for acceptance testing and must have adequate equipment for the performance of the tests required by these Specifications. The Engineer shall have priority in use of the equipment necessary for acceptance testing.

b. The effective working area of the laboratory shall be a minimum of 250 square feet with a ceiling height of not less than 7.5 feet. Lighting shall be adequate to illuminate all working areas. It shall be equipped with heating and air conditioning units to maintain a temperature of 70 degrees F plus or minus 5 degrees F.

c. In addition to the equipment required for testing, the laboratory shall be equipped with a paper copier and facsimile machine to be utilized by the Engineer.

d. Keep laboratory facilities clean and maintain all equipment in proper working condition. Allow the Engineer unrestricted access to inspect the Contractor's laboratory facility and to witness quality control activities. The Engineer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies or testing personnel and procedures. When in the Engineer's opinion deficiencies may adversely affect test results, immediately suspend delivery and placement of asphalt materials and do not resume until the deficiencies are satisfactorily corrected.

9. Noncompliance

In cases where quality control activities do not comply with either the Contractor's Quality Control Program or the Contract provisions, or where the Contractor fails to properly operate and maintain an effective Quality Control Program, the Engineer may order the Contractor to replace ineffective or unqualified quality control personnel.

C. Source of Aggregate and Sampling

1. Virgin Aggregate

a. Select sources of virgin aggregates well in advance of the time the materials are required for the construction. When the aggregates are obtained from a previously approved source, submit random hot bin samples, if requested by the Chief of Materials Engineering, Materials Engineering Unit, a minimum of 14 calendar days prior to the start of production and if from a source not previously approved, submit random hot bin samples a minimum 45 calendar days prior to the start of production. Sampling of the hot bin materials for job mix formulation will be observed by the Engineer and identical samples will be obtained for verification of the job mix formulation by the Authority's Materials Engineering Unit. The Engineer may require the proposed mix formulation to be batched at the asphalt plant and tested in the presence of the Engineer.

b. Where previously used or concurrent job mix formulations are to be used, the taking of hot bin samples may be waived by the Engineer.

2. Reclaimed Asphalt Pavement

a. Where reclaimed asphalt pavement material is permitted, it shall have 100 percent passing 1/2 inch sieve and shall be a mixture of only coarse aggregate, fine aggregate, and asphalt cement, free of solvents or other contaminating substances. The fine aggregate contained in the reclaimed asphalt pavement shall have a plasticity index not greater than 4 when tested in accordance with ASTM D 4318.

(1) Maintain stockpiles of reclaimed asphalt pavement in a manner to prevent contamination with other aggregates and keep covered in order to maintain a low moisture content of the reclaimed asphalt pavement.

b. Unless otherwise shown on the Contract Drawings, the maximum proportion of reclaimed asphalt pavement permitted within each mix shall be 10 percent for top and bottom courses and 25 percent for base course.

c. Contractor's reclaimed asphalt pavement will be considered for use provided that the Engineer is notified of the intended use and that he approves the reclaimed asphalt pavement. Take at least six representative samples, each at least 7 pounds, from each stockpile. Stockpiles shall not exceed 3000 tons. Sample in accordance with ASTM D 75. Sampling will be observed by the Engineer. Take duplicate samples and submit them with mix design for verification. Test samples in accordance with ASTM D 2172 to determine asphalt cement content; test recovered aggregate in accordance with ASTM C 136 for gradation.

d. Once a reclaimed asphalt pavement stockpile has been approved for use, the stockpile shall be dedicated to the Contract and no reclaimed asphalt pavement may be added to the stockpile. If there is an insufficient amount of reclaimed asphalt pavement in the stockpile to complete the Work, a new, separate stockpile may be made and shall be tested for acceptance as aforementioned.

3. Locate stockpiles of reclaimed asphalt pavement and of new aggregate so as to prevent intermingling.

4. When more than one asphalt plant is to be used to supply asphalt concrete to the construction site, each asphalt plant shall use a similar job mix formula, as approved by the Engineer.

5. Locations and timing of random sampling shall be determined in accordance with Section 6 of FAA ERLPM.

D. Contractor's Quality Control Tests

1. Perform all quality control tests necessary to control the production and construction processes. The testing program shall include, but not necessarily be limited to, tests for the control of asphalt content, aggregate gradation, Marshall properties and temperatures. Obtain samples at the direction of the Engineer for the purpose of quality control testing. Random sampling procedures specified in Section 6 of FAA ERLPM shall be used for determining the selection of samples as follows:

a. Take four samples of freshly mixed material per each lot (one sample from each sublot) for top, bottom, and base courses and bridge deck membrane. Take samples in accordance with ASTM D 979 from material at the mixing plant.

A lot will be defined as one day's production for each mix. Production rates for each mix will be obtained by the Engineer from the asphalt plant at the start of each day's production. A sublot will be defined as a quarter of a lot based on the initial production forecast for the mix. Maximum lot size will be 2000 tons. If a day's production is forecast over 2000 tons, the forecast quantity shall be divided into two or more equal lots. Should actual production be greater than the initial forecast of production for a given mix, the additional production will be divided into the same sublot sizes as initially calculated. If one or two additional sublots are produced they will be added to that days lot with n=5 or 6 for sublots. If three or more additional sublots are produced in a day, an additional lot will be established for that particular day.

If actual production is less than the initial forecast for a given mix but sufficient material was produced to constitute three sublots, a lot will be formed with three sublots (n=3). Should actual production constitute only one or two sublots, the sublots will be added either to the previous lot or the next production lot, whichever is closer in time. Each sublot shall contain a minimum of 75 tons of material.

Where more than one plant is simultaneously producing material for the job, the lot sizes shall apply separately for each plant.

b. Test samples to determine asphalt content in accordance with ASTM D 2172, D 4125 or D 6307. Test recovered aggregate to determine gradation in accordance with ASTM D 5444. In addition, when automated recording plants are used, submit printouts of asphalt content to the Engineer.

c. Prepare three plugs from each sample and test them in accordance with ASTM D 6926 using automatic compaction procedures. Marshall air voids shall be determined in accordance with ASTM D 3203. For each sublot, the maximum theoretical density shall be determined in accordance with ASTM D 2041.

Voids filled with asphalt, for each plant sample, shall be computed as follows:

(1) Determine asphalt content in percentage by volume (I) using:

$$I = \frac{P_b \times G_{mb}}{G_b}$$

Where:

I = Percentage by volume of asphalt

Pb = Percentage by weight of asphalt

Gmb = Bulk specific gravity of compacted mixture

Gb = Specific gravity of asphalt

(2) Determine percent voids filled with asphalt (VF) as follows:

$$VF = \frac{I \times 100}{I + P_a}$$

Where:

VF = Percent voids filled with asphalt

I = Percentage by volume of asphalt

P_a = Percent Marshall air voids

Voids in the Mineral Aggregate (VMA) will be estimated by adding the asphalt content in percentage by volume to the percent of air voids. Bulk specific gravities will be used to calculate VMA.

d. Take hot bin or feeder belt composite samples of top, bottom and base course aggregates and bridge deck membrane mixes at least twice daily and check gradation in accordance with ASTM C 136, including washing material passing No. 8 sieve in accordance with ASTM C 117.

e. At least six times daily, check and record temperatures at necessary locations to determine the temperatures of:

(1) aggregates and asphalt immediately before introduction to the pugmill or dryer drum;

(2) the mixture immediately after discharge from the pugmill or dryer drum;

(3) the mixture at the spreader on the construction site.

f. Reclaimed Asphalt Pavement

(1) Where reclaimed asphalt pavement is being used as a substitute for some of the virgin aggregate, take a sample of freshly mixed recycled asphalt concrete in accordance with ASTM D 979 and determine the moisture content at least twice daily. Moisture determinations shall be based on the weight loss by heating an approximately 4-pound sample of the freshly mixed materials for one hour in an oven at 280 plus or minus 5 degrees F. The moisture content of the freshly mixed recycled asphalt concrete shall not exceed 0.5 percent.

(2) Take a sample of reclaimed asphalt pavement from the approved stockpile at least once daily and test in accordance with ASTM D 2172 to determine asphalt content and gradation in accordance with ASTM D 5444. The resulting asphalt content and aggregate gradation shall be similar to the average test results of the reclaimed asphalt pavement submitted with job mix formula. If there is a variation of plus or minus 1.0 percent in the asphalt content or plus or minus 10 percent in aggregate gradation on any sieve, a second sample shall be taken and tested in the same manner as the first sample. If the results are similar to that of the first sample, appropriate measures shall be taken to adjust the mixture to compensate for the variation in the reclaimed asphalt pavement.

g. Moisture Content of Aggregate

For the drum plants the moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.

h. Moisture Content of Mixture

The moisture content of the mixture shall be determined once per lot in accordance with the procedure given in 1.04 D.1.f(1). The moisture content in the freshly mixed asphalt concrete shall not exceed 0.5 percent. If the moisture content is 0.5 percent or greater, then stop production and adjust plant operation.

i. Perform additional testing as required to ensure that mixtures produced meet the requirements of this Section.

2. Control Charts

Maintain linear control charts both for individual measurements and range (i.e., difference between highest and lowest measurements) for aggregate gradation and asphalt content. When test results exceed certain limiting values, take action to bring the asphalt concrete production process under tighter control. The Action Limit is the limiting value at which corrective actions shall be made while production may continue. The Suspension Limit is the limiting value at which production must be suspended while corrections are made. Production shall not resume until Contractor's corrections are approved by the Engineer.

Post control charts in a location satisfactory to the Engineer and keep charts current. As a minimum, the control charts shall identify the project number, the contract item number, the test number, each test parameter, the Action and Suspension Limits applicable to each test parameter and the Contractor's test results. Use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If in the Engineer's opinion the Contractor's projected data during production indicates a problem and the Contractor is not taking satisfactory corrective action, the Engineer may suspend production or acceptance of the material.

a. Individual Measurements

Establish control charts for individual measurements to maintain process control within tolerance for aggregate gradation and asphalt content. The control charts shall use the job mix formula target values as indicators of central tendency for the following test parameters with associated Action and Suspension Limits:

CONTROL CHART LIMITS FOR INDIVIDUAL MEASUREMENTS		
Sieve	Action Limit	Suspension Limit
1"	±6%	±9%
3/4"	±6%	±9%
1/2"	±6%	±9%
3/8"	±6%	±9%
No. 4	±6%	±9%
No. 8	±5%	±7.5%
No. 16	±5%	±7.5%
No. 30	±3%	±4.5%
No. 50	±3%	±4.5%
No. 100	±2%	±3%
No. 200	±2%	±3%
Asphalt Content	±0.45%	±0.7%

b. Range

Establish control charts for range to control process variability for the test parameters and Suspension Limits listed below. Compute the range for each lot as the difference between the two test results for each control parameter. The Suspension Limits specified below are based on a sample size of n = 2. Should the Contractor elect to perform more than two tests per lot, the Suspension Limits shall be adjusted by multiplying the Suspension Limit by 1.18 for n = 3 and by 1.27 for n = 4.

CONTROL CHART LIMITS BASED ON RANGE	
(Based on n = 2)	
Sieve	Suspension Limit
1"	11 %
3/4"	11 %
1/2"	11 %
3/8"	11 %
No. 4	11 %
No. 8	9 %
No. 16	9 %
No. 30	6 %
No. 50	6 %
No. 100	3.5 %
No. 200	3.5 %
Asphalt Content	0.8 %

c. Corrective Action

The Quality Control Plan shall indicate that appropriate action shall be taken when the asphalt concrete production process is out of tolerance. The Plan shall contain sets of rules to gauge when a process is out of control and shall describe Contractor's actions to bring the process into control. A process shall be deemed out of control and production stopped and corrective action taken, if:

(1) One point falls outside the Suspension Limit line for individual measurements or range; or

(2) Two consecutive points fall outside the Action Limit line for individual measurements.

3. Document quality control efforts using copies of the sample forms contained in the FAA ERLPM, Appendix C, in its entirety, or use Authority forms obtained from the Engineer. Make test results available to the Engineer daily.

4. If a storage silo is used:

a. Check the silo to see that it can properly store the asphalt concrete for the time involved.

b. Take samples of asphalt concrete as it is unloaded from the silo and check them for conformance to this Section. If the asphalt concrete appears segregated, stop using the storage silo until it is demonstrated to the Engineer that the condition has been corrected.

c. Silo storage time is governed by previous State DOT approval, not to exceed 24 hours.

5. Unless otherwise noted on the Contract Drawings, and subject to the approval of the Engineer, select an area to be called a Control Strip from the first day's production of each mix. Each Control Strip shall be a minimum of 100 feet long and two spreader widths wide and shall be constructed to meet the requirements of this Section and in the same manner as the remainder of the course it represents. Take three random samples at the plant and test them for stability, flow and air voids in accordance with 1.04 D.1.c. Take three randomly selected cores from the pavement mat and three along the longitudinal pavement joint and test them to determine density in accordance with 1.04 E.5 and E.6. Use the same means and methods which will be used to construct longitudinal and transverse joints as referred to in 1.04 B.6.h and 3.02 F.1 and F.2.

   The purpose of the Control Strip is to demonstrate that the pavement may be constructed using the proposed equipment and methods of operation and to obtain all quality requirements prior to the start of full production. Construct a new Control Strip whenever there is a change is made in equipment, methods of operation or type or source of material or whenever there is a change in the job mix formula. The Control Strip may become part of the completed pavement if it meets the requirements of this Section.

6. Include, as part of the Quality Control Plan, the use of a nuclear density device to aid in meeting the specified target densities. Calibrate the nuclear density device with the control strip cores. If other than a nuclear density device is used it shall be calibrated with an additional set of pavement cores.

7. Surface Smoothness

   Perform quality control smoothness testing of the final surface. For paving lanes 500 feet or greater in length, the testing equipment shall be capable of measuring the Profile Index of the final surface, in inches per mile using a 0.2 inch blanking band, in accordance with ASTM E 1274. As a minimum test the final surface of pavement, along the center of each paving lane once during each day of paving. Provide written test results to the Engineer after each test. Test results shall identify the location of each test including starting and end stations and offset from centerline of pavement. For paving lanes less than 500 feet, the Contractor shall test the centerline of the paving lanes with a 10-foot long straightedge capable of marking locations which exceed the surface smoothness tolerance. Upon completion of all quality control testing and any required corrective work, the Engineer, in accordance with 1.04 E.10, will perform acceptance testing.

8. Final Surface Grade

Perform quality control surveys immediately after the top course has been compacted, to check final grades. Measure elevations at the finished grade locations shown on the Contract Drawings. Provide the Engineer with the survey results at the completion of each work period. The survey results shall identify the location of each measurement by station and offset, measured elevations to the nearest 0.01foot, required finished grades from the Contract Drawings and the difference between measured elevations and required elevations to the nearest 0.01 foot. This survey is for Contractor's quality control; acceptance of the finished surface shall be as specified in 1.04 E.11.

9. For Work performed, either wholly or in part, in the State of New Jersey, provide a representative present during all paving operations who shall be certified by the New Jersey Society of Asphalt Technologists, Inc. (NJSAT) as an Asphalt Paving Construction Technologist.

E. Engineer's Sampling and Testing

1. Produce asphalt concrete in approved automated plants equipped with interlocks and printouts meeting the requirements of ASTM D 995 and subject to the following:

   a. Plant interlocks and printouts shall be in operation during production and two (2) copies of all printouts shall be furnished to the Engineer daily.

   b. Scales shall be certified by an approved agency at least every 180 calendar days and copies of certifications shall be submitted to the Engineer upon request.

2. Provide labor and equipment to take samples, except cores, to check thickness and density.

3. The Engineer will perform acceptance testing for Marshall air voids, stability and flow. Samples will be taken from trucks at the plant, in accordance with FAA ERLPM, Section 6. These samples will be from the sublots that were sampled in 1.04 D.1.a. The Engineer will prepare three plugs from each sample and test them in accordance with ASTM D 6927 using automatic compaction procedures. The specimen compaction temperatures will be within the following range as measured within 1/2 inch from the outside edge:

Performance Grade	Temperature Degrees F
PG 64-22, PG 70-22	275 - 295
PG 76-22	300 - 320
PG 82-22	305 - 325
PG 64-22 in mixes containing "Rosphalt 50"	390 - 410

Air voids, voids in mineral aggregate and voids filled with asphalt will be determined in accordance with ASTM D 3203 and 1.04 D.1.c. The average test values obtained from each lot of top and bottom courses and bridge deck membrane must conform to the parameters specified in 1.03 C.

In lieu of sampling and testing in the field, the Engineer may sample and perform acceptance testing at the plant. The Contractor will be advised at the start of Work where the Engineer will sample and test.

4. For thickness determination, exclusive of overlay and bridge deck membrane pavement, the Engineer will divide each course into area lots consisting of the area covered by the lot sampled as specified in 1.04 D.1.a and he will further subdivide each lot into four equal sublots. The Engineer will take one 4-inch diameter core randomly in each sublot to check thickness of the top and bottom courses. One-fourth of all such cores will continue through the plant mix macadam base course. Thickness will be determined in accordance with ASTM D 3549.

   For bridge deck membrane, the Engineer will verify the thickness by measuring with an appropriate measuring device through the newly placed membrane course. After the measurement has been obtained, the locations shall be re-sealed to prevent any leakage.

5. Mat Density

   a. The Engineer will determine the in-place density of the Control Strip and subsequently placed pavements by taking cores at random locations as specified below.

   b. Cores taken from the top and bottom courses and bridge deck membrane in place and any other specimens taken at the construction site, sampled in accordance with the random sampling procedures as specified in 1.04 D.1, will be tested by the Engineer for bulk specific gravity in accordance with ASTM D 2726. Cores will not be taken closer than one foot from a transverse or longitudinal joint for pavement mat density determination. The in-place density of the pavement course will be the ratio of the in-place specific gravity to the laboratory Marshall bulk specific gravity expressed as a percentage.

   c. Cores taken from courses containing more than 10 percent air voids will be tested by the Engineer for density (Bulk Specific Gravity) according to the following equation:

$$S.G. = \frac{W}{12.87\, d^2 h}$$

S.G.	=	Bulk Specific Gravity
W	=	Weight, Dry Specimen (grams)
d	=	Measured Diameter* (inches)
h	=	Measured Height* (inches)

   Laboratory bulk specific gravity and computation of in-place density will be as specified in 1.04 E.5.b above.

* Average of 5 equally spaced measurements around the core

d. The average in-place density determination, taken from the area covered by the lot sampled as specified in 1.04 D.1.a, will be determined by the Engineer by summing up the sublot in-place density readings obtained from a lot and dividing the total by the number of sublots. The in-place density from each sublot will be obtained using a core reading taken from each sublot on a random basis and dividing by the Marshall bulk density (ASTM D 6926 and ASTM D 2726) taken for that sublot. Any core with a thickness less than twice the largest sieve size to retain more than 5 percent of any aggregate will be discarded and additional random cores will be taken as required to ensure representative readings.

e. The Engineer will repeat the procedure specified in a. through d. above whenever a change is made in the type or source of material or whenever a new job mix formula is approved for material from the same source.

6. Joint Density

The Engineer will take one joint core from each sublot of all surface courses or from the underlying lifts as defined in 1.04 D.1.a and will test it in accordance with 1.04 E.5. For joint cores the lowest Marshall bulk density for sublots forming the joint will be used to compute the in-place density. The Engineer will take cores from directly over the longitudinal joint in line with the location of the random cores taken under 1.04 E.5.b. When a paving lane has two longitudinal joints, both joints will be cored. The in-place joint density will be determined separately for each joint, and the joint producing the lowest in-place density will be used to determine payment. Based on site and placement conditions the Engineer may elect to core only one joint.

7. In-Place Air Voids

The Engineer will calculate the in-place mat air voids for each sublot in accordance with ASTM D 3203, by comparing the bulk specific gravity (ASTM D 2726) of the cores taken as specified in 1.04 E.5.b to the maximum laboratory specific gravity (ASTM D 2041).

8. Patch all areas where samples are taken with an approved asphalt concrete or Portland cement concrete properly tamped to fill all voids and struck off flush with the surface within 24 hours after sampling.

9. The Engineer may at any time, notwithstanding previous plant approval, reject and require the Contractor to dispose of any batch of asphalt concrete mixture which is rendered unfit for use due to contamination, segregation or incomplete coating of aggregate. Such rejection may be based on only visual inspection. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the Engineer and, if the Contractor can demonstrate in the laboratory, in the presence of and to the satisfaction of the Engineer, that such material was erroneously rejected, the Contractor will be compensated for the material.

10. Surface Smoothness

a. Longitudinal direction for roadways where paving lane lengths equal or exceed 500 linear feet:

(1) The Engineer will test the final surface of the pavement parallel to the direction of paving for smoothness. A lightweight profilometer meeting the requirements of ASTM E 950 Class 1 will be used to measure the pavement surface profile.

(2) The profilometer test results will be used to simulate California profilograph testing of the pavement. The simulation will be used to compute the Profile Index in inches per mile using a 0.2 inch blanking band, in accordance with ASTM E 1274. A third-order Butterworth low pass filter with a filter length (cutoff wavelength) of 2.0 feet will be used. Scallops will be rounded to the nearest 0.01-inch. The blanking band will be centered on a straight line determined by least - squares fit over the length of the lot. The simulation will also be used to identify any surface deviations in excess of 0.4 inch in 25 feet. Designed breaks in grade shown on the Contract Drawings will not be included in the Profile Index computations.

(3) The Contractor shall clean the pavement prior to testing. Testing will be performed on a lot basis. A lot is defined as 500 linear feet of paving lane. When less than 250 feet remains after dividing the pavement into 500 linear foot lots, the remaining length will be added to the adjacent lot. When more than 250 feet remains, a short lot will be tested.

(4) For paving lanes up to 20 feet in width, three measurements will be made along the centerline of paving lanes. The profile index of the lot will be computed by averaging the profile index of each measurement.

(5) For paving lanes greater than 20 feet in width, three measurements will be made at two locations, each six feet from and parallel to the centerline of the paving lane. The Profile Index of the lot will be computed by averaging the Profile Index of each of the two measured profiles.

(6) The Profile Index for the length of paving lane in each lot is converted to the Profile Index of the lot in inches per mile using the following formula:

$$PI = PT \times \frac{5280}{L}$$

Where:

PI = Profile Index, inches per mile

PT = Profile Index, inches per length in feet of paving lane in a lot

L = Length of the paving lane in the lot in feet

b. Longitudinal direction for roadways where paving lane lengths are less than 500 linear feet:

(1) The Engineer will evaluate each paving lane with a 10-foot long rolling straightedge, which marks the length of surface variations that exceed the required tolerance.

(2) The Contractor shall sweep the pavement prior to measurement.

(3) Measurement will be taken along the centerline of each paving lane.

(4) The Engineer will calculate the percentage of final surface which exceeds the required tolerance by dividing the measured length of the marked surface deficiencies by the total length of the paving lane.

c. Longitudinal and transverse direction for parking lots and port container areas:

(1) At the completion of paving, and in the presence of the Engineer, the Contractor shall thoroughly cover the pavement with water using a water distribution vehicle. In areas that do not adequately drain the water from the surface, or otherwise hold water, the Contractor shall remove and replace the deficient area as approved by the Engineer and in accordance with 3.03 A.

11. Final Surface Grade

The grades of the final surface of each lot will be measured at the finished grade locations shown on the Contract Drawings. Where paving lanes are 20 feet or greater in width, an additional line of grades, located at the center of the paving lane and spaced at 25 feet longitudinally, will be measured. A lot is defined as 50,000 square feet of final pavement surface. The transverse limit of the lot will be the transverse limit of paving. Where paving areas are not equally divisible into 50,000 square foot lots, odd sized lots between 25,000 and 75,000 square feet will be used. The odd sized lots will be used for the area remaining after the paved area is divided into 50,000 square foot lots. The Contractor shall perform the survey jointly with the Engineer.

12. The Engineer will perform acceptance testing of modified asphalt to determine if it meets the performance grade requirements set forth in 2.02 B. Samples will be collected at the asphalt plant for each lot of asphalt concrete produced, as specified in 1.04 D.1.a. The Engineer will sample the liquid asphalt from the plant storage tanks which must be equipped with a sample valve.

13. The Engineer will measure the temperature of each load of asphalt concrete. Any load of asphalt concrete with temperature exceeding 350 degrees F will be rejected (excluding mixes that contain "Rosphalt 50" additive). For mixes containing "Rosphalt 50" additive, any load produce with temperature exceeding 500 degrees F will be rejected.

14. Where there is a discrepancy between the Contractor's test results and those of the Engineer, the Engineer's test results shall govern.

15. The Engineer may perform acceptance testing during production to determine if the asphalt concrete meets the Tensile Strength Ratio (TSR) requirements of this paragraph. For each lot of asphalt concrete, defined in 1.04 D.1.a, one sample will be obtained from a truck at the plant and tested in accordance with ASTM D 4867. Suspend production if test results indicate that the TSR is less than or equal to 80 percent. Submit a plan to the Engineer for approval indicating how the problem will be corrected and ensure that TSR values greater than 80 percent will be consistently produced before commencing production once again.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer of asphalt cement shall be approved by either the New York State Department of Transportation (NYSDOT) or the New Jersey Department of Transportation (NJDOT).

B. Modified Asphalt shall be one of the following. No substitutions permitted.

1. "Citgoflex SP" - Citgo Asphalt Refining Co.; Paulsboro, NJ.
2. "Elvaloy RET" - DuPont Co.; Wilmington, DE.
3. "Kraton" - Kraton Polymers, LLC; Houston, TX.
4. "Polykote" - Suit-Kote Corp.; Cortland, NY.
5. "Stylink" - SemMaterials; Gloucester City, NJ.
6. "Vestoplast S" modifier - Evonik Degussa Corp.; Parsippany, NJ.

C. Additive shall be the following. No substitutions permitted.

1. "Rosphalt 50" additive - Chase Construction Products/Royston Div. of Chase Corp.; Pittsburgh, PA.

2.02 MATERIALS

A. Aggregates

1. If the tensile strength ratio of the specimens of composite mixture is less than 80 percent, as specified in 1.03 B.6, the aggregates will be rejected unless the Contractor treats the asphalt with an approved anti-stripping agent. The amount of anti-stripping agent added to the asphalt shall be sufficient to produce a tensile strength ratio of not less than 80 percent.

2. Coarse Aggregate: Material retained on the No. 8 sieve

a. Except for use in the top lift of the top course within the roadway pavement edge markings as shown on the Contract Drawings, coarse aggregate shall conform to ASTM D 692, except as follows: use broken stone or crushed gravel having not less than 75 percent by weight of pieces with two or more fractured faces and 85 percent by weight having at least one fractured face (ASTM D 5821), with a maximum of 8 percent of flat or elongated pieces (ASTM D 4791), with a maximum percentage of wear (ASTM C 131) of 40 percent and with a magnesium sulfate loss (ASTM C 88) of not more than 12 percent for a five-cycle test period.

b. For the top lift of the top course within the roadway pavement edge markings as shown on the Contract Drawings, coarse aggregate shall conform to ASTM D 692 except as follows: use broken stone which shall be trap rock or gneiss of uniform quality obtained from a source approved by the NYSDOT or the NJDOT for use in asphalt concrete. The aggregate shall have not less than 75 percent by weight of pieces with two or more fractured faces, with a maximum of 8 percent of flat or elongated pieces (ASTM D 4791), with a maximum percentage of wear (ASTM C 131) of 30 percent and with a magnesium sulfate loss (ASTM C 88) of not more than 12 percent for a five-cycle test period.

c. A flat particle is one having a ratio of width to thickness greater than five; an elongated particle is one having a ratio of length to width greater than five.

3. Fine Aggregate: Material passing the No. 8 sieve and retained on the No. 200 sieve

Fine aggregate shall be a blend of washed, textured sand and stone screenings conforming to ASTM D 1073 with a maximum percentage of wear (ASTM C 131) of 30 percent and with a magnesium sulphate loss (ASTM C 88) of not more than 18 percent for a five-cycle test period, a plasticity index of not more than 6 and a liquid limit of not more than 25 when tested in accordance with ASTM D 4318. When tested in accordance with ASTM D 2419, the sand equivalent value shall be 35 or greater.

Textured sand shall be defined as sand which when tested in accordance with ASTM C 1252, Method A, results in uncompacted voids greater than 45.0 percent. Sand that has a low texture value and slag shall not be used.

4. Mineral filler shall conform to ASTM D 242 and have a ratio to asphalt cement by weight not exceeding 1.2.

B. Asphalt

Asphalt shall be one of the following conforming to the requirements of AASHTO M320 and as specified within table entitled "Requirements for Performance Graded Asphalts" for the Performance Grade (PG) as shown on the Contract Drawings.

1. Asphalt Cement

Asphalt cement shall meet the requirements for PG 64-22, unless otherwise shown on the Contract Drawings.

2. Modified Asphalt

Modified Asphalt shall be one of the following. No Substitution is permitted.

a. "Stylink", "Kraton (SEBS)", "Polykote", "Elvaloy RET" or "Citgoflex SP" meeting the requirements for PG 76-22 or PG 82-22 as shown on the Contract Drawings.

b. Asphalt cement modified with "Vestoplast S", may be used where PG 76-22 is specified and subject to the following:

(1) Add "Vestoplast S" to the asphalt concrete mixture at a rate of 7 percent by weight of asphalt cement, by substitution.

3. Additive

Where "Rosphalt 50" is used in a mix design, add "Rosphalt 50" additive to the asphalt concrete mixture at a rate of 2.25 percent by weight of total mix.

C. Tack Coat

a. Unless otherwise shown on Contract Drawings, tack coat shall be asphalt cement as specified in 2.02 B.1 above.

b. For mixes containing "Rosphalt 50", use bond coat in place of tack coat as specified in Specification Section 02555.

D. Resultant Asphalt Cement

Resultant asphalt cement shall be a mixture of new asphalt cement as specified in 2.02 B.1 above, asphalt cement extracted from the reclaimed asphalt pavement and recycling agents if required.

REQUIREMENTS FOR PERFORMANCE GRADED ASPHALTS

PERFORMANCE GRADE (PG)	64-22	70-22	76-22	82-22
These Tests Performed on Original Binder:				
Flash Point Temperature (AASHTO T048): Minimum, Degrees Celsius.	230	230	230	230
Dynamic Shear (AASHTO T315): G*/SIN DELTA, Minimum, 1.00 kPa, Test Temperature At 10 Rad/s, Degrees Celsius.	64	70	76	82
Rotational Viscosity (ASTM D 4402): Maximum, 3 Pa-s, Test Temperature, Degrees Celsius.	135	135	135	135
Separation Test - R&B (ASTM D 5976): Percent Difference Maximum Degrees Celsius.	--	--	4.5	4.5
These Tests Performed on Rolling Thin Film Oven Test (RTFOT) Residue:				
Mass Loss (AASHTO T240): Maximum Percent.	1.00	1.00	1.00	1.00
Dynamic Shear (AASHTO T315): G*/SIN DELTA, Minimum, 2.20 kPA, Test Temperature at 10 Rad/s, Degrees Celsius.	64	70	76	82
Elastic Recovery (ASTM D 6084, Method A) 25 Degrees Celsius, 10 cm Elongation, Immediately Cut, 60 Minutes, Minimum Percent.	--	--	75	80
These Tests Performed on Pressure Aging Vessel (PAV) Residue:				
Pav Aging Temperature (AASHTO R028): Degrees Celsius.	100	100	100	100

* Varies from the New Jersey Interagency Engineering Committee Standard

Dynamic Shear (AASHTO T315): G*/SIN DELTA, Maximum, 5000 kPa, Test Temperature at 10 Rad/s, Degrees Celsius.	25	28	31	34
Creep Stiffness (AASHTO T313): S, Maximum, 300 MPa m-Value, Minimum 0.300, Test Temperature at 60 Seconds, Degrees Celsius.	-12	-12	-12	-12

2.03 MIXES

A. Mix Design Table

Mix Designation and Percentage by Weight Passing Sieves								
Sieve Size	Bottom Course	Top Course						Bridge Deck Membrane
	I-2A	I-4A	PA-5	PA-5 with "Rosphalt 50"	I-5A	I-5A with "Rosphalt 50"	I-6A	
1 1/4"	100	---	---	---	---	---	---	---
1"	90-100	100	---	---	---	---	---	---
3/4"	70-84	78-98	100	100	---	---	---	---
1/2"	54-68	64-77	72-98	88-98	100	100	---	---
3/8"	44-54	52-67	60-82	74-84	80-100	90-100	100	100
No. 4	28-36	33-46	40-56	48-58	55-85	55-65	85-93	95-100
No. 8	17-25	27-35	31-39	30-40	32-42	35-45	74-82	71-79
No. 16	12-20	17-23	19-25	24-32	20-30	24-32	---	59-67
No. 30	7-15	12-18	13-19	16-24	12-22	16-24	50-58	47-55
No. 50	5-11	8-12	8-16	10-16	7-16	10-16	24-32	25-35
No. 100	3-9	6-10	5-10	6-10	3-12	6-10	9-15	14-22
No. 200	1-5	3-6	3-6	2-6	2-6	2-6	4-8	12-16
Asphalt, Weight by Percent of Total Mixture								
	3.5-4.5	4.4-5.2	5.2-6.2	***5.0	5.8-6.5	***5.0	6.5-8.00	8.00-9.00**

** Asphalt shall be modified asphalt as specified in 2.02 B.2 above and meet the requirements for PG 76-22.

*** Asphalt binder content prior to addition of "Rosphalt 50". "Rosphalt 50" shall be added to the mix at a rate of 2.25% by weight of the mix (aggregate + binder).

FROM NEW JERSEY INTER-AGENCY ENGINEERING COMMITTEE STANDARD BITUMINOUS CONCRETE MIXTURE DESIGN TABLE			
Mix Designation and Percentage By Weight Passing Sieves			
	Plant Mix Macadam Base Course	Top Course	
Sieve Size	I-1	I-4	I-5
1 1/2"	100	-----	-----
1"	90-100	100	-----
3/4"	60-80	95-100*	-----
1/2"	-----	75-95*	100
3/8"	15-40	65-85*	80-100
No. 4	0-10	35-65	55-75
No. 8	-----	25-50*	30-60*
No. 16	-----	18-40	20-45
No. 30	-----	12-30	15-35
No. 50	-----	10-23*	10-30
No. 100	-----	-----	-----
No. 200	-----	3-6*	3-8*
Asphalt, Weight by Percent of Total Mixture			
	2.5-3.1	5.2-6.5*	5.5-7.0*

Note No. 1 - Material passing the No. 200 sieve may consist of fine particles of the aggregate, mineral filler, or both. Material passing the No. 30 sieve shall be non-plastic when tested in accordance with the requirements of ASTM D 4318.
Note No. 2 - Lift Thickness shall be no less than two times the nominal maximum size of the aggregate (See Note No. 6).
Note No. 3 - If the aggregate does not satisfy tensile strength ratio requirements, add an approved anti-stripping agent (See 2.02 A.1).
Note No. 4 - Job Mix Formula shall follow a smooth curve within the specified limits for all sieve sizes of the Mix Design Table, but should not fall on the maximum density line and should not cross the maximum density line below the No. 4 sieve. The maximum density line will be determined by plotting the gradations on a .45 power graph paper, and drawing a straight line between the amount passing the No. 200 sieve and the amount which is retained on the largest sieve.
Note No. 5 - Notify the Engineer if a satisfactory Job Mix formula using the Mix Design Table cannot be obtained.
Note No. 6 - Nominal maximum size is one sieve size larger than the first sieve to retain more than 10 percent of the aggregate, based on the Contractor's job mix formula.

* Varies from the New Jersey Interagency Engineering Committee Standard

B. Job Mix Formula and Checklist

1. The laboratory used to develop the job mix formula shall meet the requirements of ASTM D 3666. Before construction starts, submit to the Engineer a certification signed by the manager of the laboratory stating that it meets these requirements. The certification shall contain as a minimum:

   a. Qualifications of personnel: laboratory manager, supervising technician and testing technicians.

   b. A listing of equipment to be used in developing the job mix.

   c. A copy of the laboratory's quality control system.

2. Develop Job Mix Formula using procedures contained in Chapter V, "Marshall Method of Mix Design" of the Asphalt Institute's Manual Series No. 2 (MS-2) and where applicable, "Asphalt Hot-Mix Recycling", Manual Series No. 20 (MS-20) and furnish information for the following checklist:

   a. General

      (1) Contractor and Contract number.

      (2) Type of bituminous mixture.

      (3) Type and source of aggregates.

      (4) Type and source of asphalt.

   b. Aggregates

      (1) Sieve analysis of each aggregate to be used in mixture in accordance with ASTM C 136. The minus 200 fraction shall be tested by the laboratory or technician doing the mix design in accordance with ASTM C 117.

      (2) Physical test of aggregates - soundness, wear, percent fractured faces and percent flat or elongated particles.

      (3) Bulk specific gravity and absorption in accordance with ASTM C 127 for coarse aggregate and ASTM C 128 for fine aggregate. The aggregate shall be sampled by the laboratory or technician doing the mix design from the plant hot bins or feeder belt.

      (4) Proportion used of each type aggregate.

      (5) Theoretical gradation of combined proportions of aggregates.

   c. Asphalt

      (1) Type and grade.

      (2) Specific gravity.

      (3) Type of antistripping agent (if required).

   d. Optimum Asphalt Content Determination in accordance with ASTM D 1559

      (1) Compactive effort (75 or 113 blows applied to specimen, each face, as appropriate).

      (2) *Actual specific gravity and unit weight of each specimen.*

      (3) Percentage of asphalt in each specimen.

(4) Theoretical specific gravity of each specimen calculated.

(5) Graph of stabilities vs. asphalt content.

(6) Graph of flow values vs. asphalt content.

(7) Graph of voids filled with asphalt vs. asphalt content.

(8) Graph of Marshall air voids vs. asphalt content.

(9) Graph of voids in the mineral aggregate vs. asphalt content.

(10) Graph of unit weight vs. asphalt content.

(11) Visual description of specimens at optimum asphalt content (i.e., dry, flushing, etc.).

(12) Graph of Temperature vs. Viscosity of Asphalt.

e. Summation of Established Job Mix Formula

(1) Combined gradation of aggregates.

(2) Optimum asphalt content from above graphs.

(3) Specified job mix tolerance range.

(4) Mixing Temperature.

(5) Temperature of mix at point of discharge into haul units.

(6) Compaction Temperature.

f. Summation of the Characteristics of the Mixture at Optimum Asphalt Content

(1) Stability, pounds.

(2) Flow value, hundredths of an inch.

(3) Actual specific gravity of laboratory compacted mixture.

(4) Maximum specific gravity of paving mix at optimum asphalt content in accordance with ASTM D 2041.

(5) Total voids (air), percent, in laboratory compacted mixture.

(6) Voids filled with asphalt, percent, in laboratory compacted mixture.

(7) Voids in the mineral aggregate, percent, in laboratory compacted mixture.

(8) Actual unit weight, lbs./cu. ft. of laboratory compacted mixture.

(9) Tensile Strength Ratio - ASTM D 4867.

g. Verification of Job Mix Formula Characteristics

Where the asphalt content for the proposed Job Mix Formula does not coincide with the asphalt content used in the trial specimens, an additional set of specimens shall be prepared for the proposed Job Mix Formula asphalt content to verify that actual Marshall results duplicate those anticipated from the curves.

PART 3. EXECUTION

3.01 PREPARATION

A. Clean all underlying pavement surfaces and previous courses of all loose and foreign material by sweeping with hand brooms, power sweepers or blowers as directed by the Engineer. Remove permanent pavement markings and reflectors.

B. Verify that required grade and density tolerances of previous courses have been obtained before placing asphalt concrete.

C. Construct keyways for overlay pavements as shown on the Contract Drawings by using longitudinal or transverse cuts into the existing pavement, and removing the necessary amount of pavement to provide a smooth transition from the new to existing asphalt concrete surfaces.

D. Tack Coat

1. Apply tack coat by brush on edges of all previously placed or existing pavement and surfaces of manholes and other structures that will be in contact with pavement course to be placed.

2. Apply tack coat by pressure distributor to existing pavement surface to receive new pavement course or where a course is not placed within 24 hours for roadway areas *after placement of the underlying course, except as specified in 3.02 E.7 and* 3.02 F.2. However, if the underlying pavement course has not been exposed to traffic and, in the opinion of the Engineer, is kept clean, tack coat shall not be required when a course is placed beyond the time frame mentioned above.

3. Unless otherwise shown on the Contract Drawings, the tack coat shall be at an application rate and temperature range of 0.05 to 0.10 gallons per square yard and 275 to 350 degrees F, respectively. The tack coat application rate for Portland cement concrete surfaces shall be 0.10 to 0.15 gallons per square yard.

4. Protect structures such as manhole frames and covers, joints and steel faced curbs within areas to be tack coated, prior to tack coating, by masking them with tar paper, polyethylene film or other approved materials.

5. After the application of tack coat, follow immediately with placement of asphalt concrete pavement course. Take precautions necessary to maintain and protect the tack coated surface from damage until the next course is placed, including placement and removal of sand as necessary to blot up excess material.

6. All tack coated surfaces shall be paved or protected prior to opening the area to traffic.

E. Mixing Plant Requirements for Recycled Asphalt Concrete

1. Batch plants shall have an appropriately located metering device for adding the reclaimed asphalt pavement to the heated new aggregate and shall provide an accurate method for proportioning the reclaimed asphalt pavement into the mixture.

2. The batch plant's dryer may have to be operated at temperatures higher than with all new materials. If necessary, modify the dryer and the dust collection system to prevent damage.

3. Drum-mix plants shall have an appropriately located metering device for adding the reclaimed asphalt concrete to the dryer-mixer in a manner that does not damage the asphalt in the reclaimed material. Ensure that an accurate method for proportioning the reclaimed asphalt concrete into the mixture is provided. Make provisions for compensating for the moisture in the reclaimed asphalt concrete.

4. The mixing for a drum-mix plant shall be such as to achieve an intimate blending of the new and reclaimed materials and a complete coating of all aggregate particles.

5. At the Contractor's option, the batch or drum-mix plant may be equipped with a surge-storage bin at the mixture discharge point.

3.02 APPLICATION

A. Mixing in Plant

1. Place aggregate through a dryer and heat to temperature not exceeding 350 degrees F (excluding mixes that contain "Rosphalt 50" additive). For mixes containing "Rosphalt 50" additive, place aggregate through a dryer and heat to temperature not exceeding 550 degrees F.

2. Screen aggregate to appropriate fractions and place each fraction in a storage bin over mixer unit.

3. Use equipment conforming to ASTM D 995 for preparation of paving mixtures, except provide one bin for fine aggregate, three for coarse aggregate, and one for reclaimed asphalt pavement (if applicable).

4. Introduce aggregate into mixer at between 250 and 350 degrees F (between 450 and 500 degrees F for mixes containing "Rosphalt 50" additive) and dry mix for minimum of 5 seconds (7 seconds for mixtures containing "Vestoplast S", 10 seconds for mixes containing "Rosphalt 50" additive) before adding asphalt. Where reclaimed asphalt pavement or "Vestoplast S" is used, add to mixer after dry mixing and before asphalt cement. Where "Rosphalt 50" additive is used, add to the mixer during the dry mixing.

5. Heat asphalt to a temperature not exceeding 325 degrees F (350 degrees F for modified asphalt) and introduce it into mixer at a temperature of not less than 275 degrees F (300 degrees F for modified asphalt).

6. Mix as long as necessary, but not less than 30 seconds (not less than 70 seconds for mixes containing "Rosphalt 50" additive) after introduction of asphalt cement, to completely and uniformly coat aggregate particles.

7. Regulate temperature of mixture according to outdoor temperature and as necessary to meet minimum laydown temperatures specified in 1.03 A.3 and 4. However, asphalt concrete mix production temperatures leaving the plant shall be as follows:

Type of Asphalt	Temperature Degrees F
Asphalt Cement	275 - 325
Modified Asphalt – PG 76-22	305 - 335
Modified Asphalt – PG 82-22	310 - 340
Asphalt containing "Rosphalt 50"	410 - 450

Any deviation from these temperatures must be approved by the Chief of Materials Engineering, Materials Engineering Unit. Use of storage silos will be permitted provided such silos are approved as specified in 1.04 D.4.

B. Delivery, Placing and Spreading

1. Trucks used for hauling asphalt concrete mixtures shall have tight, clean and smooth metal beds free from kerosene and other solvents. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened. Trucks used for hauling asphalt concrete mixtures containing "Rosphalt 50" additive shall have heated bodies and a suitable cover to protect the mixture from adverse weather which shall be securely fastened.

2. Load trucks using a minimum of three drops. About 40 percent of the total weight of the mix to be hauled shall be loaded into the center of the front half of the truck. The truck shall then be pulled forward so that the next 40 percent or so of the total load can be deposited into the center of the back half of the bed, near the tailgate. The vehicle shall then be moved backward so that the remaining 20 percent of the mix can be dropped into the center of the bed, between the first two piles.

3. Deliveries shall be scheduled so that placing and compacting of mixture is uniform without stopping and starting of the paver. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified herein, and allowed to cool to ambient temperature.

4. Spread evenly, screed and finish each course to tolerances and requirements specified in this Section.

5. Asphalt concrete pavers shall be self-propelled, with an activated screed, heated as necessary, and shall be capable of spreading and finishing courses of asphalt concrete which will meet the specified thickness, smoothness and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

   The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required smoothness and texture without tearing, shoving or gouging the mixture.

6. An automatic screed control system shall be used which is capable of automatically maintaining the specified screed elevation and transverse slope. The control system shall be automatically actuated from a reference system by a sensor.

   The control system shall be capable of working in conjunction with any of the following reference systems:

   a. Ski-type device 40 to 60 feet in length.

   b. Taut stringline (wire) set to grade.

   c. Laser beam set to grade.

7. Before commencing each day's paving, clean the paver of any material left from previous paving operations.

8. Place in minimum of 10-foot wide strips, except that the last strip may be a lesser width if necessary.

9. Begin along high sides of areas and proceed towards low side of areas with a one directional slope. Start on centerline and work both ways for crowned pavements.

10. The longitudinal joint in one lift shall offset the longitudinal joint in the lift immediately below by at least 1 foot; however, the longitudinal joint in the surface lift shall be at the centerline of the pavement. Transverse joints in one lift shall be offset by at least 10 feet from transverse joints in the previous lift. Within the same lift, transverse joints in adjacent lanes shall be offset a minimum of 10 feet.

11. When starting paving operations at transverse joints, provide four starting block strips under full length of paver screed. Blocks shall be of a thickness appropriate for the lift being placed.

12. The paver's hopper shall be kept half full throughout the paving day. The wings shall not be emptied until the end of the paving day. Residual material shall be disposed of off Authority property.

13. No raked asphalt concrete material shall be broadcast back onto the pavement mat. Raked material shall be placed back in the paver hopper or disposed of.

14. Use hand placing and finishing methods, as approved by the Engineer, in small areas where use of power equipment is impractical. Lutes shall be used for hand spreading.

15. After density requirements have been meet, and a minimum of one hour after completion of rolling, reduce mat temperature by the controlled application of water, as directed by the Engineer. The compacted mat shall be allowed to cool to 140 degrees F before opening to vehicular traffic.

C. Grade Control

1. Remove grade stakes just prior to rolling of the plant mix macadam base course.

2. The Engineer will provide bench marks and alignment controls adjacent to each area of construction, which shall be checked and maintained by the Contractor.

3. Perform Contractor's quality control surveys immediately after top course has been rolled to check final surface grades, in accordance with 1.04 D.8.

4. Establish and maintain required lines and grades, including crown and cross slope, for each course during paving operations.

5. Use only qualified surveyors licensed in the State in which Work is being performed.

D. Compaction Equipment

1. Use power rollers weighing not less than 10 tons, having wheel loads of at least 250 lbs./linear inch of combined static and dynamic force and equipped with adjustable scrapers to keep wheel surfaces clean and with efficient means of keeping them wet to prevent the mixture from sticking to the roller.

2. Use types and quantities of equipment as necessary to meet all quality and production requirements of this Section.

3. Do not use steel rollers with pits, flat spots or grooves worn into rolling surface. Roller shall be capable of reversing without backlash.

4. Keep roller on asphalt concrete to avoid contamination of pavement with foreign material.

E. Rolling

1. Commence as soon as material will sustain roller without undue displacement, cracking or shoving.

2. The speed of the roller shall at all times be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Immediately correct any displacement occurring as a result of reversing the direction of the roller, or from any other cause.

3. The sequence of rolling operations shall be at the discretion of the Contractor.

4. Perform rolling with types and quantity of rollers as may be necessary to satisfy all of the pavement quality requirements specified herein.

5. Do not re-roll cold in-place asphalt concrete with a steel wheel or vibratory roller to attempt to increase density. A pneumatic tire roller may be used, subject to approval by the Engineer.

6. At end of each day's operations or when paving is interrupted sufficiently to allow mixture to cool, make a stop by means of tapering the course and form a transverse joint.

7. When resuming operations, cut back joint to expose a granular surface for full depth of the course, paint exposed edge with tack coat, place fresh mixture against joint, tamp and roll.

8. Any pavement that becomes loose and broken or mixed with dirt, develops check-cracking, or is in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at no cost to the Authority. Skin patching shall not be allowed.

9. For asphalt concrete mixes containing "Rosphalt 50", breakdown rolling shall begin immediately after laydown and finish rolling shall be performed when the mix temperature is between 210 degrees F and 140 degrees F.

F. Joints

1. Form of all joints in such a manner as to ensure a continuous bond between the courses and obtain the required density, as demonstrated, tested and approved in the control strip. All joints shall have the same texture as other sections of the course and meet the requirements for density, smoothness and grade. Minimize raking of joints. Any mix raked from joint shall be discarded and not broadcast back onto the mat.

2. For transverse joints, the roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a temporary stop. After a temporary stop and prior to the continuation of paving, the tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face before placing the adjacent lane. Apply tack coat on all newly exposed contact surfaces before placing any fresh mixture against the joint.

3.03 CORRECTIONS OF DEFICIENCIES

A. Deficiencies in Surface Smoothness

1. Make corrections as specified below at no cost to the Authority in the event of the following:

   a. Longitudinal Smoothness for roadways where paving lane lengths equal or exceed 500 linear feet.

      (1) The Profile Index exceeds 22.0 inches per mile, or the surface profile deviations exceed 0.4 inches in 25 feet, when tested in accordance with 1.04 E.10.a, unless the Engineer elects to accept the deficient surface subject to an adjustment to Contract compensation. Adjustments to Contract compensation will be made as set forth in 4.01 H and I.

   b. Longitudinal and transverse direction for parking lots and port container storage areas.

      (1) In areas that do not adequately drain the water from the surface, or otherwise hold water.

   c. Longitudinal direction for roadways where paving lane length is less than 500 feet.

      (1) 15 percent of all measurements in a paving lane exceed the requirements of 1.03 D.1.c when tested in accordance with 1.04 E.10.b.

      (2) Any deviations exceeding 1/4 inch when tested with a 10-foot straightedge.

2. The area of deficiencies in surface smoothness and/or surface grade tolerance shall be defined as the area of the lot defined in 1.04 E.10.a.(3), b.(1), except for parking lots and port container storage areas where the area of deficiencies will be determined by the Engineer based on the results of the test specified in 1.04 E.10.c.

3. Remove and replace, or diamond grind, pavement deficient in surface smoothness, in accordance with all applicable requirements of the Contract Drawings and this Section, at times approved by the Engineer, so as not to interfere with operations of the Authority or others using the area.

4. Remove and replace shall mean milling a minimum depth of twice the nominal maximum aggregate size of the asphalt concrete and repaving to the finished grade shown on the Contract Drawings with the same type asphalt concrete mix as removed. Existing pavement shall be removed as necessary to provide square joints for the full depth of the overlay.

5. Diamond grinding may be used to correct deficiencies in surface smoothness and surface grade tolerance subject to approval by the Engineer. However, if removal of more than 3/4 inch of pavement is required to correct any deficiency, the deficient area shall be removed and replaced.

6. Diamond grinding equipment shall be approved by the Engineer and have a minimum grinding head of 36 inches and at least 5 blades per inch of shaft. Diamond grinding shall not be performed when the temperature of the asphalt concrete surface exceeds 80 degrees F. Slurry produced from grinding operations shall be properly disposed of off Authority property.

7. Where corrections are required, the entire width of the paving lane by the length of defective area shall be corrected. In the sole opinion of the Engineer, if the deficiencies are closely spaced and correcting individual areas will adversely affect ride, the entire pavement surface shall be corrected.

8. Following the correction of deficiencies, the Engineer will retest the finished surface of the asphalt concrete. In the event the Profile Index or surface profile deviations exceed the required values, make additional corrections at no cost to the Authority.

B. Deficiencies in In-Place Air Voids of Top and Bottom Courses and Bridge Deck Membrane

1. With the exception of bridge deck membrane, any pavement sublot with in-place mat air voids less than 2.0 percent or greater than 8.0 percent (9.0 percent for bottom course and materials placed on roadway structures) shall be removed and replaced at no additional cost to the Authority. For mixes containing "Rosphalt 50" additive, any pavement sublot with in-place mat air voids greater than 6.0 shall be removed and replaced at no additional cost to the Authority. For paving lifts other than the top lift of asphalt concrete, the Engineer may elect to accept deficient material subject to an adjustment to Contract compensation. Adjustments to Contract compensation will be made as set forth in 4.01 G.

2. For bridge deck membrane, any pavement sublot found to be below the lower density limit as specified in 1.03 D.2.a or having air voids greater than 2.0 percent shall be removed and replaced at no additional cost to the Authority.

C. Deficiencies in Marshall Stability and Flow

In accordance with 1.03 C.2 for stability and flow, if the Percentage of Material Within Tolerance Limits (PWL) of a lot for either parameter as set forth in 4.03 B.5 equals or exceeds 90 percent, the lot will be acceptable. If the PWL for either parameter is less than 90 percent, determine the reason and take corrective action immediately. If the PWL is below 80 percent for either parameter, stop production and make adjustments to the mix.

D. Deficiency in Final Surface Grade

1. When more than 15 percent of all measurements within a lot exceed the grade tolerance, measured in accordance with 1.04 E.11, remove and replace or diamond grind the entire lot in accordance with 3.03 A, unless the Engineer elects to accept the deficient surface, subject to Contract compensation. Adjustments to Contract compensation will be made as set forth in 4.01 H and I.

2. When any individual measurement exceeds a grade tolerance of plus or minus 0.06 foot, remove and replace the surface of the area exceeding the tolerance in accordance with 3.03 A.

3. Following the correction of deficiencies, the Engineer will retest the final surface of the asphalt concrete. In the event grade tolerance is exceeded, make additional corrections at no cost to the Authority.

E. Deficiencies in the Performance Grade Requirements of Modified Asphalt

Remove and replace the deficient material on a lot basis, unless the Engineer elects to accept the deficient material subject to an adjustment to Contract compensation. Adjustments to Contract compensation will be made as set forth in 4.01 G.

F. Deficiencies for Tensile Strength Ratio (TSR)

Remove and replace the deficient material on a lot basis if the TSR is less than or equal to 60 percent , unless the Engineer elects to accept the deficient material subject to an adjustment to Contract compensation. Adjustments to Contract compensation will be made as set forth in 4.01 G.

PART 4. ADJUSTMENTS TO CONTRACT COMPENSATION

4.01 GENERAL

A. Where the Contract requires less than 500 tons of asphalt concrete, no adjustments to Contract compensation will be made as specified herein.

B. Where the Contract requires 500 tons or more of asphalt concrete, adjustments to Contract compensation will be made as specified in 4.03 A, B, C, D, E and F.

C. Notwithstanding other adjustments to Contract compensation or corrections specified herein for various deficiencies, no payment will be made for material placed above the allowable tolerance above required grade as specified in 1.03 D.4, or for material that must be removed to correct deficiencies, or for that material placed in excess of the plus tolerance for the total thickness of each course as specified in 1.03 D.3.

D. The computations for adjustments to Contract compensation may require conversion between tons and square yards. Such conversion will be made using the actual computed weight per square yard per inch of thickness determined from the lot's average bulk specific gravity for each type of course times the density of water at 70 degrees F.

E. Adjustments to Contract compensation for in-place mat densities, in-place joint densities for surface course and Marshall air voids shall be determined by applying percentages, calculated as specified in 4.03 B, to the assigned unit price of Sixty Dollars ($60.00), One Hundred Sixty Dollars ($160.00) for mixes containing "Rosphalt 50", per ton of asphalt concrete; or in the case of Classified Work, by applying such percentages to the actual Contract Unit Price bid for the appropriate asphalt concrete item in the Schedule of Unit Prices for Classified Work, but in no case less than Sixty Dollars ($60.00), One Hundred Sixty Dollars ($160.00) for mixes containing "Rosphalt 50", per ton of asphalt concrete.

F. The percentage adjustment to the unit price specified in 4.01 E for Marshall air voids, mat density and joint density of the surface course shall be as follows, except as set forth in 4.01 G:

1. When all values calculated in accordance with 4.03 B are 100 percent or greater, the highest value will be used to adjust Contract compensation.

2. When all values calculated in accordance with 4.03 B are less than 100 percent, the lowest value will be used to adjust Contract compensation.

3. When values calculated in accordance with 4.03 B are both greater and less than 100 percent, the product of the highest and lowest value will be used to adjust Contract compensation.

G. When the Engineer elects to adjust Contract compensation in lieu of removal and replacement of material with deficient in-place mat air voids, tensile strength ratio or deficiencies in modified asphalt performance grade, the percentage adjustment to the unit price specified in 4.01 E will be set at 50 percent. No further adjustment will be made for *Marshall air voids, mat density or joint density of the surface course.*

H. Adjustments for surface smoothness and final surface grade will be based on the final test results, which will be measured after the correction of deficiencies. Reductions in payment will be determined by the following:

$R = A \times D \times F \times T \times 0.00646$

Where:

R = Reduction in payment per lot for surface smoothness or final surface grade, dollars

T = Thickness of final pavement lift, inches

A = Area of lot, square feet

D = Price per ton of asphalt concrete, assigned unit price or contract unit price as set forth in 4.01 E

F = Contract Unit Price Adjustment Factor specified in 4.03 D and 4.03 E

Reductions in payment for failure to meet surface smoothness and final surface grades will be calculated separately for the entire pavement or overlay surface. Deductions from Contract compensation will be made for the requirement (surface smoothness or final surface grade) which results in the greatest payment reduction. Reductions for surface smoothness or final surface grade will be in addition to all other adjustments to Contract compensation.

I. When the Engineer elects to adjust Contract compensation in lieu of correcting areas with deficiencies in surface smoothness or final surface grade, the Contract Unit Price Adjustment Factor specified in 4.01 H will set at 0.10 for surface smoothness and 0.25 for final surface grade.

4.02 ADJUSTMENT TO CONTRACT COMPENSATION FOR THICKNESS DEFICIENCY IN PLANT MIX MACADAM BASE COURSE

A. Where the deficiency of a plant mix macadam base course core exceeds the allowable minus tolerance in plant mix macadam base course thickness, one additional core will be taken by the Engineer in each of the other three sublots adjacent to the core taken in accordance with 1.04 E.4. Plant mix thickness for the area of entire lot will be the average of the four cores.[2] Where there is a deficiency in the average of the four cores in excess of the allowable minus tolerance, the total thickness of succeeding courses in the area of entire lot shall be increased by the amount the deficiency exceeds the allowable tolerance.

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[2] In determining average thickness, if any core exceeds required thickness by more than 1/2 inch, the thickness of that core will be assumed to be 1/2 inch in excess of required thickness.

B. For each additional lot resampled in accordance with 4.02 A above, there will be deducted from the Contract compensation, in addition to adjustments for deficiencies as hereinafter specified, an amount of One Thousand Dollars ($1,000.00).

4.03 ADJUSTMENT TO CONTRACT COMPENSATION FOR DEFICIENCIES IN TOP AND BOTTOM COURSES AND BRIDGE DECK MEMBRANE

A. Deficiency in Thickness

Thickness of each course, excluding overlay, will be the average of the four cores in the lot for each course[3]. Deductions from Contract compensation for deficiencies in thickness of top course or total of top and bottom courses, modified as may be required by 4.02 A, will be the following amounts (deducted per square yard) for the entire area lot:

Amount of Minus Deficiency (inches)	Amount of Payment Deduction (Dollars per Square Yard)
Greater than 1/4 and up to 1/2	1.00
Greater than 1/2 and up to 3/4	2.00

For minus deficiencies in excess of 3/4 inch either in average of four cores or in any individual core, at the Engineer's option, remove and replace deficient pavement or place an overlay that will satisfy all requirements of this Section.

B. Deficiency in In-Place Mat Density, In-Place Joint Density and Marshall Air Voids

1. Top and bottom courses shall be approved on a lot basis with each lot coinciding with that defined in 1.04 D.1.a.

2. Density

   a. In-place mat density specified in 1.03 D.2.a will be evaluated for Section compliance using the average of the random sublot in-place density determinations from cores of the area covered by the lot specified in 1.04 D.1.a.

   b. In-place joint density specified in 1.03 D.2.b will be evaluated for Section compliance using the average of random sublot in place joint density determinations from cores of the area covered by the lot specified in 1.04 D.1.a.

3. Marshall air voids will be evaluated for Section compliance using the average of the random sublot void determinations from hot mix samples from the lot specified in 1.04 D.1.a.

4. The Engineer will check each lot for in-place mat densities, in-place joint densities for surface courses only, and Marshall air voids with adjustments to Contract compensation based on the Percentage of Material Within Tolerance Limits (PWL) as determined by 4.03 B.5 below and by the "Table For Estimating Percent of Lot Within Tolerance Limits-PWL (Standard Deviation Method)". No deficient lot will be approved without an adjustment to Contract compensation made in accordance with the tables entitled "Adjustment to Contract Compensation For In-Place Mat Density and Marshall Air Voids" and "Adjustment to Contract Compensation for In-Place Joint Density".

[3] In determining average thickness, if any core exceeds required thickness by more than 1/4 inch, the thickness of that core will be assumed to be 1/4 inch in excess of required thickness.

5. Method of Estimating Percentage of Material Within Tolerance Limits (PWL)

a. Locate sampling positions on the lot by use of random sampling procedures specified in FAA ERLPM, Section 6.

b. Make a measurement at each location, or take a test portion and make the measurement on the test portion in accordance with 1.04 D and E.

c. Determine the average value of all samples ($\overline{X}$).

d. Find the standard deviation (Sn) by use of the following formula:

$$S_n = \sqrt{d_1^2 + d_2^2 + d_3^2 + \ldots + d_n^2/n-1}$$

Where

S_n	=	standard deviation of the number in the set
$d_1, d_2,$	=	deviation of the individual sample values $X_1, X_2, \ldots$ from the average value that is,
d_i	=	$(X_1 - \overline{X})$, $d_2 = (X_2 - \overline{X})$, $d_n = (X_n - \overline{X})$
n	=	number of sublots

e. Find the Lower Quality Index (QL) by subtracting the lower tolerance limit (L) from the average values ($\overline{X}$) and dividing the result by standard deviation (Sn).

$$Q_L = \frac{\overline{X} - L}{S_n}$$

f. Find the Upper Quality Index (QU) by subtracting the average value ($\overline{X}$) from the upper tolerance limit (U) and dividing the result by standard deviation (Sn).

$$Q_U = \frac{U - \overline{X}}{S_n}$$

g. The percentage of material above lower tolerance limit (PL) and the percentage of material below upper tolerance limit (PU) will be found by entering the "Table For Estimating Percent of Lot Within Tolerance Limits - PWL (Standard Deviation Method)" with QL and QU, using the column appropriate to the total number (n) of sublots and reading the number under the column headed "Percent Within Tolerance Limits (PWL)". If the values fall between values shown on the table, use the next higher value for PL or PU.

h. For asphalt concrete properties with only a lower tolerance limit (stability, mat density, joint density), the Percentage of Material Within Tolerance Limits (PWL) equals PL. For asphalt properties with upper and lower tolerance limits (air voids and flow) determine PWL using the following formula:

$$PWL = (P_U + P_L) - 100$$

i. If the tests within a lot include a very large or a very small value which appears to be outside the limits of variation, the Engineer will check for an outlier in accordance with ASTM E 178, at a significance level of 5 percent, to determine if this value will be discarded when computing Percentage of Material Within Tolerance Limits (PWL).

C. Adjustment to Contract compensation for each lot will be made in accordance with the formula contained in the table entitled "Adjustment to Contract Compensation For In-Place Mat Density and Marshall Air Voids" by entering the appropriate row with the value of PWL and performing the calculation indicated for that PWL to determine the percentage adjustment of the unit price (specified in 4.01).

ADJUSTMENT TO CONTRACT COMPENSATION FOR IN-PLACE MAT DENSITY AND MARSHALL AIR VOIDS	
Percentage of Material Within Tolerance Limits (PWL)	Percentage Adjustment of the Unit Price (specified in 4.01 E and 4.01 F)
96-100	106
90-96	PWL + 10
80-90	0.5 (PWL) + 55
65-80	2.0 (PWL) – 65
Below 65	15

D. Deficiency in Final Surface Grade Tolerance

Adjustment to Contract compensation for each lot will be made using the table entitled "Adjustment to Contract Compensation for Exceeding Final Surface Grade Tolerance" by entering the appropriate row with the percentage of all measurements within a lot which exceed the grade tolerance, measured in accordance with 1.04 E.11, and reading the number under the column headed "Contract Unit Price Adjustment Factor".

ADJUSTMENT TO CONTRACT COMPENSATION FOR EXCEEDING FINAL SURFACE GRADE TOLERANCE	
Measurements Exceeding Grade Tolerance (Percent)	Contract Unit Price Adjustment Factor
0.0 – 5.0	0.00
5.1 – 10.0	0.05
10.1 – 15.0	0.25
15.1 and up	Corrective work required as specified in 3.03 D

The Contract Unit Price Adjustment Factor is used to calculate adjustments to Contract compensation as specified in 4.01 H.

E. Deficiency in Surface Smoothness

Adjustment to Contract compensation for each lot will be made using the table entitled "Adjustment to Contract Compensation for Surface Smoothness", by entering the appropriate row with the Profile Index, measured and calculated in accordance with 1.04 E.10, and reading the number under the column headed "Contract Unit Price Adjustment Factor".

ADJUSTMENT TO CONTRACT COMPENSATION FOR SURFACE SMOOTHNESS	
Average Profile Index (inches per mile)	Contract Unit Price Adjustment Factor
0.0 - 15.0	0.00
15.1 - 16.0	0.02
16.1 - 17.0	0.04
17.1 - 18.0	0.06
18.1 - 20.0	0.08
20.1 - 22.0	0.10
22.1 and up	Corrective work required as specified in 3.03 A

The Contract Unit Price Adjustment Factor is used to calculate adjustments to Contract compensation as specified in 4.01 H.

F. Adjustment to Contract compensation for each lot will be made in accordance with the formula contained in the table entitled "Adjustment to Contract Compensation for In-Place Joint Density" by entering the appropriate row with the value of PWL and performing the calculation indicated for that PWL to determine the percentage adjustment of the unit price (specified in 4.01 E.).

ADJUSTMENT TO CONTRACT COMPENSATION FOR IN-PLACE JOINT DENSITY	
Percentage of Material Within Tolerance Limits (PWL)	Percentage Adjustment of the Unit Price (specified in 4.01 E and 4.01 F)
96 – 100	106
90 – 96	PWL + 10
80 – 90	0.25 x PWL + 77.5
65 – 80	PWL + 17.5
Below 65	[9]

[9] The lot shall be removed and replaced to meet Section requirements as ordered by the Engineer. In lieu thereof, and subject to the provisions in 3.03 B for mandatory removal and replacement, the Contractor and the Engineer may agree in writing that, for purposes of practicality, the deficient lot shall not be removed and adjustment to Contract compensation shall be made at 75 percent of the unit price specified in 4.01 E.

TABLE FOR ESTIMATING PERCENT OF LOT WITHIN TOLERANCE LIMITS - PWL (STANDARD DEVIATION METHOD)

Percent Within Tolerance Limits (PWL)	Positive Values of Q_L or Q_U n = Number of Sublots					
	n = 3	n = 4	n = 5	n = 6	n = 7	n = 8
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4716
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630
87	1.0597	1.1100	1.1173	1.1191	1.1199	1.1204
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015
83	0.9939	0.9900	0.9785	0.9715	0.9672	0.9643
82	0.9749	0.9600	0.9452	0.9367	0.9325	0.9281
81	0.9550	0.9300	0.9123	0.9025	0.8966	0.8928
80	0.9342	0.9000	0.8799	0.8690	0.8625	0.8583
79	0.9124	0.8700	0.8478	0.8360	0.8291	0.8245
78	0.8897	0.8400	0.8160	0.8036	0.7962	0.7915
77	0.8662	0.8100	0.7846	0.7716	0.7640	0.7590
76	0.8417	0.7800	0.7535	0.7401	0.7322	0.7271
75	0.8165	0.7500	0.7226	0.7089	0.7009	0.6958

TABLE FOR ESTIMATING PERCENT OF LOT WITHIN TOLERANCE LIMITS - PWL (STANDARD DEVIATION METHOD)

Percent Within Tolerance Limits (PWL)	Positive Values of Q_L or Q_U n = Number of Sublots					
	n = 3	n = 4	n = 5	N = 6	n = 7	n = 8
74	0.7904	0.7200	0.6921	0.6781	0.6701	0.6649
73	0.7636	0.6900	0.6617	0.6477	0.6396	0.6344
72	0.7360	0.6600	0.6316	0.6176	0.6095	0.6044
71	0.7077	0.6300	0.6016	0.5878	0.5798	0.5747
70	0.6787	0.6000	0.5719	0.5583	0.5504	0.5454
69	0.6490	0.5700	0.5423	0.5290	0.5213	0.5164
68	0.6187	0.5400	0.5129	0.4999	0.4924	0.4877
67	0.5878	0.5100	0.4836	0.4710	0.4638	0.4592
66	0.5563	0.4800	0.4545	0.4424	0.4354	0.4310
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4031
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855
56	0.2164	0.1800	0.1688	0.1636	0.1613	0.1592
55	0.1806	0.1500	0.1408	0.1363	0.1338	0.1322
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057
53	0.1087	0.0900	0.0843	0.0817	0.0802	0.0792
52	0.0725	0.0600	0.0562	0.0544	0.0534	0.0528
51	0.0363	0.0300	0.0281	0.0272	0.0267	0.0264
50	0.0	0.0	0.0	0.0	0.0	0.0

G. Additional Tests

1. In the event the Contractor elects to question the original density test results obtained from a particular lot for either the mat density or joint density, the Contractor may request additional testing of that lot in writing within 48 hours of receipt of the written test results from the Engineer. Upon written request received from the Contractor for such additional testing, the Engineer will test one additional sample from each sublot from randomly selected locations in the pavement where the lot was placed. The redefined test will consist of the Engineer's original samples and the additional Contractor's requested samples. The "Percent of Material Within Tolerance Limits-PWL" will be determined in accordance with 4.03 B.5. The value will be used to determine any adjustment to Contract compensation. Only one resampling per lot will be permitted.

2. Additional tests requested by the Contractor shall be paid for by the Contractor to the Authority at a cost of One Thousand Dollars ($1,000) per lot tested.

4.04 ADJUSTMENT TO CONTRACT COMPENSATION FOR CHANGES IN THE INDEX PRICE OF ASPHALT CEMENT

A. General

An adjustment to Contract compensation will be made for changes in the index price of the asphalt cement in asphalt concrete and plant mix macadam base and for tack coat, as set forth in 4.04 C, provided that the Contract requires a total of 500 tons or more of asphalt concrete and plant mix macadam base course.

B. Method of Measurement

1. Asphalt concrete including top course and bottom course and plant mix macadam base course will be measured by the ton. The weight will be determined by one of the following methods:

a. A weigh ticket printed by an automatic printer system used in conjunction with an automated batching and mixing system. The printed ticket shall show the date, the individual weights of the various components of the asphalt concrete or plant mix macadam base course mixture in a batch, the total weight of each batch, and the sum of the all batch weights in the truckload. At the completion of each day's work, a producer's representative shall certify in writing that the total weight supplied was correct.

b. A weigh ticket printed by an automatic scale showing the tare and gross weights of the truck as determined for each trip and the time and date indicating when the empty truck was tarred and when the loaded truck departed from the plant. Time and date may be printed automatically by a time clock. However, the net weight must be documented on each delivery ticket by a State certified weigh master.

c. In the event of a breakdown of an automatic printer system, weigh tickets showing the gross, tare and net weight of each truck, as entered and certified by a weigh master, will be accepted for a period not exceeding the necessary repair time as certified by a State licensed repairman.

A weigh ticket shall be furnished for each truckload. Material will not be accepted unless accompanied by a weigh ticket, which shall be legible and clearly indicate the printed heading of the supplier and location of the batch plant, the title of the Contract for which delivery is intended, the time and date, truck number, lot number and mix number of material being furnished and the total net weight in each truckload.

2. Tack coat will be measured by the gallon at a temperature of 285 degrees F.

C. Asphalt Price Adjustment

1. The asphalt price adjustment for the asphalt cement in asphalt concrete or plant mix macadam base course will be determined monthly using the following formula:

$$Ac = (A - BA) \times T$$

Where Ac = Asphalt Cement Price Adjustment, in dollars
A = Asphalt Cement Price Index[4], in dollars per ton
BA = Basic Asphalt Cement Price Index[5], in dollars per ton
T = Tons of New Asphalt Cement[6]

2. The asphalt price adjustment for tack coat will be determined on a monthly basis using the following formula:

$$At = (A - BA) \times (C) \times (G) \times 0.003986$$

Where At = Asphalt Cement Price Adjustment for tack coat, in dollars
C = Petroleum Content of the Tack Coat in Percent by Volume: Use 1.0 for asphalt cement and cutbacks
A = Asphalt Cement Price Index[4], in dollars per ton
G = Tack Coat Furnished in Gallons and Applied at 285°F, where one gallon is equal to 0.003986 ton
BA = Basic Asphalt Cement Price Index[5], in dollars per ton

3. Should a monthly Asphalt Cement Price Index increase 50 percent or more over the Basic Asphalt Cement Price Index, no additional asphalt concrete, or plant mix macadam base shall be furnished for the Contract without written approval from the Engineer.

4. Should a monthly Asphalt Price Index decrease from the Basic Asphalt Price Index, payments will be decreased accordingly.

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[4] The Asphalt Cement Price Index is the price in dollars per ton (English Units), published by the New Jersey Department of Transportation for the area North of Route 195, for the month during which the asphalt concrete paving or tack coat application occurred.

[5] The Basic Asphalt Cement Price Index is the price in dollars per ton (English Units), published by the New Jersey Department of Transportation, for the area North of Route 195, for the month immediately prior to the month during which bids are received.

[6] The weight of asphalt cement eligible for price adjustment including all conventional and modified asphalt concrete and plant mix macadam base course will be determined by multiplying the percentage of new asphalt cement in the approved job mix formula by the weight of asphalt concrete mixture, measured in accordance with 4.04 B.

5. Asphalt price adjustments will not be made in those months for which the Monthly Asphalt Cement Price Index has changed by less than five percent from the Basic Asphalt Cement Price Index.

6. If the Asphalt Cement Price Index is adjusted more than once in a month, the asphalt price adjustment may be made.

END OF SECTION

SECTION 02553

ASPHALT CONCRETE PAVING

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Samples

02553C01 Submit to the Chief of Materials Engineering , Port Authority Technical Center, 241 Erie Street, Jersey City, New Jersey, 07310-1397, for approval, all Job Mix Formulae with Checklist (specified in 2.03 B) for each type of asphalt concrete mix, from each plant and each new source of material at least 10 days prior to the start of production.

02553C02 If requested, submit to the Chief of Materials Engineering, Materials Engineering Unit samples of each type aggregate to be used and from each source with proper identification as to source, type of aggregate and Contract number. Submit in clean, sturdy bags and in the following amounts for each sample when requested:

Reclaimed Asphalt Pavement (when used) - 50 lbs.
Coarse Aggregate - 25 lbs.
Fine Aggregate - 25 lbs.
Mineral Filler - 5 lbs.

02553C04 Submit for each type asphalt cement proposed for use to the Chief of Materials Engineering, Materials Engineering Unit the following for approval. Resubmit the data each time asphalt cement from a different source is proposed.

1. The name and location of the supplier(s).
2. An analysis of such asphalts by the supplier, certifying that the results of tests comply with the requirements of AASHTO M320 and this Section.
3. If requested, submit four 1-quart samples of the asphalt cement.

02553C05 Submit for each additive proposed for use to the Chief of Materials Engineering, Materials Engineering Unit, the following for approval:

1. The name and location of the supplier(s).
2. An analysis of such additive by the supplier, certifying the chemical properties and compliance with this Section.
3. If requested, submit a sample of the additive, in the manufacturers original sealed bag or container.

02553C10 In lieu of submitting samples of aggregates, asphalt cement and/or additives, the Engineer may verify the Job Mix Formulae at the plant.

Product Data

02553D01 Submit to the Chief of Materials Engineering, Materials Engineering Unit, the name of the supplier and an analysis of the asphalt tack coat to be used on the Contract.

Manufacturer Test Reports

02553F01 Submit certified test data, location of each type aggregate to be used and quantities to be obtained from each location and make arrangements for the Materials Engineering Unit to obtain samples from each such location for checking against the samples submitted. Take all samples in accordance with requirements of ASTM D 75 and ASTM D 242.

Quality Assurance-Quality Control

02553L11 Submit quality control plan and control charts to the Chief of Materials Engineering, Materials Engineering Unit, for approval, at least 5 days prior to the start of production.

END OF APPENDIX "A"

DIVISION 2

SECTION 02575

PAVEMENT MILLING

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for the removal of asphalt concrete and Portland cement concrete pavement by milling.

1.02 JOB CONDITIONS

Prior to commencement of work, ensure that all equipment is in proper working order.

1.03 PERFORMANCE REQUIREMENTS

A. Milled Surface Grade

As shown on the Contract Drawings, mill the asphalt concrete or Portland Cement concrete to a certain depth below finished or existing grade elevation. The grade of the milled surface shall be within a tolerance of plus or minus ¼ inch of the required depth as shown on the Contract Drawings. If necessary, correct any deficiency in the milled surface grade in accordance with Paragraph 3.02 A.

B. Milled Surface Smoothness

When a 10-foot straight edge is laid on the milled surface parallel to the centerline of roadway, runway, or taxiway, the milled surface shall not vary from edge of straight edge more than ¼ inch, except at intersections or any change of grade. If necessary, correct any deficiency in the smoothness of the milled surface in accordance with Paragraph 3.02 B.

C. Milled Surface Texture

D. The milled surface shall be free from gouges, continuous grooves and ridges not greater than 3/8 inch in depth, and delaminated areas, and shall have a uniformly textured appearance consisting of discontinuous longitudinal striations.

1.04 QUALITY CONTROL / ASSURANCE

A. Sampling and Testing

During or immediately after milling, and prior to opening to vehicular traffic, perform quality control surveys and straightedge testing of the milled surface jointly with the Engineer to ensure that the milled surface grade, texture and smoothness comply with the requirements Paragraph 1.03.

1. Measure the grade of the milled surface by surveying at the locations that coincide with the finished or existing grade as shown on the Contract Drawings.
2. Test the smoothness with a 10-foot straight edge along the centerline of the lane created by each pass of the milling equipment.
3. If necessary, correct any deficiency in the milled surface grade or smoothness in accordance with Paragraph 3.02.

PART 2. EQUIPMENT

2.01 DESCRIPTION

A. Milling equipment shall be a self-propelled planing, grinding or cutting machine, with variable operating speeds and automatic grade and slope controls. The milling equipment shall be capable of removing asphalt concrete and Portland cement concrete pavement without the use of heat, and equiped with a water supply system to control dust. The milling equipment shall be capable of milling a minimum width of 10 feet in a single pass.

B. Pneumatic hammers shall not be heavier than nominal 30-pound class when used on bridge decks.

PART 3. EXECUTION

3.01 REMOVAL

A. Perform milling parallel to the roadway, runway, or taxiway centerline.

B. Remove existing asphalt concrete or Portland cement concrete to the limits and depths shown on the Contract drawings.

C. Prevent milled asphalt concrete or Portland cement concrete from being deposited in catch basins or other drainage structures. Any material deposited shall be promptly removed.

D. Do not damage existing construction that are to remain in place. Immediately repair any damage to the satisfaction of the Engineer at no cost to the Authority.

E. Use pneumatic hammers in areas not accessible to the milling equipment. On bridge decks, do not operate the pneumatic hammer at an angle exceeding 45 degrees relative to the pavement surface.

F. If milled surfaces are required to be reopened to vehicular traffic, ramp the perimeter of the milled areas, utility castings and other appurtenances with asphalt concrete to ensure a smooth, safe transition.

G. Prior to the conclusion of each Work period, use hand brooms, mechanical sweepers or vacuum equipment to ensure that the area of Work is cleaned to the satisfaction of the Engineer.

3.02 CORRECTIONS OF DEFICIENCIES

A. Deficiency in Milled Surface Grade

1. If the milled surface grade is above the required grade, then perform additional milling at no additional cost to the Authority as required to comply with the requirement of Paragraph 1.03 A.

2. If the milled surface grade is below the required grade, then perform additonal milling at no additional cost to the Authority as required to place a minimum two inch thick asphalt concrete overlay. The finished surface of the asphalt concrete overlay shall comply with the requirement of Paragraph 1.03. The type of asphalt concrete and placement requirements shall be as directed by the Engineer at no additional cost to the Authority.

3. Following corrections, the Engineer will perform additional measurements in accordance with Paragraph 1.04 B.1. If necessary, and as approved by the Engineer, perform additional corrections until the requirements are met at no additional cost to the Authority.

B. Deficiency in Milled Surface Smoothness and Texture

1. If any measurment exceeds the surface smoothness variation tolerance of Paragraph 1.03 B., or if the texture requirements of Paragraph 1.03 C. are not met, perform additional milling at no additional cost to the Authority as required to comply with the requirement of Paragraph 1.03 B. and Paragraph 1.03 C.

2. If the milled surface cannot be remilled without the surface falling below the grade tolerance, perform additional milling at no additional cost to the Authority as required to place a minimum two inch thick asphalt overlay. The finished surface of the asphalt concrete overlay shall comply with the requirements of Paragraph 1.03. The type of asphalt concrete and placement requirements shall be as directed by the Engineer at no additional cost to the Authority.

3. Following corrections, the Engineer will perform additional measurements in accordance with Paragraph 1.04 B.2. If necessary, and as approved by the Engineer, perform additional corrections until the requirements are met at no additional cost to the Authority.

PART 4. DISPOSAL

4.01 REQUIREMENTS

Dispose of material resulting from operations off Authority property and in accordance with Division 1 clause entitled "Recycling of Construction Debris Material".

END OF SECTION

DIVISION 2

SECTION 02578

PAVEMENT JOINT SEALING

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for sealing joints in pavements, sidewalks and curbs located on grade.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM D 3405	Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements

Federal Specifications

SS-S-1401	Sealant, Joint, Non-Jet-Fuel-Resistant, Hot-Applied, for Portland Cement and Asphalt Concrete Pavements
SS-S-200	Two Component Joint Sealant, Jet Fuel Resistant, Cold Applied for Portland Cement Concrete Pavement

1.03 ENVIRONMENTAL REQUIREMENTS

A. Do not apply any sealant during rain conditions.

B. Do not apply silicone sealant when ambient or pavement temperature is 40 degrees F, or below.

C. Do not apply rubberized asphalt sealant when ambient or pavement temperature is 50 degrees F, or below.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver silicone sealant to the construction site in unopened containers with the manufacturer's lot numbers clearly marked on the containers. Include with the delivery a manufacturer's invoice stating the date(s) of shipment and lot numbers of the silicone sealant to be used.

B. Store silicone sealant at ambient temperatures at or below 90 degrees F.

C. Silicone sealant which has been in storage more than six months shall not be used in the construction and shall be removed from the construction site immediately.

1.05 SUBMITTALS

See Appendix "A" for Submittal requirements

PART 2. PRODUCTS

2.01 MATERIALS

A. Rubberized Asphalt Joint Sealant shall be one of the following and no substitution will be permitted.

1. Road Saver 211 - manufactured by Crafco Inc. Chandler, AZ
2. Hi-Spec - manufactured by W. R. Meadows, Elgin, IL
3. Koch 9005 - manufactured by Koch Materials Company, Pensauken, NJ

B. Silicone Sealant

1. For Concrete Pavement, Sidewalk and Curb Joints
   a. "Dow Corning 888", manufactured by Dow Corning Corp., Midland, MI; or approved equal meeting ASTM D 3405 and Federal Specification SS-S-200.
2. For Asphalt Pavement in Aircraft Apron and Fueling Areas
   a. "Dow Corning 890", manufactured by Dow Corning Corp., Midland, MI; or approved equal meeting ASTM D 3405 and Federal Specification SS-S-1401.

C. Backer Rod - closed cell, expanded polyethylene foam rod, manufactured by A.H. Harris, New Britain, CT; or approved equal.

PART 3. EXECUTION

3.01 PREPARATION

A. Removal and Cleaning Equipment

1. Mechanical joint router shall be "Jiffy" Crack and Joint Router, manufactured by Aeroil Products Co., Inc., South Hackensack, NJ; or approved equal.
2. Air compressor shall be capable of furnishing not less than 100 cubic feet of air per minute at a pressure of not less than 100 pounds per square inch. Compressed air shall be free of oil and moisture.
3. Power driven concrete saw shall be "Compact Concrete and Asphalt Saw" manufactured by Cimline, Inc., Minneapolis, MN; or approved equal.

B. Removal of Existing Joint Material

1. For existing asphalt concrete and Portland cement concrete pavement joints, use a mechanical joint router to remove any joint sealing material present and to reface or modify existing joints to the dimensions shown on the Contract Drawings.

2. For new asphalt concrete pavement joints, use a mechanical joint router or power-driven concrete saw to cut joints to the dimensions shown on the Contract Drawings.

3. For newly sawed Portland cement concrete joints, after a minimum of 72 hours has passed from the completion of concrete placing operations, use a mechanical joint router or power-driven concrete saw to widen sawed joints to their final required dimensions shown on the Contract Drawings.

4. No removals are required for formed joints.

5. During removal and cleaning operations, do not damage any premolded joint filler that is to remain in expansion joints.

C. Cleaning Joints

1. General

   a. Pavement joints shall be cleaned of any routing or cutting debris, and made free of any particles or film of old sealant.

   b. Abrasive blasting operations shall be performed in accordance with requirements specified in the Section entitled "ABRASIVE BLASTING".

2. Asphalt Concrete Pavement Joints (New and Existing)

   Clean joint slots with power-driven wire brush followed by an oil-free compressed air jet.

3. Existing Portland Cement Concrete Pavement Joints

   Clean joint slots with a power-driven wire brush, followed by an abrasive blast, followed by an oil-free compressed air jet.

4. New Portland Cement Concrete Pavement Joints (Sawed or Formed)

   Clean joint slots with an abrasive blast. Follow by an oil-free compressed air jet.

3.02 SEALANT APPLICATION

A. Application Equipment

1. Double Boiler Indirect-Fired Kettle/Rubberized Asphalt Sealant Applicator

The space between the inner and outer shells of a double boiler indirect-fired kettle shall be filled with suitable heat transfer oil having a flash point of not less than 550 degrees F. The kettle shall be equipped with satisfactory means of agitating the sealant at all times without excessive incorporation of air. The kettle shall be equipped with thermostatic control for automatic regulation of the temperature of the oil bath and sealant and shall have a recording thermometer for recording the temperature of the sealant. A hose shall be directly connected to the melting kettle in such a manner as to permit pumping the melted sealant through the hose to a shoe-type applicator that shall direct and control the filling of the joints. The hose and applicator shall be insulated.

2. Compressed Air-Driven Extrusion Pump/Silicone Sealant Applicator

a. The applicator shall be one of the following, or approved equal:

(1) "700 Series Teflon Packed Pumping System" with teflon lined hoses, manufactured by Pyles Industries, Inc., Wixom, MI

(2) "King" or "Bulldog" Model pumping systems with teflon lined hoses, manufactured by Graco., Inc., Minneapolis, MN

b. The silicone sealant applicator nozzle shall be shaped to fit inside the joint to introduce the sealant between the joint faces.

B. Rubberized Asphalt Sealant Installation

1. Use rubberized asphalt sealant for sealing joints in asphalt concrete pavement and joints between asphalt concrete pavement and Portland cement concrete pavement and curbs.

2. Seal joints immediately following, and during the same work period as, the cleaning operation.

3. Rubberized asphalt sealant shall be heated using a double boiler indirect-fired kettle/applicator. Apply the sealant to cleaned joints at the manufacturer's recommended application temperature.

4. At the start of each day's sealing operations, one gallon of heated sealant shall be flushed through the applicator into a one-gallon container and disposed of away from Port Authority property.

5. Apply sealant as shown on the Contract Drawings in such a manner that the in-place sealant shall be well bonded to the pavement and be free of voids or entrapped air. Seal the joints so that upon completion of the work, the surface of the sealant material shall be 1/4 inch, plus or minus 1/8 inch, below the adjacent pavement surface. Refill or "spot up" all low areas before final approval. Remove excess material on the surface of the pavement and leave the pavement surface in a clean condition. The period of cure shall be in accordance with the manufacturer's recommendations. Vehicular or heavy equipment traffic shall not be permitted on the pavement in the area of the joints during the curing period.

C. Silicone Sealant Installation

1. Silicone sealant shall be used to seal Portland cement concrete pavement, sidewalks, curb joints and asphalt concrete pavements in aircraft aprons and fueling areas.

2. Seal joints immediately following, and during the same work period as, the cleaning operation.

3. Install backer rods without stretching and as shown on the Contract Drawings.

4. Apply silicone joint sealant to cleaned joints using a compressed air driven extrusion pump/silicone sealant applicator.

5. Apply sealant as shown on the Contract Drawings in such a manner that the in-place sealant will adhere to the concrete and be free of voids. Seal the joints so that material shall be 1/4 inch, plus or minus 1/8 inch, below the pavement surface. Refill or "spot up" all low areas before final approval. Remove excess material on the surface of the pavement and leave the pavement surface in a clean condition.

6. If the silicone sealant is not self-leveling, the sealant material shall be tooled in a manner that causes it to wet the joint surfaces.

7. Allow silicone sealant to cure in accordance with the manufacturer's installation instructions before reopening to traffic. Protect surface of sealer from dirt for one to three hours, until tack-free.

END OF SECTION

SECTION 02578

PAVEMENT JOINT SEALING

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Samples

02578C01 Submit to the Engineer of Materials, Engineering Materials Laboratory, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397, the following samples for approval:

1. Rubberized Asphalt Sealant - 10 pounds from each lot.
2. Silicone Sealant - one 10.3-fluid ounce cartridge.
3. Backer Rod - three-foot length

END OF APPENDIX "A"

DIVISION 2

SECTION 02580

THERMOPLASTIC REFLECTORIZED PAVEMENT MARKINGS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for thermoplastic reflectorized pavement markings.

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 247	Glass Beads Used in Traffic Paints.
AASHTO M 249	White and Yellow Reflective Thermoplastic Striping Material (Solid Form).
AASHTO T 250	Standard Method of Test for Thermoplastic Traffic Line Material.

American Society for Testing and Materials (ASTM)

ASTM D 36	Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus).
ASTM D 1155	Test Method for Roundness of Glass Spheres.
ASTM D 1214	Test Method for Sieve Analysis of Glass Spheres.

Federal Highway Administration (FHWA)

MUTCD	Manual on Uniform Traffic Control Devices.

Federal Standards

Test Standard No. 595 Colors used in Government Procurements.

National Board of Fire Underwriters

1.03 QUALITY ASSURANCE

A. The quality and workmanship of the completed marking installation shall conform to 3.02 C.4.

B. Arrange for the completed marking installation to be warranted to the Authority, from the date of issuance of the Certificate of Final Completion, against peeling, chipping, flaking, delamination and shoving for a period of one year. The warranty shall run to the Authority's benefit and shall grant the Authority a direct right of action against the Manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Use thermoplastic material that has been manufactured in block form and packaged in suitable corrugated containers to which it will not adhere during shipment or storage. Each container shall weigh approximately 50 pounds and shall consist of blocks approximately 12 inches x 36 inches x 2 inch in size. Each container shall be sealed at the point of manufacture and plainly marked with the color, basic resin type (either hydrocarbon or alkaloid), manufacturer's name, batch number and date of manufacture, and a statement stating the contents meet the requirements of this Section. Each batch manufactured shall have its own separate number. The label shall warn the user that the material shall not be heated in excess of 440 degrees F gauge.

B. Arrange for the reflective glass spheres for drop-on application to be shipped in strong moisture resistant bags each containing approximately 50 lbs of reflective glass spheres. Each bag shall be marked with the name and address of the manufacturer, the name and weight of the material, a statement stating the contents meet the requirements of this Section, date of manufacture and batch number.

C. Arrange for primer to be shipped in pails, drums or other strong substantial containers. Each container shall be plainly marked with the brand name of the product, the name and address of the manufacturer, the date of manufacture, the quantity of material, the date of expiration or shelf life and appropriate hazard warnings. Primers shall be shipped to the construction site with instructions for use affixed to each container.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. White and yellow reflectorized thermoplastic shall conform to AASHTO M 249.

1. Composition Requirements

The thermoplastic material composition shall be specifically formulated for application at temperatures greater than 400 degrees F true (measured with high precision laboratory grade equipment) and shall show no significant breakdown or deterioration at a true temperature of 450 degrees F.

a. The binder component shall be formulated as hydrocarbon resin or formulated as alkaloid base product. The pigment, beads and filler shall be uniformly dispersed in the binder resin.

b. The thermoplastic material shall be free from all skins, dirt and foreign objects and shall comply with the following requirements:

	Percentage by Weight	
Component	White	Yellow
Binder	18.0 Min.	18.0 Min.
Titanium Dioxide	10.0 Min.	---
Glass Beads	30 - 40	30 - 40
Calcium Carbonate & Inert Fillers	42.0 Max.	*
Yellow Pigments	---	*

*Relative amounts and types of yellow pigment, calcium carbonate and inert fillers shall be at the option of the manufacturer, provided that the other composition requirements of this Specification are met and the yellow pigment does not contain chromates or lead.

2. Physical Properties of Composition

a. Colors

White thermoplastic composition, as placed, shall be white, free from dirt or tint. Yellow thermoplastic composition, as placed, shall be yellow, free from dirt, and shall match Federal Test Standard No. 595 – Color 13538.

b. Drying Time

When applied at a temperature of 412.5 ±12.5 degrees F and in a thickness between 1/8 inch and 3/16 inch, the thermoplastic material shall be completely solid and shall show no damaging effects from traffic after 2 minutes when the air temperature is 50 ±3 degrees F and after 10 minutes when the air temperature is 90 ±3 degrees F.

c. Color Retention

The thermoplastic material shall not change color during the warranty period.

d. Yellowness Index

White thermoplastic material shall not exceed a yellowness index of 0.12 when tested in accordance with AASHTO T 250.

e. Softening Point

After heating for 240 ±5 minutes at 425 ±3 degrees F, the thermoplastic material shall have a softening point of 215 ±15 degrees F when tested in accordance with ASTM D 36.

f. Specific Gravity

The specific gravity of the thermoplastic material as determined by a water displacement method at 25 degrees C shall not exceed 2.15.

g. Cracking Resistance at Low temperature

After heating the thermoplastic material for 240 ±5 minutes at 425 ±3 degrees F, applying to concrete blocks and cooling at 15 ±3 degrees F, the material shall show no cracks.

h. Impact Resistance

After heating the thermoplastic material for 240 ±5 minutes at 425 ±3 degrees F and forming test specimens, the impact resistance shall be a minimum of 10 inch-pounds.

i. Flowability

After heating the thermoplastic material for 240 ±5 minutes at 425 ±3 degrees F and testing for flowability, the residue of the white thermoplastic shall not exceed 18 percent and the residue of the yellow thermoplastic shall not exceed 21 percent.

j. Fumes

The thermoplastic material shall not exude fumes that are toxic, obnoxious and/or injurious to persons or property when it is heated during application.

B. Reflective Glass Spheres (Pre-Mix and Drop-On)

Reflective glass spheres for use in the thermoplastic composition and for drop-on shall conform to AASHTO M 247 - Type 1.

1. The glass spheres shall be colorless; clean; transparent; free from milkiness or excessive air bubbles, and essentially clean from surface scarring or scratching. They shall be spherical in shape and at least 70 percent of the glass beads shall be true spheres when tested in accordance with ASTM D 1155.

2. The refractive index of the spheres shall be a minimum of 1.50 as determined by the liquid immersion method at 25 degrees C.

3. The crushing resistance of the spheres shall be 30-lbs. Minimum spheres retained on No. 40 sieve.

4. The glass spheres shall have the following gradation when tested in accordance with ASTM D 1214.

U.S. Standard Sieve	Mass % Passing
No. 20	100
No. 30	75-95
No. 50	15-35
No. 100	0-5

5. Glass spheres for drop-on shall be treated with a moisture-proof coating meeting the flow requirements of AASHTO M 247 Section 4.4.2, shall not absorb moisture during storage, shall remain free from clusters and shall flow freely from dispensing equipment.

C. Primer

Primer for use on both bituminous and Portland cement concretes shall be of the type recommended by the manufacturer of the thermoplastic material and shall be designed to dry tack-free in under 5 minutes.

2.02 BASIS OF ACCEPTANCE

A. Thermoplastic material will be accepted on the basis of sampling and inspection at the place of manufacture or in warehouse lots as determined by the Engineer. In addition, deliver all samples with the manufacturer's certified test results and identification of the binder formulation (e.g., "formulated as a hydrocarbon resin"). Any unauthorized tampering, opening or breaking of seals on the containers between the time of sampling and delivery to the construction site shall be cause for rejection of the material.

B. The minimum batch size of thermoplastic material when tested shall be not less than 3000 lbs., unless the total order is less than that amount.

2.03 Primers will be subject to approval by the Engineer prior to use. Requests for approval shall be accompanied with technical data including brand name, instructions for use, hazard warnings and 1 qt. sample of the primer material.

A. Primer previously approved by the Engineer may be accepted at the construction site on the basis of the brand name labeled on the container.

B. Any rejected materials shall be immediately replaced with materials meeting the requirements of this Section.

PART 3. EXECUTION

3.01 APPLICATION EQUIPMENT

A. General

Thermoplastic application equipment will be subject to approval by the Engineer prior to the start of application.

1. The equipment used for the placement of thermoplastic pavement markings shall be of two general types: mobile applicator and portable applicator.

2. Unless otherwise approved by the Engineer, all longitudinal pavement marking lines shall be striped using only mobile applicator equipment. Longitudinal pavement marking lines include broken lines (skip line), edge lines, barrier lines and solid lines as defined by the FHWA Manual on Uniform Traffic Control Devices.

   a. Portable applicator equipment will be acceptable for placing all other markings; and for longitudinal marking where use of mobile applicator equipment is impractical, as approved by the Engineer.

3. Apply thermoplastic material to the primed pavement surface by the extrusion method, wherein one side of the shaping die is the pavement and the other three sides are contained by, or are part of, equipment suitable for maintaining the temperature and controlling the flow of material.

4. Applicators shall be equipped and constructed in such a manner as to satisfy the requirements of the National Board of Fire Underwriters.

5. For heating the thermoplastic material, the applicator equipment shall include melting kettle(s) of such capacity as to allow for continuous marking operations. The melting kettle(s) may be mounted on a separate "supply" vehicle or included as part of the application equipment. The kettle(s) shall be capable of automatically heating the thermoplastic material to, and maintaining it at, an indicated gauge temperature of 420 degrees F to 430 degrees F. The heating mechanism shall incorporate a thermostatically controlled indirect heat transfer medium. Direct heating of the melting kettle by flame will not be permitted.

6. Thermoplastic material temperature gauges accurate to plus or minus 15 degrees F shall be provided at both ends of each kettle and reservoir, and in each extrusion shoe, in such a manner as to be visible and capable of monitoring the thermoplastic material temperature throughout the marking operation.

7. Applicator equipment including separate "supply" kettles shall be constructed to provide continuous mixing and agitation of the thermoplastic material. Conveying parts of the equipment between the main material reservoir and the extrusion shoe(s) shall be so constructed as to prevent accumulation and clogging. All parts of the equipment that come into contact with material shall be so constructed as to be easily accessible and exposable for cleaning and maintenance. The equipment shall be constructed so that mixing and conveying parts, up to and including the extrusion shoe(s), maintain the material at the required application temperature.

8. The applicator equipment shall be so constructed as to:

   a. Ensure continuous uniformity in the dimensions of the stripe;

   b. Provide a means for cleanly cutting off stripe ends squarely;

   c. Provide a method of applying "skip" lines; and

   d. Be capable of applying various widths of traffic markings from 3 to 12 inches wide.

9. The applicator equipment shall be equipped with a drop-on type bead dispenser capable of uniformly dispensing reflective glass spheres at controlled rates of flow up to 10 lbs. per 100 sq. ft. of thermoplastic material. The bead dispenser shall be automatically operated in such a manner that it will dispense beads only while the thermoplastic material is being applied.

10. Applicator equipment shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

B. Mobile Applicator Equipment

1. The mobile applicator shall be a truck mounted, self-contained pavement marking machine that is capable of applying hot thermoplastic material by the extrusion method. The applicator shall be equipped to maintain and apply the thermoplastic material at an indicated gauge temperature of 420 degrees F and at the widths and thicknesses specified in this Section. The applicator shall be capable of operating continuously and of installing a minimum of 20,000 linear feet of longitudinal markings in 8 hours.

2. The mobile applicator shall be equipped with melting kettle(s) or materials storage reservoir(s) and a glass bead hopper of such capacity as to allow for continuous marking operations. The kettle(s) or reservoir(s) shall be capable of heating and/or holding the thermoplastic material at an indicated gauge temperature of 420 degrees F.

3. The mobile applicator shall be equipped with an extrusion shoe(s) and shall be capable of marking edge line and center line stripes. The extrusion shoe(s) shall be:

   a. Closed, heat jacketed or suitably insulated units;

   b. Able to apply the molten thermoplastic at an indicated gauge temperature greater than 415 degrees F; and

   c. Capable of extruding a uniform line pre-set at 3 to 12 inches wide at a thickness of not less than 1/8 inch nor more than 3/16 inch.

4. The mobile applicator shall be equipped with an electronic and programmable line pattern control system, or mechanical control system, so as to be capable of applying skip or solid lines in any sequence, and through any extrusion shoe in any cycle length.

C. Portable Applicator Equipment

1. The portable applicator shall be hand operated equipment, specifically designed for placing hot extruded thermoplastic material in installations such as crosswalks; stop bars; legends; arrows; and short lengths of lane, edge and centerlines. The portable applicator reservoir shall be loaded with hot thermoplastic material from the supply vehicle melting kettle(s).

2. The portable applicator shall be equipped with all necessary components (including material storage reservoir, glass bead hopper, temperature gauges, bead dispenser, extrusion shoe and heating accessories) so as to be capable of holding and applying the molten thermoplastic at indicated guage temperatures greater than 415 degrees F; of extruding a line of generally uniform cross-section, pre-set at 3 to 12 inches in width, and at a thickness of not less than 1/8 inch nor more than 3/16 inch.

3.02 INSTALLATION

A. General

1. Apply pavement markings at the locations and in accordance with the patterns and dimensions shown on the Contract Drawings and the FHWA Manual on Uniform Traffic Control Devices.

2. Before any pavement marking Work is begun, submit a schedule of operations to the Engineer for approval.

3. When pavement markings are applied under traffic conditions, provide all necessary qualified personnel, flags, markers and signs to maintain and protect traffic and to protect marking operations and the new markings until thoroughly set. Perform short duration lane and work area closures in accordance with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.

4. Apply pavement markings in the general direction of traffic. Striping against the direction of traffic flow will not be permitted.

5. Remove all tracking marks, spilled thermoplastic and thermoplastic applied in unauthorized areas, to the satisfaction of the Engineer.

6. When necessary, establish marking alignment points at 25 ft. intervals throughout the length of the marking area, or as otherwise approved by the Engineer.

7. Thermoplastic pavement markings shall be placed upon dry pavement surfaces. At the time of installation, the pavement surface temperature shall be a minimum of 55 degrees F and the ambient temperature shall be a minimum of 49 degrees F and rising.

B. Surface Cleaning and Preparation of Pavement

1. Clean the pavement surfaces to be marked to the satisfaction of the Engineer immediately prior to priming and marking application. Perform surface cleaning and preparation only in the area of the thermoplastic markings application.

2. At the time of application of the thermoplastic material, ensure that all pavement surfaces are dry, free of oil, dirt, dust, grease and similar foreign materials and the primer shall be tack-free.

C. Application

1. Apply a primer to all pavement surfaces (new and existing) to be marked. Apply primer to bituminous concrete and/or Portland cement concrete pavements at the rates and in accordance with the recommendations of the manufacturer of the thermoplastic material. The primer shall dry tack-free in less than 5 minutes.

2. Apply the thermoplastic material at an indicated gauge temperature no lower than 415 degrees F at the point of deposition. As used in this Section, the point of deposition shall be defined as within the extrusion shoe.

3. Immediately following application, drop reflective glass spheres onto the molten thermoplastic marking at the rate of 5 lbs. per 100 sq. ft. of composition.

4. Upon cooling to ambient pavement temperature, the resultant marking shall be an adherent reflectorized strip of a thickness not less than 1/18 inch nor more than 3/16 inch, and of the width and dimensions shown on the Contract Drawings, capable of resisting deformation by traffic. The exposed marking surface shall be smooth, with no pockmarks, blisters or other surface blemishes evidencing improper application, improper temperature or equipment malfunction. The pavement markings shall show a smooth alignment with continuous uniformity of the required dimensions and widths.

END OF SECTION

SECTION 02580

THERMOPLASTIC REFLECTORIZED PAVEMENT MARKINGS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Product Data

02580D01 Detailed catalog cuts, manufacturer's specifications and test data of products to be used demonstrating conformance to the requirements of this Section.

02580D02 Product Data Sheet and MSDS

Certificates

02580E01 Certified Product Test Result

END OF APPENDIX "A"

DIVISION 2

SECTION 02582

PREFORMED REMOVABLE RETRO-REFLECTIVE PAVEMENT MARKING TAPE

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for the following:

A. Preformed removable retro-reflective pavement marking tape for lane lines, stop lines, crosswalks, traffic arrows, symbols, and legends.

B. Removal of existing pavement markings.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section.

American Association of State Highway and Transportation Officials (AASHTO)

Manual for Signing and Pavement Markings of the National System for Interstate and Defense Highways

American Society for Testing and Materials (ASTM)

ASTM D 638	Test Method for Tensile Properties of Plastics
ASTM D 1535	Method for Specifying Color by the Munsell System
ASTM E 303	Using the Brit Pendulum Test and Method for Measuring Surface Frictional Properties

Federal Highway Administration (FHWA)

Manual on Uniform Traffic Control Devices for Streets and Highway

1.03 QUALITY ASSURANCE

A. Tolerances

1. Width of Lines: Minus zero, plus 1/8 inch.
2. Length of skip or lane lines and unpainted surface between the skip lines shall be plus or minus 3 inches.
3. Location of Directional Arrows, Messages, and Stripes

   Within 2 inches of locations shown on the Contract Drawings.
4. Size of Letters and Arrows: Plus or minus 2 inches.

1.04 SUBMITTALS

For Submittal Requirements, see Appendix "A".

PART 2. PRODUCTS

2.01 MATERIALS

A. Material for preformed removable retroflective pavement marking tape shall consist of white or yellow 3M Scotch-Lane Brand #5710 (white) and #5711 (yellow) tape for line Work, and Series SMF-270 for symbols and legends, or approved equal.

B. Prefabricated legends, symbols and line markings shall conform to the applicable shapes and sizes specified in FHWA Manual on Uniform Traffic Control Devices for Streets and Highway and shall be fabricated from maximum width material to provide the least number of contiguous pieces.

C. Prefabricated lines, legends and symbols shall be precoated with a pressure-sensitive adhesive which is compatible with bituminous concrete and portland cement concrete, and which adheres securely to the roadway.

D. The removable retro-reflective film shall not contain metallic foil and shall consist of high quality preformed plastic materials and pigments, with glass beads uniformly distributed throughout its cross-sectional area and shall have a retro-reflective layer of glass beads bonded to the top surface. A non-metallic medium such as fiberglass, shall be incorporated into the film to facilitate removal.

E. The surface of the retro-reflective preformed plastic film shall provide a minimum skid resistance value of 50 BPN units when tested in accordance with ASTM E 303.

F. The preformed plastic film shall provide a neat and durable marking that will not flow or become distorted due to temperature. The preformed plastic film shall be weather resistant, shall show no appreciable fading, lifting or shrinkage throughout the life of the marking and shall show no significant tearing, roll back, movement or other signs of poor adhesion.

G. The thickness of the retro-reflective preformed plastic film without adhesive shall be not less than 60 mils and not more than 90 mils.

H. The film shall conform to roadway surface contours, breaks and faults during the action of traffic. The film shall have the characteristic of fusing with itself and previously applied marking film of the same composition.

I. The film shall have a minimum tensile strength of 100 psi of cross section when a 1.0-inch wide strip is tested in accordance with ASTM D 638 at a temperature between 70 and 80 degrees F and a jaw speed of 0.25 inch per minute.

J. A sample measuring 1 inch by x 3 inches shall be able to support a dead weight of 4 pounds for not less than 5 minutes at a temperature between 70 and 80 degrees F.

K. The marking film shall be tested for adhesive shear strength in accordance with ASTM D 638.

L. Pigments shall be compounded to maintain the original film color throughout the expected life of the film. White film composition, as placed, shall be white, free from dirt or tint. Yellow film composition, as placed, shall be yellow, free from dirt or tint, and shall be a reasonable visual match to Munsell book notation 10YR8/14 in accordance with ASTM D 1535.

M. The preformed plastic film shall have a minimum of 20 percent by weight of glass beads with a minimum of 2 percent of the beads adhered to the top of the film.

N. The marking film shall be removable from bituminous concrete and portland cement concrete intact or in large pieces, either manually or with a roll-up device, at temperatures above 40 degrees F without the use of heat, solvents, grinding or blasting.

O. All pavement marking materials shall be manufactured and packaged in accordance with the manufacturer's recommendations and in a manner to permit storage for a period of not less than one year from date of purchase.

PART 3. EXECUTION

3.01 INSTALLATION

A. General

1. Pavement markings shall be applied at the locations and in accordance with the patterns and dimensions shown on the Contract Drawings and the FHWA Manual on Uniform Traffic Control Devices for Streets and Highway.

2. Give 48 hours advance notice to the Engineer of the time when pavement marking and striping are to be performed.

3. When pavement markings are applied under traffic conditions, provide all necessary qualified personnel, and traffic control devices to maintain and protect traffic, and to protect marking operations and the new markings until thoroughly set. Short duration lane and work area closures shall be in accordance with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.

B. Cleaning and Preparation of Pavement Surfaces

1. Cleaning and surface preparation shall be confined to the surface area shown on the Contract Drawings for the application of new pavement marking material; and the surface area of existing pavement markings that are shown on the Contract Drawings for removal.

2. Surface preparation Work shall include cleaning for lines or cleaning for letters and symbols. Lines include: broken line; dotted line; solid line; channelizing line; barrier lines; stop lines; crosswalk lines; and crossbars. When lines are installed, the area of preparation shall be at least the width of the new pavement marking, or existing line, plus 1 inch on each side. When letters and symbols are installed the area of preparation shall be sufficiently large to accommodate the new marking, or to remove the existing marking. Materials used for cleaning pavement of existing marking and any new spills, spatter, or overspray shall not damage the paved surface.

3. Whenever a marking area is cleaned by grinding, scraping, or sandblasting, the cleaning Work shall be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that will mislead or misdirect the motorist. When such cleaning Work is completed, the pavement surface shall be thoroughly blown-off with compressed air to remove residue and debris resulting from such Work.

4. On new concrete pavements, cleaning operations shall not begin until sufficient cure time has elapsed after the placement of concrete unless otherwise approved by the Engineer. New concrete pavements shall be cleaned by either sandblasting or water blasting. When water blasting is performed, pavement markings shall be applied no sooner than 24 hours after the blasting has been completed. The extent of the blasting Work shall be to clean and prepare the concrete surface such that:

   a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.

   b. There are no heavy puddled deposits of curing compound in the valleys of the textured concrete surface.

   c. All remaining curing compound is intact; all loose and flaking material is removed.

   d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.

5. Existing pavement markings shall be removed for the purpose of preparing the pavement surface for the application of new pavement markings in the same location as the existing markings, or to remove existing markings that are in good condition which, if allowed to remain, will interfere with or otherwise conflict with newly applied marking patterns as determined by the Engineer in his sole discretion. New pavement markings shall not be applied over existing markings unless approved by the Engineer.

C. Application

1. The application of pavement markings shall be performed in the general direction of traffic. Striping against the direction of traffic flow shall not be permitted

2. The Contractor shall establish marking alignment points throughout the length of the marking area as approved by the Engineer.

3. The retro-reflective, preformed marking film shall adhere to bituminous concrete and portland cement concrete surface courses when applied according to the manufacturer's recommendations at surface temperatures down to 50 degrees F. A primer shall be applied to the roadway surface when recommended by the manufacturer. The roadway surface shall be dry at the time of marking application. Dirt, debris, loose particles and heavy oil residues shall be removed from the road surface application areas immediately prior to the installation of the preformed marking film.

4. Applied tape shall not be overlapped and only butt splices shall be used. Preformed marking film lines shall be placed with a mechanical applicator to provide lines which are neat, accurate and uniform without the use of heat, solvents or other additional adhesive means and shall be immediately ready for traffic after application.

5. Preformed marking film for symbols and legend shall be carefully laid and aligned using butt splices only.

6. All new markings shall be immediately tampered in place with a rubber tire roller weighted at 100 pounds per inch of width minimum, or approved equal.

7. The Contractor shall prepare or remove and reapply any pavement markings that fail to satisfy the requirements specified in this Section at no cost to the Authority.

8. The Contractor shall continuously monitor, maintain and repair all installed pavement markings until completion of the Contract.

END OF SECTION

SECTION 02582

PREFORMED REMOVABLE RETRO-REFLECTIVE PAVEMENT MARKING TAPE

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Product Data

02582D01 Submit detailed catalog cuts, manufacturer's specifications and test data of products proposed for use demonstrating conformance to requirements of this Section in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS.

Construction and Installation Procedures

02582G01 A schedule of pavement marking and striping to be performed.

02582G02 Submit proposed means of cleaning, removing, or obliterating existing or unsatisfactory markings to the Engineer for approval prior to commencing corrective work.

END OF APPENDIX "A"

DIVISION 2

SECTION 02588

TRAFFIC PAINT PAVEMENT MARKINGS

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for traffic paint pavement markings.

1.02 REFERENCES

A. The following is a listing of the publications referenced in this Section:

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO M247 Glass Beads Used in Traffic Paints

American Society for Testing and Materials (ASTM)

ASTM D522 Mandrel Bend Test of Attached Organic Coatings.

ASTM D562 Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer.

ASTM D 711 No-Pick-Up Time of Traffic Paint.

ASTM D969 Laboratory Determination of Degree of Bleeding of Traffic Paint.

ASTM D2369 Volatile Content of Coatings.

ASTM D2805 Hiding Power of Paints by Reflectometry.

ASTM D3723 Pigment Content of Water-Emulsion Paints by Low-Temperature Ashing.

ASTM D4060 Abrasion Resistance of Organic Coatings by the Taber Abraser.

ASTM E1347 Color and Color Difference Measurement by Tristimulus (Filter) Colorimetry.

Federal Highway Administration (FHWA)

MUTCD Manual on Uniform Traffic Control Devices

U.S. GSA - Federal Standards

Fed-Std 595B Colors Used in Government Procurement

Color Reference

Munsell Book of Color

1.03 QUALITY ASSURANCE

A. Environmental Requirements - Weather Limitations: Perform painting only when the surface is dry, when the atmospheric temperature is above 50 degrees Fahrenheit (or is 45 degrees Fahrenheit and rising) and when the weather is not foggy or windy.

B. Warranty: The completed marking installation, except for temporary markings, shall be warranted to the Authority, from the date of issuance of the Certificate of Final Completion, against peeling, chipping, flaking and delamination for a period of one year. Warranty shall grant the Authority a direct right of action against the manufacturer.

1.04 SUBMITTALS

A. See Appendix "A" for submittal requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint to the construction site in sealed containers clearly marked with the date of manufacture, expiration date, name of manufacturer and VOC content.

B. Store paint inside at normal room temperature.

PART 2. PRODUCTS

2.01 MANUFACTURERS

A. Deliver no paint until the Engineer has pre-approved the paint manufacturer(s).

2.02 MATERIALS

A. Paint

1. The paint shall be formulated and manufactured from first grade raw materials and shall be free from defect and imperfections that might adversely affect the serviceability of the finished product. The materials shall show no hard settling or gelling upon storage in the sealed containers as received that will affect the performance of the product. The paint shall be furnished ready for use. Upon the Engineer's request, take a one-quart sample of paint. Seal the sample and mark it for future reference.
2. Directional Reflectance: The directional reflectance of the white paint (without glass spheres) shall be 84% minimum and of the yellow paint shall be 54% minimum when tested in accordance with ASTM E1347.
3. Flexibility: The paint shall show no cracking, chipping or flaking when tested in accordance with ASTM D522, Method B, when bent 180 degrees.
4. Bleeding: The paint shall have a minimum bleed ratio of 0.95 when tested in accordance with ASTM D969.
5. Viscosity: The consistency of the paint shall be not less than 75 or more than 95 Krebs Units at 77 degrees Fahrenheit, when tested in accordance with ASTM D562.
6. Dry Opacity: Test the paint in accordance with ASTM D2805. The minimum contrast ratio of the paint shall be 0.95.
7. Field Drying Time: The paint, when applied at 13 mils plus or minus 1 mil wet film thickness and 160 degrees Fahrenheit at the gun and with glass spheres at the specified application rate, shall dry to no pickup in under one minute when tested by passing with a passenger car. A line showing no visual deposition of the paint to the pavement surface when viewed from a distance of fifty feet shall be considered non-tracking and conforming to the requirement of the field drying time.
8. Lab No Pickup: The paint dry time when tested in accordance with ASTM D711 shall be not greater than 3 minutes.

9. Abrasion Resistance: Maximum weight loss of the paint film shall be 49 mg when tested in accordance with ASTM D4060.
10. Shelf Life: The paint shall have a usable shelf life of not less than 12 months. Store paint in inside structures at normal room temperature.
11. The paint shall contain less than 0.06 percent lead when tested in accordance with FS TT-P-1952, Section 4.3.1.1 and shall be chromium free when tested in accordance with FS TT-P-1952 Section 4.3.1.2.
12. Color
    a. For New Jersey traffic markings, the dried paint color shall match Fed. Std. 595B, Color Nos. White 37778 and Yellow 33538.
    b. For New York traffic markings, white shall be an approximate visual color match to Munsell Book Notation N9.5/0 and yellow shall be an approximate visual match to Munsell Book Notation 10YR 8/14.
13. Non-Volatile Vehicle: The paint shall have a minimum non-volatile vehicle of 43.0% when tested in accordance with ASTM D3723.
14. Pigment: The paint shall have a pigment content of 58.0 to 62.0 percent by weight when tested in accordance with ASTM D3723.
15. Total Solids: The paint shall have a minimum solids content of 76 percent when tested in accordance with ASTM D3723.
16. Volatile Organic Content (VOC): The VOC shall not exceed 150 g/L when tested in accordance with ASTM D2369.
17. Glass Beads: Glass beads shall meet the requirements of AASHTO M247, Type I. Arrange for Manufacturer to treat glass beads with adhesion promoting and/ or flotation coatings.

PART 3. EXECUTION

3.01 GENERAL

A. Apply painted pavement markings at the locations shown and in accordance with the patterns and dimensions indicated on the Contract Drawings and the MUTCD.

B. Before any pavement marking Work is begun, submit a schedule of operations to the Engineer for approval.

C. When painted pavement markings are applied under traffic conditions, provide all necessary qualified personnel, flags, markers and signs to maintain and protect traffic, and to protect marking operations and the new markings until thoroughly set. Perform short duration lane and work area closures in accordance with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.

D. Perform painting of pavement markings in the general direction of traffic. Striping against the direction of traffic flow will not be permitted.

E. Remove all tracking marks, spilled paint and paint applied in unauthorized areas, to the satisfaction of the Engineer.

F. When necessary, establish marking alignment points at 25 foot intervals throughout the length of the marking area, or as otherwise approved by the Engineer.

3.02 EQUIPMENT

A. All equipment for the Work shall be as approved by the Engineer and shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the Work.

B. The mechanical marker shall be an atomizing spray-type marking machine suitable for application of traffic paint and glass beads. It shall produce an even and uniform film thickness at the required coverage and shall be designed so as to apply markings of uniform cross sections and clear-cut edges without running or spattering and within the limits for straightness set forth herein. The machine shall have a gauge for measuring the quantity of paint used, graduated in gallons, or other approved measuring method. The equipment shall be truck mounted and capable of painting an 18-inch wide line in one pass.

C. Suitable adjustments shall be provided on the sprayer(s) of a single machine or by furnishing additional equipment for painting the width required.

3.03 SURFACE CLEANING AND PAVEMENT PREPARATION

A. The exact limits for the removal of existing pavement markings are to be as shown on the Contract Drawings and as verified at the work site and approved by the Engineer.

B. Conduct removal and cleaning work in such a manner as to minimize airborne dust and similar debris.

C. Contain, immediately collect and properly dispose of waste materials resulting from the removal of existing thermoplastic and painted pavement markings. Use a high efficiency particulate air (HEPA) filter equipped vacuum attachment operated concurrently with the removal operations to collect waste materials unless other collection means are approved by the Engineer.

D. Do not wash wastes and residues resulting from the removal, surface cleaning and preparation operations into catch basins or the street storm drainage system.

E. Remove existing pavement markings no longer needed to the extent that 95 percent removal is achieved without the removal of more than 1/8 inch of pavement.

F. Prior to the start of removal operations, demonstrate the proposed method of removal to the satisfaction of the Engineer. Any method that leaves gouges, ridges or grooves in the pavement will not be permitted.

G. Obliterating stripes by painting over them will not be permitted.

H. Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance or other foreign material that would reduce the bond between the paint and the pavement. Clean the area to be painted by sweeping and blowing as required to remove all dirt and loose materials. Areas which cannot be satisfactorily cleaned by brooming and blowing, shall be scrubbed as directed with a water solution of trisodium phosphate (10 percent Na_3PO_4 by weight) or an approved equal solution. After scrubbing, rinse off the solution and dry the surface prior to painting.

I. Do not apply paint to portland cement concrete pavement until the concrete in the areas to be painted is clean of curing material. Use abrasive blasting or high-pressure water to remove curing material from concrete surfaces.

3.04 LAYOUT OF MARKINGS

A. Lay out pavement markings as shown on the Contract Drawings or, if not shown, as approved by the Engineer in advance of the paint application. Verify the location, alignment and radii of all existing pavement markings prior to using them as a guide. Space control points at such intervals as will ensure accurate location and reproduction of all markings at the tolerances specified herein.

3.05 APPLICATION

A. Apply markings at the locations and to the dimensions and spacing shown on the Contract Drawings. Do not apply paint until the layout and condition of the surface have been approved by the Engineer.

B. Mix paint in accordance with the Manufacturer's instructions and apply to the pavement with a mechanical marker at a rate of approximately 115 square feet per gallon for permanent markings and a rate of 230 square feet per gallon for temporary markings. The addition of thinner will not be permitted.

C. Allow a period of 30 days, for permanent markings, to elapse between placement of a bituminous surface course or seal coat and application of the paint. For periods less than 30 days, install temporary markings. The paint shall not bleed excessively, curl or discolor when applied to bituminous surfaces. The paint, when applied at the application rate specified herein, and 160 degrees Fahrenheit at the gun, shall dry to no pick-up in under 1 minute.

D. Paint to achieve neat straight edges. The edges of the markings shall not vary from a straight line by more than 1/2 inch in 50 feet, and marking dimensions and spacings shall be within the following tolerances:

DIMENSION AND SPACING	TOLERANCE
36" or less	±1/2"
>36" - 6'	±1"
>6' - 60'	±2"
>60'	±3"

1. If the markings do not conform to these requirements, immediately obliterate and correct them as approved by the Engineer. Perform corrective work within the Work hours specified by the Engineer.

E. Distribute the glass beads to the surface of the marked areas immediately after application of the paint. Use a dispenser which is properly designed for attachment to the marking machine and suitable for dispensing glass spheres.

F. Notify the Engineer upon arrival of each shipment of paint to the job site. Return all emptied containers to the paint storage area for checking by the Engineer. Remove the containers from the construction site, but only after authorization by the Engineer. Maintain an accurate accounting of the paint materials used in the accepted Work.

G. Apply black paint as a 6-inch wide outline to increase visibility on concrete surfaces.

H. Do not apply glass beads to temporary markings or black paint.

3.06 PROTECTION

A. After application of the paint, protect all markings from damage until the paint is dry. Erect or place suitable warning signs, flags or barricades, protective screens or coverings, as required. Protect all surfaces from excess moisture and/or rain and from disfiguration by spatter, splashes, spillage and drippings of paint.

3.07 ADJUSTING

A. Defective Workmanship or Materials: When any material not conforming to the requirements of this Section or the Contract Drawings has been delivered to the construction site but not yet installed, or has been incorporated in the Work and has been found to be of inferior quality, as determined by the Engineer, such material or Work will be considered defective and shall be removed as directed by the Engineer and replaced, at no additional cost to the Authority.

END OF SECTION

SECTION 02588

TRAFFIC PAINT PAVEMENT MARKINGS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Product Data

Detailed catalog cuts and manufacturer's specifications of products proposed for use demonstrating conformance to the requirements of this Section. Arrange for Material Safety Data Sheets (MSDS) to be part of every shipment and test sample of paint.

Catalog cuts and/or manufacturer's specifications for all equipment to be used.

END OF APPENDIX "A"

SECTION 02588

TRAFFIC PAINT PAVEMENT MARKINGS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

02588A01 Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

A. Product Data

1. Detailed catalog cuts and manufacturer's specifications of products proposed for use demonstrating conformance to the requirements of this Section. Arrange for Material Safety Data Sheets (MSDS) to be part of every shipment and test sample of paint.
2. Catalog cuts and/or manufacturer's specifications for all equipment to be used.

Product Data

02588D01 Product Data Sheet and MSDS

Certificates

02588E01 Certified Product Test Result

END OF APPENDIX "A"

DIVISION 2

SECTION 02720

MANHOLES AND DRAINAGE STRUCTURES

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for precast or cast-in-place concrete manholes and drainage structures.

B. Definition of terms shall be in accordance with ASTM C 822.

1.02 REFERENCES

A. The following is a listing of the publications referenced in this Section:

	American Concrete Institute (ACI)
ACI 318	Building Code Requirements for Structural Concrete and Commentary
	American Society for Testing and Materials (ASTM)
ASTM A 48	Gray Iron Castings
ASTM A 536	Ductile Iron Castings
ASTM B26	Aluminum-Alloy Sand Castings
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C 55	Concrete Building Brick
ASTM C 117	Test Method for Materials Finer than 75μm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 136	Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 150	Portland Cement
ASTM C 387	Packaged, Dry, Combined Materials for Mortar and Concrete
ASTM C 443	Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 497	Test Methods for Concrete Pipe, Manhole Sections, or Tile
ASTM C 822	Terminology Relating to Concrete Pipe and Related

	Products
ASTM C 891	Practice for Installation of Underground Precast Concrete Utility Structures
ASTM C 913	Precast Concrete Water and Wastewater Structures
ASTM C 923	Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
ASTM C 990	Joints for Concrete Pipe, Manholes, And Precast Box Sections Using Preformed Flexible Joint Sealants

1.03 ENVIRONMENTAL REQUIREMENTS

Cold and hot weather requirements shall conform to the applicable requirements of the Section 03301 entitled "PORTLAND CEMENT CONCRETE, LONG FORM" except that in a precast plant the ambient temperature may be below 40 degrees F providing that forms and product are preheated and heat cured and protected. Temperature recording devices shall be used.

1.04 DESIGN AND PERFORMANCE REQUIREMENTS

A. As approved by the Engineer, the Contractor may substitute cast-in-place concrete manholes and drainage structures which conform in size and strength to the precast concrete structures shown on the Contract Drawings and as specified in this Section. As approved by the Engineer, the Contractor may also substitute precast concrete structures which conform in size and strength to the cast-in-place concrete structures shown on the Contract Drawings and as specified in this Section. Equivalent strength of substituted structures shall be based on structural design of reinforced concrete as outlined in ACI 318.

B. Design of lifting devices for precast structures shall conform to ASTM C 913.

C. Design of joints for precast concrete structures shall conform to ASTM C 913. Unless otherwise shown on the Contract Drawings, joints shall be designed for leakage not to exceed .025 gallons per hour per foot of joint at 3 feet of head.

1.05 QUALITY ASSURANCE

A. Workers shall be experienced and skilled in the fabrication and installation of precast and cast-in-place concrete manholes and drainage structures.

B. Precast concrete manholes, drainage structures, including castings, will be visually inspected by the Engineer when delivered to the construction site. Damaged material or material not meeting the requirements of this Section shall be removed from the construction site and replaced, at no additional cost to the Authority.

C. Precast concrete manholes and drainage structures may be inspected by the Engineer at the place of manufacture.

D. Where manholes and drainage structures are cast-in-place, do not place concrete until the Engineer has inspected the formwork and verified that the dimensions and concrete reinforcing are in accordance with details shown on the Contract Drawings and as specified in this Section.

E. Conform to the applicable requirements for quality assurance of the Section 03301 entitled "PORTLAND CEMENT CONCRETE, LONG FORM" except that, if the concrete is precast, the producer shall maintain a fully equipped testing lab and employ a Quality Control Technician to perform Quality Control Tests. Unless otherwise shown on the Contract Drawings, Quality Control Tests for precast concrete shall consist of compression tests on a minimum of two cylinders for each day's production tested in accordance with ASTM C 39 for cylinders or ASTM C 497 for drilled cores. Acceptance shall be based on the requirements of ACI 318.

F. Tolerances of dimensions, squareness, joint surfaces, reinforcement location, and thickness of slabs and walls for precast structures shall conform to ASTM C 913.

G. Castings shall be of uniform quality, free from sand holes, shrinkage cracks and other defects. Surface of the castings shall be free from burnt-on sand and shall be smooth. Bearing surfaces between grates or covers and frames shall be cast or machined with such precision that continuous, full and uniform bearing is provided throughout the perimeter area of contact. The bearing contact with the frame shall be non-rocking when in place and under the influence of traffic or other loads. Pairs of machined castings shall be match marked to facilitate subsequent identification at installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and drainage structures.

B. Care shall be taken when storing precast concrete manholes and drainage structures to prevent damage to Authority or other public or private property, and any property so damaged shall be repaired at the Contractor's expense.

C. Each precast concrete structure shall be clearly marked by indentation or waterproof paint to indicate the date of manufacture, manufacturer and identifying symbols and/or numbers shown on the Contract Drawings to indicate its intended use.

1.07 SUBMITTALS

For Submittals, see Appendix "A".

PART 2. PRODUCTS

2.01 MANUFACTURERS

For each of the specified materials, manufacturer shall be one of the following, or approved equal.

A. Manhole and Drainage Structure Frames, Covers and Grates:

Frames, Cover and Grates shall be as specified on the Contract drawings.

B. Resilient Connectors:

1. NPC Inc., Milford, NH 03055
2. Press Seal Gasket Corporation, Fort Wayne, IN 46804
3. A-Lok Products Inc., Tullytown, PA 19007

2.02 MATERIALS

A. Concrete

1. Concrete including concrete mixes shall be Category VI with a minimum 28-day compressive strength of 5000 psi for precast and 4000 psi for cast-in-place concrete manholes and drainage structures in accordance with the applicable requirements of the Section 03301 entitled "PORTLAND CEMENT CONCRETE, LONG FORM".

B. Joints

1. Unless otherwise shown on the Contract Drawings joints shall not be permitted in manholes and drainage structures
2. Joints between precast sections, which occur four feet or more below finished grade, shall be sealed with rubber gaskets conforming to ASTM C 443 or a preformed flexible plastic gasket as specified in 2.02 B.3.
3. Where a preformed flexible plastic gasket is specified on the Contract Drawings, joints between precast sections shall be sealed with a preformed flexible plastic gasket conforming to ASTM C 990, except that gasket size, lengths, quantity of primer and packing material shall be in accordance with the manufacturer's recommendation. Preformed flexible plastic gaskets shall be the following, or approved equal:
   a. "Ram-Nek", as manufactured by Henry Co., El Segundo, CA
   b. "CONSEAL CS-102", as manufactured by the Concrete Sealants, Inc, New Carlisle, OH
   c. "PRO-STIK", as manufactured by Press-Seal Gasket Coproration, Fort Wayne, IN

C. Steel Reinforcement

1. Steel reinforcement shall conform to the Section 03200 entitled "CONCRETE REINFORCEMENT".
2. There shall be a continuity of reinforcement at all corners of the structure.

D. Silt Buckets

1. Cast aluminum silt bucket shall be furnished and installed for all sanitary sewer manhole structures shown on the Contract Drawings and shall be fabricated of aluminum alloy 319, conforming to ASTM B26.

E. Frames, Grates and Covers

1. Frames shall be of the type shown on the Contract Drawings and shall be fabricated of Class 35B cast iron, conforming to ASTM A 48.

2. Covers and grates shall be of the types and materials shown on the Contract Drawings. Where cast iron is shown, manhole covers and drainage grates shall be fabricated of Class 35B cast iron, conforming to ASTM A 48. Where ductile iron is shown, manhole covers and drainage grates shall be fabricated of Grade, Grade 65-45-12, or Grade 80-55-06 ductile iron and castings, conforming to ASTM A 536 and shall bear the letters "D.I." in a clearly visible manner on the upper surface.

3. Frames, covers or grates of other materials shall be as shown on the Contract Drawings.

4. Each casting shall be identified by the name of the producing foundry, origin and date of manufacture, ASTM designation number and class of cast or ductile iron.

F. Masonry Collar for Frame

1. Concrete Building Brick - ASTM C 55

2. Cement mortar:

   ASTM C 387, Type M

G. Crushed Stone Bedding

1. Crushed limestone, trap rock or recycled concrete aggregate conforming to the following gradation determined in accordance with ASTM C 136 and C 117. Recycled concrete aggregate shall contain not less than 95 percent crushed Portland cement concrete and shall be in accordance with the applicable requirements of the Section 02231 entitled "AGGREGATE BASE COURSE".

2. Gradation of crushed stone bedding shall be as follows:

Sieve Size	Total Passing Percent by Weight
2-1/2 inch	100
1 inch	60 - 100
3/4 inch	45 - 85
3/8 inch	30 - 60
No. 10	14 - 30
No. 40	3 - 15
No.200	0 - 3

H. Connection Between Structure and Pipe

1. Unless otherwise specified on the Contract Drawings, the opening between the wall of the structure and the wall of the pipe shall be sealed with cement mortar conforming to ASTM C 387, TYPE M or a resilient connector.

2. Resilient connector shall conform to ASTM C923. If resilient connector is not integrally cast into the wall of the structure, provide cast or cored opening of the size specified by manufacturer of the resilient connector.

2.03 FABRICATION

Manufacture of precast concrete structures shall conform to ASTM C 913.

PART 3. EXECUTION

3.01 PREPARATION

A. Ensure proper orientation of the structure to accommodate pipes.

B. Immediately prior to placement in the excavation, precast concrete structures shall be inspected in the presence of the Engineer to verify that they are internally clean and free of damage. Damaged units shall be removed from the construction site and replaced, at no additional cost to the Authority. Subject to the approval of the Engineer, damaged precast concrete structures may be repaired in a manner that ensures that the structure will conform to the requirements of this Section and its intended use. Acceptance of repaired units is at the sole discretion of the Engineer.

3.02 INSTALLATION

A. Excavation and Backfill

1. Excavate for manhole or drainage structure in accordance with the Section 02221 entitled "EXCAVATION, BACKFILLING AND FILLING" in the location and to depth shown on the Contract Drawings. Provide clearance around the sidewalls of the structure as required for construction.

2. If ground water is encountered, prevent accumulation of water in excavations by methods approved by the Engineer. Manhole or drainage structure shall be placed in a dry trench.

3. Where the possibility exists of a watertight structure becoming buoyant in a flooded excavation, take necessary steps to avoid flotation of the structure.

B. Support and Backfilling

1. Manhole or drainage structure shall be supported at proper grade and alignment on crushed stone bedding or other support system, as shown on the Contract Drawings.

2. Backfill excavation for manhole or drainage structure in accordance with the Section 02221 entitled "EXCAVATION, BACKFILLING AND FILLING".

C. Installation of Precast Concrete Sructure

1. To ensure safety precast concrete structures shall only be lifted at the lifting points so designated by the manufacturer.

2. When lowering manhole or drainage structure into the excavation and joining pipe to the structure, take precaution to ensure that the interior of the pipes and structure remains clean.

3. Set precast concrete structure so that it is fully bearing on crushed stone bedding, compacted in accordance with the provisions of the Section 02221 entitled "EXCAVATION, BACKFILLING AND FILLING" or on other support system shown on the Contract Drawings.

4. For multiple section structures lower and set the base section before placing additional sections. Ensure joint integrity by removing all foreign materials from joint surfaces and verify that sealing materials are placed properly. Avoid misalignment by using guide devices affixed to the lower section or as otherwise approved by the Engineer. Joint seal material may be installed at the manufacturer's plant prior to delivering to job site.

5. Verify that manholes and drainage structures installed satisfy required alignment and grade.

6. Remove knockout or core the structure for pipe so as not to create an opening in excess of that required. Fill resultant annular space with cement mortar or with a resilient connector installed in accordance with manufacture's instructions.

7. Cut pipe to finish flush with interior of structure.

8. Shape inverts through manhole as shown on the Contract Drawings.

D. Installation of Cast-In-Place Concrete Structure

1. Prepare crushed stone bedding or other support system shown on the Contract Drawings, to receive the base slab as specified for precast structures in 3.02 C.3.

2. Erect forms in accordance with the provisions of the Section entitled 03100 "CONCRETE FORMWORK" and ensure that they are braced against all movement.

3. Furnish and install reinforcing steel in accordance with the details shown on the Contract Drawings and the provisions of the Section entitled 03200 "CONCRETE REINFORCEMENT".

4. After formwork and reinforcing steel are inspected and approved by the Engineer, place and cure concrete in accordance with the provisions of the Section 03301 entitled "PORTLAND CEMENT CONCRETE, LONG FORM".

5. Complete installation in accordance with the applicable requirements of 3.02 C above.

E. Installation of Frame and Cover or Grate

1. Set frame using cement mortar and masonry as shown on Contract Drawings. Radially laid concrete brick shall have 1/4-inch thick vertical joints at inside perimeter. Lay all concrete brick in a full bed of cement mortar and completely fill all joints. Where more than one course of concrete brick is required, stagger vertical joints.

2. Set frame and cover two inches above finished grade for manhole structure located in unpaved area. Otherwise, set frame and cover flush with finished grade.

3. Set frame and grate flush with finished grade for all catch basins or drainage inlets, unless otherwise shown on the Contract Drawings.

4. Manhole, inlet and catch basin frames, grates, and covers shall be fitted together and matched-marked to avoid rocking of covers and grates. All castings shall be set firm and snug and shall not rattle.

3.03 VERTICAL ADJUSTMENT OF EXISTING STRUCTURES

A. Where shown on the contract drawings, adjust the elevation of existing manhole or drainage structure to finished grade.

B. Existing frame and grate or cover shall be carefully removed, cleaned of all mortar fragments to the satisfaction of the Engineer and set to the finished grade in accordance with the requirements specified in 3.02 E.

C. When removal of an existing reinforced concrete wall is required, the concrete shall be removed so as not to damage the existing reinforcing bars. The bars shall be cleaned of all concrete to the satisfaction of the Engineer and bent into the new concrete top slab or spliced to required vertical reinforcement, as shown on the Contract Drawings.

D. Bond new concrete to existing concrete in accordance with the requirements specified in the Section 03301 entitled "PORTLAND CEMENT CONCRETE, LONG FORM".

3.04 FIELD TESTS

Field tests will be used by the Engineer to evaluate and approve cast-in-place concrete in accordance with the Section entitled 03301 "PORTLAND CEMENT CONCRETE, LONG FORM".

3.05 PROTECTION

Protection and curing of concrete shall be in accordance with the Section 03301 entitled "PORTLAND CEMENT CONCRETE, LONG FORM"

END OF SECTION

SECTION 02720

MANHOLES AND DRAINAGE STRUCTURES

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

02720A01 Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of DIVISION 1 - GENERAL PROVISIONS:

1. Shop drawings of precast concrete and cast-in-place manholes and drainage structures.
2. Catalog cuts of frames, grates and covers.
3. Catalog cuts of gaskets for joints in precast concrete manholes and drainage structures, including manufacturer's installation instructions.
4. Catalog cuts of resilient connectors.

Samples

02720C01 Submit to the Chief of Materials Engineering, Materials Engineering Unit, Port Authority Technical Center, 241 Erie Street, Jersey City, New Jersey 07310-1397, certified test data covering gradation and composition of the crushed stone for bedding proposed for use.

1. Do not deliver material to the construction site from any source until the Engineer has approved the material from that source.

Certificates

02720E01 Submit certificate from gasket manufacturer certifying that the proposed gaskets comply with the requirements specified in this Section and that the gaskets are compatible with the type of joint used.

Construction and Installation Procedures

02720G01 Submit plans, methods, equipment and procedures as applicable for:

1. Prevention of accumulation of groundwater as specified in 3.02.
2. Methods other than guide devices to avoid misalignment of joints during installation of precast concrete structures as specified in 3.02.
3. Methods to prevent flotation of watertight structures as specified in 3.02.
4. Installation of resilient connectors as specified in 3.02 C.6.

Calculations

02720H01 Submit design calculations prepared by a Professional Engineer, licensed in the State where the Work is being performed:

1. For design of substitute manhole or drainage structure. Calculations shall demonste that the substituted design is equivalent to the design shown on the Contract Drawings.

END OF APPENDIX "A"

DIVISION 2

SECTION 02722

STORM DRAINAGE SYSTEM

(INFILTRATION/EXFILTRATION TESTING NOT REQUIRED)

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for exterior storm drainage systems not requiring infiltration/ exfilitration testing.

B. Definition of terms relating to Reinforced Concrete Pipe and Plastic Pipe shall be in accordance with ASTM C 822 and ASTM D 883 respectively.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM A 746	Ductile Iron Gravity Sewer Pipe
ASTM C 76	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 117	Test Method for Material Finer Than .075mm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 136	Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 150	Portland Cement
ASTM C 443	Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 507	Reinforced Concrete Elliptical Culvert Storm Drain and Sewer Pipe
ASTM C 655	Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
ASTM C 822	Terminology Relating to Concrete Pipe and Related Products
ASTM D 883	Standard Terminology relating to Plastics
ASTM D 2321	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity-Flow Applications
ASTM D 3212	Standard Specification for Joints for Drain and sewer Plastic Pipes Using flexible Elastometric Seals
ASTM F 2306	12 to 60 in. Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity Flow Storm Sewer and Subsurface Drainage

application

American Water Works Association (AWWA)

AWWA C 104	Cement- Mortar Lining for Ductile-Iron Pipe Fittings for Water
AWWA C 105	Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
AWWA C 110	Ductile-Iron Fittings, 3 Inch Through 48 Inch, for Water and Other Liquids
AWWA C 111	Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings

1.03 QUALITY ASSURANCE

A. Any entity performing the Work of this Section shall have at least three years of installation experience on projects with piping systems of types and sizes similar to that required under this Contract.

B. Pipe will be visually inspected by the Engineer when delivered to the construction site. Damaged material or material not meeting the requirements of this Section shall be removed from the construction site and replaced at no additional cost to the Authority.

C. Pipe may be inspected at the place of manufacture by the Engineer.

1.04 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer's instructions for unloading, storing and moving pipe.

B. Care shall be taken when storing pipe and appurtenances so as not to damage Authority or other public or private property, and any property so damaged shall be repaired at the Contractor's expense.

1.05 SUBMITTALS

For Submittals, see Appendix "A".

PART 2. PRODUCTS

2.01 MATERIALS

Use any of the pipe sytems specified below unless otherwise shown on the Contract Drawings.

A. Reinforced Concrete Pipe

1. ASTM C 76, Class V, Wall B or Wall C for Circular Reinforced Concrete Pipe, ASTM C 507, Class HE-IV for Horizontal Elliptical Pipe and Class VE-VI for Vertical Elliptical Pipe, unless otherwise shown on the Contract Drawings. Use ASTM C 150, Type II Portland cement. Pipe joints shall be tongue and groove or bell and spigot, and shall be sealed with a continuous gasket. Lifting holes in pipe will not be permitted.

2. Pipe joints shall be sealed with rubber gaskets. Design of joints and physical requirements for rubber gaskets shall conform to ASTM C 443. Rubber gaskets shall be the following types of rubber gaskets, manufactured by Hamilton Kent Manufacturing Co., Toronto, Ontario or approved equal:

a. "Tylox Type C" for straight tongue and groove pipe

b. "Tylox Superseal " for offset pipe

c. "Tylox Type 0" for recessed pipe

B. Ductile Iron Pipe

1. ASTM A 746, minimum wall thickness Class 50 unless otherwise shown on the Contract Drawings, with push-on joints, and cement mortar lining, which shall be twice the standard thickness in AWWA C 104.

2. Joints shall be sealed with continuous ring rubber gaskets conforming to AWWA C 111.

3. Polyethylene Encasement for Ductile Iron Sewer Pipe: AWWA C 105, Class C polyethylene, 8-mil thickness.

C. Corrugated Polyethylene Pipe

1. ASTM F 2306, high density Polyethylene pipe, joints shall be bell and spigot and sealed with a continuous gasket.

2. Pipe joints shall be sealed with continuous ring rubber gaskets and conforming to ASTM F 477 and meet the requirements of ASTM D 3212.

C. Crushed Stone for Pipe Bedding

Crushed limestone, gneiss, trap rock or recycled Portland cement concrete aggregate conforming to ASTM C 33, size number 67. Recycled concrete aggregate shall contain not less than 90 percent crushed Portland cement concrete and shall be in accordance with the requirements of the Section 02231 entitled "AGGREGATE BASE COURSE".

PART 3. EXECUTION

3.01 EXAMINATION

Where the storm drain is to cross existing utilities, the Contractor shall verify their elevation and horizontal location through excavation of the test pits shown on the Contract Drawings.

3.02 INSTALLATION

A. Excavation

1. Excavate pipe trench in accordance with Section 02221 entitled "EXCAVATION, BACKFILLING AND FILLING" in the location and to the depth shown on the Contract Drawings.

2. In the course of excavation, should the trench or subtrench width exceed the outside diameter of pipe plus two feet for nominal diameters up to 18 inches or outside diameter plus three feet for nominal diameters in excess of 18 inches, the Engineer may require remedial measures to reduce the load on the pipe such as the use of concrete cradle or concrete arch bedding, or reinforced concrete encasement. Or the Engineer may require the Contractor to substitute a stronger pipe capable of withstanding the increased load such as ASTM C 655 or ASTM A 746. A subtrench is defined as a trench excavated for pipe placement within a wider trench.

3. If ground water is encountered, prevent accumulation of water in trench by methods approved by the Engineer. Pipe shall be laid in a dry trench.

B. Pipe Support and Backfilling

1. Where concrete cradles are shown on the Contract Drawings, support the pipe at proper alignment and grade, place concrete (as specified in the Section entitled "PORTLAND CEMENT CONCRETE, LONG FORM") to dimensions shown and vibrate same. Concrete, when cured, shall support the full length of pipe.

2. Where crushed stone bedding is shown on the Contract Drawings, place and compact crushed stone bedding material in the bottom of the trench to provide a firm but slightly yielding surface and to an elevation such that pipe laid on same will be at the proper grade and alignment. Make suitable excavations for the pipe bells, where applicable so that the bottom reaction and support are confined to the pipe barrel. After installation of pipe on the compacted layer, place and compact additional bedding material in small lifts to the dimensions shown.

3. a. Reinforced Concrete Pipe and Ductile Iron Pipe

Continue backfilling of the trench from the pipe support limits reached in 3.02 B.1 and 2 above in accordance with the Section entitled "EXCAVATION, BACKFILLING AND FILLING".

b. Corrugated Polyethylene Pipe

Place pipe embedment and backfilled in accordance with ASTM D 2321.

C. Polyethylene Encasement for Ductile Iron Pipe

1. Install polyethylene encasement on all ductile iron pipes using one of the installation methods described in AWWA C 105.

2. Pipe surface shall be totally cleaned prior to installation of the polyethylene encasement. During installation, care shall be exercised to prevent soil or bedding material from becoming trapped between the pipe and the polyethylene encasement.

3. The polyethylene film shall be fitted to the contour of the pipe to effect a snug, but not tight, encasement with the minimum space between the polyethylene and the pipe. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, or fittings, and to prevent damage to the polyethylene due to backfilling operations.

4. Overlaps and ends shall be secured with adhesive tape, string or plastic tie straps to hold the polyethylene encasement in place until backfilling operations are complete.

D. Pipe Installation

1. Immediately prior to placement in the trench, all pipe shall be inspected in the presence of the Engineer to verify that it is internally clean and free of damage. Damaged units shall be removed from the construction site and replaced to the satisfaction of the Engineer, at no additional cost to the Authority.

2. When lowering pipe into the trench and joining the units, take precautions to ensure that the interior of the pipeline remains clean.

3. Lay pipe true to line and grade, with uniform bearing under the full length of its barrel, without break from structure to structure, and with bell or grooved end facing upgrade. Adjustments to line and grade shall be made by scraping away or adding bedding material under the pipe.

4. Prior to start of construction, the method for control of alignment and grade shall be submitted for approval. The method shall be a laser system or gradeboard setup to establish a reference grade and alignment control directly above or within the pipe. Use of other equipment may be substituted if, in the opinion of the Engineer, the alternate system produces equivalent accuracy.

5. Make up pipe joints in accordance with the manufacturer's instructions and taking extreme care that joints are clean and free of foreign materials. Support pipe free of the bedding during the joining process to avoid disturbing the subgrade.

6. In large diameter sewers with compression-type pipe joints, or where considerable force will be required to insert the spigot fully into the bell, come-alongs and winches or other equipment may be rigged to provide the necessary force. Inserts shall be used to prevent the sewer pipe from being thrust completely home prior to checking gasket location. After the gasket is checked, the inserts shall be removed and the joint completed.

7. Close all openings in the pipeline with watertight plugs when pipelaying is stopped at the conclusion of the work period or if work is interrupted for any reason.

8. Install polyethylene encasement prior to backfilling ductile iron pipe.

3.03 PROTECTION

A. Care shall be taken not to damage or displace installed pipes and joints during construction of pipe supports, backfilling and other operations.

B. Where pipe is damaged or displaced, take remedial measures as directed by the Engineer including but not limited to relaying pipe or replacing the pipe and/or testing of joints. All such remedial measures shall be performed at no additional cost to the Authority.

END OF SECTION

SECTION 02722

STORM DRAINAGE SYSTEM (INFILTRATION/EXFILTRATION TESTING NOT REQUIRED)

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

02722A01 Submit catalog cuts of gaskets for pipejoints including manufacturer's installation instructions.

Samples

02722C01 Submit to the Manager, Materials, Engineering Division, Port Authority Technical Center, 241 Erie Street, Jersey City, New Jersey 07310 1397, one 75 pound representative sample of crushed stone for pipe bedding proposed for use.

1. Submit the sample in a clean, sturdy container or bag which shall not permit loss of any of the material.
2. Clearly label the container or bag of the sample with: Contract location, title and number; the name of the material supplied; and location of the source.
3. The Engineer will approve or disapprove the proposed material within 21 days after receipt of the sample.
4. Do not deliver material to the construction site from any source until the Engineer has approved the material from that source.

Certificates

02722E01 Submit certificate from gasket manufacturer certifying that the proposed gaskets comply with the specified requirements and that the gaskets are compatible with the type of pipe joint used.

02722E02 Submit certificate from the pipe manufacturer certifying that such pipe complies with the requirements specified in this Section.

02722E03 Submit certificate from the polyethylene film manufacturer that such polyethylene film complies with the requirements specified in this Section.

Manufacturer Test Reports

02722F01 Submit to the Manager, Materials, Engineering Division, Port Authority Technical Center, 241 Erie Street, Jersey City, New Jersey 07310-1397, certified test data covering gradation and composition of the crushed stone for pipe bedding proposed for use.

Construction and Installation Procedures

02722G01 Submit plans, methods, equipment and procedures as applicable for prevention of accumulation of groundwater specified in 3.02.

02722G02 Submit plans, methods, equipment and procedures as applicable for alternate method of line and grade control specified in 3.02.

Record Documents

02722M01 Submit "As Built" drawings in accordance with the Section entitled "UTILITY RECORD DRAWINGS" of Division 1 of the Specifications.

END OF APPENDIX "A"

DIVISION 2

SECTION 02765

CLEANING STORM DRAINAGE AND SANITARY SEWER SYSTEMS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for the removal and disposal of debris and sediment from catch basins, manholes, sumps and scuppers, and from the connecting pipes of such catch basins, manholes and scuppers, to restore system capacity and/or in preparation for other Work.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

National Fire Protection Association (NFPA)

NFPA 328 "Recommended Practice for the Control of Flammable and Combustible Liquids and Gases in Manholes, Sewers and Similar Underground Structures"

1.03 PERFORMANCE REQUIREMENTS

A. Cleaning Requirements

1. Clean pipes and structures shown on the Contract Drawings or as directed by the Engineer.
2. Unless otherwise shown on the Contract Drawings, cleaning shall be for maintenance purposes, and shall remove all foreign matter, debris and sediment as required to restore each element of the system to a minimum of 95% of its original capacity.
3. Performance requirements for cleaning in preparation for other Work shall be as specified elsewhere or as shown on the Contract Drawings.

B. Site Condition Requirements

1. When Work in any area is completed, the Contractor shall clean the area, replace all covers and grates, and leave the area in a condition satisfactory to the Engineer.
2. The Contractor shall report to the Engineer any castings in need of replacement as specified elsewhere herein.

1.04 ENVIRONMENTAL REQUIREMENTS

A. The Contractor shall remove debris from the work sites and away from Authority property as it accumulates. Debris shall not be stored, burned, or otherwise disposed of on Authority property.

B. The Contractor shall handle and dispose of debris and sediments removed from the locations specified in 1.01 in accordance with the requirements of Appendix B of this Section.

C. Unless otherwise specified in Appendix B, water generated from cleaning operations under this Section shall be decanted back into the system from which it was removed.

1.05 SAFETY REQUIREMENTS

The warnings and recommendations of NFPA 328 shall be followed in order to ensure that the Work is performed safely.

1.06 SUBMITTALS

See Appendix 'A' for submittal requirements.

PART 2. *PRODUCTS*

2.01 MATERIALS

A. Water required for the performance of the Work will be supplied to the Contractor at no cost to him and from a source within a reasonable distance from the work areas unless otherwise shown on the Contract Drawings. Water will not be made available from systems dedicated exclusively to fire protection.

2.02 CONSTRUCTION FEATURES

A. Pipe Cleaning Equipment:

1. Hydraulically Propelled Equipment: The equipment used shall be of a movable dam type, and shall be constructed in such a way that a portion of the dam may be collapsed at any time during cleaning operation to protect against flooding of the sewer. The movable dam shall be equal in diameter to the pipe being cleaned, and shall provide a flexible scraper around the outer periphery to ensure removal of grease. If sewer cleaning balls or other equipment that cannot be collapsed is used, special precautions to prevent flooding of the sewers and public and private property shall be taken.

2. High-Velocity Jet (Hydrocleaning) Equipment: All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles developing approximately 1000 psi of water pressure. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring walls and floors of structures. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall be a self-contained truck unit with its own water tank, auxiliary engines, pumps, and at least 200 feet of hydraulically driven hose on a reel.

3. Mechanically Powered Equipment: Bucket machines shall be in pairs with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an overload device. Machines with direct drive that could cause damage to the pipe will not be allowed. A power rodding machine shall be either a sectional or continuous rod type capable of holding a minimum of 750 feet of rod. The rod shall be specifically heat-treated steel. To ensure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.

B. Vacuum Truck

The vacuum truck shall have a minimum capacity of 13 cubic yards with a 25-foot minimum length vacuum hose. The vacuum truck shall be capable of removing debris such as dirt, sand, rocks, grease, and other solid, semi-solid and liquid material resulting from the cleaning operation.

C. Removal Equipment:

1. Vacuum truck as specified above.
2. Trash pumps.
3. Buckets, shovels and other equipment for manual removal of solids and semi-solids.

D. Testing Equipment

1. Approved atmospheric monitors that determine the presence of asphyxiating, toxic, and flammable or explosive atmospheric conditions in confined spaces.
2. Equipment shall be similar to monitors manufactured by GASTECH, Newark, CA.

PART 3. EXECUTION

3.01 PREPARATION

A. The Contractor shall carry out his operations in strict accordance with all applicable OSHA standards. Particular attention is drawn to those safety requirements involving working with scaffolding and entering confined spaces.

B. Test each subsurface structure for combustible, toxic or otherwise harmful gases, vapors or airborne particulates prior to entry of personnel. Conform to recommendations of NFPA 328. If such gases, vapors or particulates are detected, ventilate and retest prior to entry.

C. The Contractor shall select and mobilize the cleaning, removal and testing equipment. Selection of the equipment used shall be based on the conditions of the system at the time the work commences. The equipment shall be capable of safely removing dirt, grease, rocks, sand, and other materials and obstructions from the pipes and structures. The Contractor shall obtain prior approval from the Engineer for all equipment and procedures to be employed in the performance of this Section.

3.02 APPLICATION

A. General

Remove debris and sediment from catch basins, manholes, pipes, tunnel sumps and scuppers to clear drainage paths and provide unobstructed water flow. Dispose of removed materials away from Authority property.

B. Cleaning

1. Pipe cleaning shall be performed by using a high pressure water system or mechanically powered equipment designed for cleaning pipe systems. If successful cleaning of a pipe section cannot be performed, or if the equipment fails to traverse the pipe section, the Contractor shall set up at the other end or utilize other equipment and measures as directed by the Engineer and at no additional cost to the Authority. When, in the sole opinion of the Engineer, a major blockage exists which cannot be removed by methods specified in this Section, the cleaning effort will be abandoned.

2. Catch basins, manholes, sumps and scuppers shall be cleaned by use of a vacuum system, or by other means approved by the Engineer.

3. At no time will chemical solvents or treatments be used for the Work of this Section.

C. Removal

1. Sludge, dirt, sand, rocks, grease, debris and other solid and semi-solid materials shall be removed at the downstream end of the section being cleaned.

2. These materials shall not be passed from section to section that could cause line stoppages, accumulations in wet wells, or damage to pumping equipment.

D. Disposal

1. Unless otherwise specified in Appendix 'B', the cleaning water from which solids have been separated shall be discharged back into the system from which it was removed.

2. Dispose of removed materials away from Authority property on a daily basis and as specified in Appendix 'B'.

3.03 REMOVAL AND RESTORATION OF CASTINGS

A. At the time of removal of casting covers or grates, mark the edge of such cover or grate and edge of the frame in such a way so that the cover or grate can be restored in the same position relative to the frame. The lip of the frame shall be cleaned of debris so that the cover or grate fits securely in the frame.

B. The Contractor shall report to the Engineer any castings that are broken, or are worn such that the grate or cover is not continuously seated on the frame or is depressed more than 1/4" below the top of the frame.

3.04 FIELD TESTING

A. This basis for acceptance of the performance requirements shall be as specified herein unless otherwise shown on the Contract Drawings.

1. For pipes: Passage of the cleaning equipment in the presence of the Engineer. For hydrocleaning equipment, this shall include a return pass with the water jet "on" and showing no evidence of sediment being flushed back out of the pipe.

2. For catch basins, manholes, scuppers, sumps and open channels: Visual inspection of the clean bottom in the presence of the Engineer, or photographs.

B. The Contractor shall provide labor and equipment necessary to perform field testing at no additional cost to the Authority.

3.05 PROTECTION

Cleaning Precautions: During sewer cleaning operations, satisfactory precautions shall be taken in the use of cleaning equipment. When hydraulically propelled cleaning tools (which depend upon water pressure to provide their cleaning force) or tools which retard the flow in the sewer line are used, precautions shall be taken to ensure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. When possible, the flow of water in the sewer shall be utilized to provide the necessary pressure for hydraulic cleaning devices. When additional water from fire hydrants is necessary to avoid delay in normal work procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.

END OF SECTION

SECTION 02765

CLEANING STORM DRAINAGE AND SANITARY SEWER SYSTEMS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Construction and Installation Procedures

02765G01 Submit plans, methods, equipment and procedures as applicable for cleaning pipes and structures as specified in 3.01 C.

END OF APPENDIX "A"

DIVISION 2

SECTION 02832

METALLIC-COATED STEEL CHAIN LINK FENCE AND GATES

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for aluminum-coated and zinc-coated steel chain link fence including the following:

1. Furnishing and installing new fencing;
2. Removal of existing fencing;
3. Relocation of existing fencing.

B. Definitions of terms related to chain link fencing shall be in accordance with ASTM F 552.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American Concrete Institute (ACI)
ACI 318	Building Code Requirements for Structural Concrete.
	American Society for Testing and Materials (ASTM)
ASTM A 121	Specification for Metallic-Coated Carbon Steel Barbed Wire.
ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
ASTM A 392	Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
ASTM A 491	Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
ASTM A 817	Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire.
ASTM A 824	Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence.
ASTM B 117	Practice for Operating Salt Spray (Fog) Apparatus.
ASTM B 429	Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
ASTM F 552	Standard Terminology Relating to Chain Link Fencing.
ASTM F 567	Practice for Installation of Chain-Link Fence.
ASTM F 626	Specification for Fence Fittings.
ASTM F 900	Specification for Industrial and Commercial Swing Gates.
ASTM F 1043	Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.

ASTM F 1083	Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
ASTM F 1184	Specification for Industrial and Commercial Horizontal Slide Gates.
ASTM F 1345	Specification for Zinc - 5% Aluminum Mischmetal Alloy-Coated Steel Chain-Link Fence Fabric.

1.03 QUALITY ASSURANCE

Upon request arrange for the Engineer to inspect all fencing materials at the place of manufacture.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Arrange for fence fabric and accessories to be delivered to the construction site in packed cartons or firmly tied rolls.

B. Verify that each package is identified and bears the manufacturer's name.

C. Store fence fabric and accessories in a secure and dry area.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

A. Sliding gates shall be one of the following with no substitutions permitted:

"Easy Track" by
Boundary Fence and Railing Systems, Inc.
Richmond Hill, NY 11418

"Internal Roller" by
Anchor Fence/Master Halco Inc.
Baltimore, MD 21224

"Fortress Gate" by
Tymetal Corporation
Clifton Park, NY 12065

2.02 MATERIALS

A. General

1. Chain link fence components shall be zinc-coated steel except as otherwise permitted herein for fabric, barbed wire and gate framing.

2. Take field measurements prior to preparation of Shop Drawings and fabrication.

3. Unless otherwise specified herein or shown on the Contract Drawings, materials, coatings and shapes shall be of uniform type and manufacture.

B. Fence Fabric

1. Unless otherwise shown on the Contract Drawings, comply with ASTM A 817 for 0.192-inch diameter, 2-inch mesh, wire fabric.

2. Type II, Class 2 Zinc-Coated (Galvanized) fabric shall comply with ASTM A 392.

3. Type I Aluminum-Coated (Aluminized) fabric shall comply with ASTM A 491.

4. Type III Zinc - 5% Aluminum - Mischmetal coated fabric shall comply with ASTM F 1345.

5. Fence fabric height shall be as shown on the Contract Drawings. For fabric height of 6 feet and over, top and bottom selvage shall be twisted and barbed, unless otherwise shown on the Contract Drawings. For fabric height of less than 6 feet, both top and bottom selvages shall be knuckled.

6. Apply clear acrylic sealer to selvage area after weaving.

C. Barbed Wire

1. Each line of barbed wire shall consist of two strands of No. 12 1/2 gage (0.099-inch diameter) wires twisted with 4-point No. 14 gage barbs spaced approximately 5 inches apart. The barbed wire shall conform to ASTM A 121, Class 3 (0.8 oz/sf) zinc-coated or ASTM A 121, Type II aluminum-coated steel barbed wire with aluminum alloy barbs.

2. Extension arms shall be 45 degrees, extended outward as shown on the Contract Drawings and slotted to support three lines (unless otherwise shown on the Contract Drawings) of barbed wire such that the outermost line is positioned approximately 12 inches horizontally from the fence line.

3. End and intermediate vertical members of gates shall be extended vertically 12 inches and shall be provided with the necessary clips to secure barbed wire.

D. Fence Framing

1. Steel posts and rails shall conform to ASTM F 1043 for Heavy Industrial Fence.

2. External and internal protective coatings shall conform to ASTM F 1043 for the fence framework material group furnished. Framework shall demonstrate the ability to withstand salt spray when tested in accordance with ASTM B 117 based on certified test results, as follows:

   a. Exterior: 1000 hours with maximum 5 percent red rust.

   b. Interior: 650 hours with maximum 5 percent red rust.

3. Zinc-coated (galvanized) round steel pipe shall conform to the applicable portions of ASTM F 1083, Standard Weight Pipe (Schedule 40) with a minimum yield strength of 25,000 psi.

4. Unless otherwise shown on the Contract Drawings, equivalent steel sections may be substituted for the sections shown on the Contract Drawings. Equivalent sections shall conform to ASTM F 1043 Group IC - Round Steel Pipe, Group II - Roll Formed Steel Shapes or Group III - Hot-rolled Shapes and shall have bending strengths at least equal to those of the sections shown as determined by ASTM F 1043.

5. Rail sleeves and connectors shall allow for expansion and contraction of the rail. Use sleeves of the same material as the rail having a minimum length of 6 inches, or provide rails swedged at one end for a minimum length of 3 inches for connecting into a continuous run. Furnish and install suitable fittings for securing rails to terminal posts.

E. Gates

1. General

a. Gate types, opening widths and directions of operation shall be as shown on the Contract Drawings.

b. Gates shall conform to the requirements specified for metallic-coated steel chain link fence except that aluminum alloy framing conforming to ASTM B 429 may be used.

c. Gates shall be designed for operation by one person.

d. Where shown on the Contract Drawings, gates shall be topped with three lines of barbed wire, meeting the requirements of 2.02 C.1.

2. Swing Gates

a. Swing gates shall be factory assembled and shall swing 180 degrees.

b. Swing gates shall conform to ASTM F 900 except that framing shall be assembled by welding at the corners. Use of corner fittings will not be permitted.

3. Sliding Gates

a. Sliding gates shall be factory-assembled by one of the manufacturers specified in this Section.

b. For overhead and cantilever sliding gates, the materials, manufacture and dimensions and weights of frame members and posts shall, at a minimum, meet the requirements of ASTM F 1184, Class 2 (internal rollers).

c. Rollers for overhead and cantilever sliding gates shall be equipped with ball bearings. Non-sealed ball bearings shall be provided with a grease fitting for periodic maintenance. Rollers shall be secured to post or frame without welding.

4. Cantilever Sliding Gates

a. The gate leaf frames and tracks shall be fabricated of aluminum conforming to ASTM B 429 alloy 6063-T6 or as required to meet the performance requirements of ASTM F 1184 and specified herein.

b. Frame members shall be minimum 2-inch square, 0.91 lb/ft aluminum tubing assembled by welding at all corners to form a rigid, one-piece unit. Fabric shall be securely stretched and held in the center of the tubing. All cantilever overhang frames shall have 3/8-inch brace rods. For gate leaf sizes 23 feet to 30 feet, an additional lateral support rail shall be welded adjacent to the top and bottom horizontal rails.

c. The single leaf opening size shall determine the minimum overhang as follows:

Opening	Overhang
Up to 10'-0"	6'-6"
10'-1" to 14'-0"	7'-6"
14'-1" to 22'-0"	10'-0"
22'-1" to 30'-0"	12'-0"

d. The track shall be a combined integral track and rail. The rail shall be an aluminum extrusion having a minimum total weight of 3.72 pounds per foot and designed to withstand a reaction load of 2000 pounds. The roller track assembly shall be designed for the same reaction load as the rail and shall consist of two swivel type zinc die cast trucks having four sealed-lubricant ball bearing wheels of a minimum 2-inch diameter by 9/16-inch width. Provide two side-rolling wheels to ensure alignment of truck in track for each gate leaf. Fasten trucks to post brackets by minimum 7/8-inch diameter, 1/2-inch shank ball bolts.

e. Provide galvanized steel guide wheel assemblies for each supporting post. Each assembly shall consist of two rubber wheels of minimum 4-inch diameter with oil-impregnated bearings. The assembly shall be attached to the post so that the bottom horizontal member will roll between the wheels and can be adjusted to maintain plumb gate frames and proper alignment.

F. Tension Wire: ASTM A 824, Type I or Type II.

G. Accessories and Fittings

1. Furnish all necessary fittings for installation of fence as a complete unit including, but not limited to, post and line caps, rail and brace ends, rail sleeves, tie wires and clips, tension and brace bands, tension bars, truss rods and barbed wire extension arms.

2. Fence fittings shall conform to ASTM F 626.

3. Ferrous accessories and fittings shall be zinc-coated at a minimum of 1.2 oz./sf. in accordance with ASTM A 153, unless otherwise specified herein.

4. Furnish malleable iron non-lift-off type hinges offset to permit 180 degree swing gate opening.

5. Furnish malleable iron forked type latch with padlock eye suitable for operation from both sides of gate.

6. Furnish 2-inch cylinder type padlock for each gate and provide 3 keys for each padlock.

7. Furnish gate stops for double gates consisting of a mushroom type flush plate with anchors capable of being set in concrete and designed to engage center drop rod or plunger.

8. Furnish keepers to hold the gate leaf in the fully open position until manually released.

9. Wire ties shall be of the same material and coating as the fabric.

H. Concrete

Concrete for post footings shall attain a minimum compressive strength of 3000 psi in 28 days and shall conform to the requirements of ACI 318 for mixing and placing.

PART 3. EXECUTION

3.01 PREPARATION

Prepare the grade and remove surface irregularities, if any, which may cause interference with the installation of chain link fence.

3.02 REMOVAL OF EXISTING FENCING

A. Where shown on the Contract Drawings, remove existing fence including fabric, gates, posts and other appurtenances. Cut post footings flush with the ground surface and grout resulting voids, unless otherwise shown on the Contract Drawings.

B. Fencing materials and debris resulting from removal operations shall be disposed of away from Authority property, unless otherwise shown on the Contract Drawings.

3.03 INSTALLATION

A. Comply with applicable provisions of ASTM F 567.

B. Install fence with all posts vertical and all components to the line and grade shown on the Contract Drawings.

C. Connect to existing fence at an existing terminal post or by installation of an end post. Subject to approval by the Engineer, an existing line post may be converted to a terminal post by installation of appropriate brace rails and brace rods.

D. The clear opening from end posts to buildings, fences and other structures shall not exceed 2 inches.

E. Excavate holes for posts to the diameter and spacing shown on the Contract Drawings without disturbing the underlying materials. Holes resulting from removal of existing post footings may be reused as approved by the Engineer.

F. Center and align posts. Place concrete around posts and vibrate or tamp for consolidation. Confirm vertical and top alignment of posts and make necessary corrections. Extend concrete footings 1 inch above grade and trowel to a crown to shed water. Unless otherwise approved by the Engineer, no materials shall be installed on the posts nor shall the posts be disturbed within 7 days after the individual post footing is completed.

G. For non-FAA contracts only, use of mechanical devices may be substituted for concrete in the setting of line posts, provided the Contractor can demonstrate to the satisfaction of the Engineer that such mechanical devices will develop a strength in the ground equal to or greater than that of concrete footings shown on the Contract Drawings.

H. Stretch chain link fabric taut and securely fasten to posts. Cut fabric and attach each span independently to terminal posts with tension bars and tension bands spaced a maximum of 15 inches apart. Fasten fabric to line posts with tie wires, bands or other method approved by the Engineer, spaced a maximum of 15 inches apart. Fasten top edge of fabric to top rail or top tension wire at intervals not exceeding 24 inches. Fasten bottom edge of fabric to bottom tension wire with wire ties at intervals not exceeding 24 inches. Join rolls of wire fabric by weaving a single strand into the end of the rolls to form a continuous mesh. Install the bottom of the fence fabric to within 2 inches of the finished ground or pavement surface. Grade where necessary to provide a neat appearance.

I. Install fabric on security side of fence.

J. Firmly seat barbed wire extension arms or caps on tops of posts.

K. Stretch barbed wire tightly to remove all sag; firmly install it in slots of extension arms and anchor it to the terminal extension arms.

L. Install fabric on gate frames with stretcher bars at vertical edges. Install fabric at top and bottom edges with stretcher hooks at not more than 15-inch intervals.

M. Install gates plumb, level and secure for full opening without interference. For double gates, install ground-set, mushroom type, flush plate in concrete. Adjust hardware for smooth operation and lubricate where necessary.

N. Install horizontal brace rails with diagonal truss rods and turnbuckles at all terminal posts.

3.04 RELOCATION OF EXISTING FENCING

A. Remove existing fabric where shown on the Contract Drawings for installation on new posts. Prevent damage to the fabric. Repair or replace any damaged fabric to the satisfaction of the Engineer at no additional cost to the Authority.

B. Remove and dispose of existing posts and accessories as specified in 3.02 B.

C. Furnish and install new posts, footings and accessories as specified in this Section.

D. Install the removed fabric as specified in 3.03.

3.05 ELECTRICAL GROUNDS

At each location where an electric transmission, distribution or power line passes over the fence, construct electrical ground conforming to the following requirements:

A. Construct electrical grounds per NESC-093E, Specification Section 16450 and NFPA 780.

B. Ground the fence directly beneath the point where a power line passes over the fence and additionally approximately every 20 feet for 250 feet on each side of the power line crossing and at corner posts.

C. Ground fences at both sides of gates or at other opening in the fence with flexible braided ground strap.

D. Bond across all gates and openings with a buried bonding jumper.

E. The ground shall be accomplished with a copper clad rod 10-feet (3000 cm) long and 3/4-inch (20 mm) in diameter driven vertically until the top is 6 inches (150 mm) below the ground surface. Use a 4/0 AWG bare stranded copper conductor for the ground grid and 1/0 AWG for connection to fence posts. For above ground connections use a double-bolt compression type connector and for below grade use exothermic welded connections.

F. The grounding loop shall have less than 5 ohms resistance to ground.

G. Bond each barbed wire strand to a grounded fence post or grounding conductor.

H. Ground the fence wire mesh fabric, unless it is held in place by a conductive tie-wraps or similar device.

I. Construct electrical grounds at other locations along the fence as shown on the Contract Drawings.

END OF SECTION

SECTION 02832

METALLIC-COATED STEEL CHAIN LINK FENCE AND GATES

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

02832A01 Submit shop drawings of chain link fence and gates in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS.

Samples

02832C01 Submit representative samples of fabric to the Manager, Materials Engineering Division, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397.

Certificates

02832E01 Submit manufacturer's certificates of compliance with all requirements for material types, coatings, etc. specified in this Section including but not limited to fabric, barbed wire, fence and gate framing, tension wire, fittings and accessories. Submit certification that rail and roller track assembly for sliding gates are designed for the specified reaction load.

Manufacturer Test Reports

02832F01 Submit certified test results for:
1. Salt spray testing of framework
2. Concrete compressive strength

Inspection Reports

02832O01 Submit methods, types of equipment and other information required by the Engineer to demonstrate equivalent strength of mechanical line post setting devices.

END OF APPENDIX "A"

DIVISION 2

SECTION 02841

W-BEAM AND THRIE-BEAM GUIDE RAIL

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for W-beam and Thrie-beam guide rail.

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 30	Zinc-Coated Steel Wire Rope and Fittings for Highway Guardrail
AASHTO M 102	Steel Forgings, Carbon and Alloy, for General Industrial Use
AASHTO M 133	Preservatives and Pressure Treatment Process for Timber
AASHTO M 180	Corrugated Sheet Steel Beams for Highway Guardrail

American Society for Testing and Materials (ASTM)

ASTM A 36	Structural Steel
ASTM A 123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip
ASTM A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 563	Carbon and Alloy Steel Nuts

1.03 QUALITY ASSURANCE

A. Guide rails and appurtenances may, at the option of the Engineer, be inspected at the place of manufacture.

B. Furnish certificate for each type material specified in 2.01, certifying that such material complies with the applicable specified requirements.

C. Guide rails and appurtenances will be visually inspected when delivered to the construction site. Any such material that does not meet requirements of this Section or is damaged, shall be removed from the construction site and replaced with satisfactory material.

D. All stages of installation will be inspected by the Engineer for compliance with the provisions hereof and conformance to required line and grade. Any failures to comply shall be immediately corrected to the satisfaction of the Engineer.

1.04 SUBMITTALS

Refer to Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Steel Guide Rail and Terminal Sections

AASHTO M 180, CLASS B, TYPE 2, for W-Beam or Thrie-Beam, as shown on the Contract Drawings.

B. Posts, Spacers, Plates, Rub Rail and Anchorage Units

ASTM A 36 of type and size shown on the Contract Drawings, galvanized in accordance with ASTM A 123. No punching, drilling, cutting or welding will be permitted after galvanizing. When shown on the Contract Drawings, provide rub rail.

C. Bolts and Nuts

Conform to AASHTO M 180.

D. Miscellaneous Hardware for End Treatments

When end treatments are shown on the Contract Drawings, conform to AASHTO M 180 except as follows:

1. Guide rail end treatment cables shall conform to AASHTO M 30, Type 1 with Class A coating. Swaged fittings shall be fabricated from forged steel conforming to AASHTO M 102.
2. Nuts for guide rail end treatment shall conform to ASTM A 563, Grade A.
3. Plates and rods for guide rail end treatment shall be structural steel conforming to ASTM A 36 and galvanized in accordance with ASTM A 123.

E. Timber Posts for Breakaway Cable Terminals

Where shown on the Contract Drawings, provide timber posts having a stress grade of 1200 pounds per square inch or more as tested in accordance with requirements of West Coast Lumber Inspection Bureau, Southern Pine Inspection Bureau or other appropriate Timber Association. Posts may be rough sawn or dressed and shall be treated with a preservative conforming to AASHTO M 133 with retention property of six pounds of creosote per cubic foot of timber, minimum.

PART 3. EXECUTION

3.01 INSTALLATION

A. Posts shall be set to the required depth. Posts shall be plumb, properly spaced and to the prescribed line and grade as shown on the Contract Drawings.

B. Prior to driving the posts or excavating for concrete footings, the exact location of underground utilities that may conflict with the posts shall be determined. Post spacing may be adjusted by six inches or double spacers may be used, as approved by the Engineer, to eliminate such conflicts.

C. Damage to utilities due to the performance of the Work shall be located and repaired at no additional cost to the Authority.

D. The rail elements shall be erected with the top edge in a straight line or smooth curve, parallel or concentric to the roadway. Where a vertical transition is required, the top edge of rail elements shall form the chords of a smooth vertical curve. No punching, drilling, reaming, cutting or welding of the rail elements will be permitted in the field.

E. Where earth is of a type that cannot be drilled using a mechanical earth auger, obtain approval from the Engineer for an alternate method of installing posts.

F. If concrete Footings are required, support posts at proper line and grade as shown on the Contract Drawings in such a manner so that they will not be displaced during concreting operations.

G. Use erectors trained by manufacturer.

H. Touch up all damage to the zinc coating with an approved type paint.

I. Paint portions of posts to be imbedded in concrete with two heavy coats of an approved bitumastic paint.

3.02 STAGING FOR INSTALLATION ADJACENT TO EXISTING ROADWAYS

Install W-beam and Thrie-beam guide rail in the following sequence:

A. Approach terminal end shall be the first section installed.

B. Posts and rails shall be constructed in the direction of traffic.

C. At the end of a work period, all posts that have been installed shall have the rail elements attached.

D. New guide rail shall be installed prior to the removal of an existing system, if any, unless otherwise shown on the Contract Drawings.

END OF SECTION

SECTION 02841

W-BEAM AND THRIE-BEAM GUIDE RAIL

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

02841A01 Submit Detailed shop drawings of all components of the guide rail installation in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 – GENERAL PROVISIONS.

END OF APPENDIX "A"

DIVISION 2

SECTION 02842

TEMPORARY TRAFFIC BARRIERS

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for temporary traffic barriers.

B. Coordinate the Work of this Section with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.

C. Materials and constructions of this Section constitute temporary facilities that are and shall remain the property of the Contractor unless otherwise shown on the Contract Drawings.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American Society for Testing and Materials (ASTM)
ASTM A 36	Structural Steel
ASTM A 123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 307	Carbon Steel Externally Threaded Standard Fasteners
ASTM D 1751	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
	West Coast Lumber Inspection Bureau (WCLIB)
Standard Grading Rules	

1.03 SUBMITTALS

Refer to Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. General

Provide new materials or, if acceptable to the Engineer, undamaged previously used materials in serviceable condition conforming to requirements specified in this Section. Provide materials suitable for the use intended.

B. Precast Concrete Barriers

1. White Portland cement proportioned to produce 3000 psi reinforced concrete.
2. Joint fillers shall conform to ASTM D 1751

C. Timber Barriers and Curbs

1. Lumber

   Douglas Fir or Hem-Fir, WCLIB Standard Grade, Dressed on 4 sides (S4S).

2. Penetrating Sealer

   Transparent colorless wood sealer which is effective in retarding transmission of moisture at cross-grain cuts and which shall not interfere with paint finish.

3. Paint Finish

   Exterior alkyd resin reflectorized paint in colors shown on the Contract Drawings.

D. Connector, Anchors, Accessories

Fabricated ASTM A 36 shapes, plates and bars welded into assemblies required, with ASTM A 307 steel bolts, lag bolts and other fasteners as required. Finish each assembly and fastener with ASTM A 123 hot-dip zinc coating.

E. Concrete Barrier Flags

Aluminum, 6 x 6 inch, with weather-resistant reflective silver sheet suitable for daylight and night hours.

F. Concrete Barrier Lights

High intensity flashers of type specified in "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.

G. Timber Barrier Markers

Light-retroreflective markers as shown on the Contract Drawings.

2.02 CONSTRUCTION FEATURES

A. Fabricate exposed traffic approach end of barriers with a gradual taper with no blunt ends, arranged to redirect the path of a vehicle parallel to the line of normal traffic flow.

B. Fabricate concrete barriers with a cross section of a portable, concrete safety shape barrier as shown on the Contract Drawings.

1. Fabricate in lengths of 20 feet or less with the rectangular footing cut out at regular intervals to ensure storm water runoff.
2. Furnish connections at vertical joints that will develop the full strength of the barrier system and ensure that the individual elements are aligned to provide a smooth, continuous barrier face.
3. Provide barrier lights as shown on the Contract Drawings.

C. Fabricate timber barriers and curbs of type and size shown on the Contract Drawings. Paint as shown on the Contract Drawings, or if not shown, paint white with rails of alternating orange and white stripes that slope down toward the side on which traffic is to pass. All paint shall be reflectorized.

PART 3. EXECUTION

3.01 PREPARATION

Provide and place temporary traffic control devices in accordance with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1.

3.02 INSTALLATION

A. Install barriers and curbs at locations shown on the Contract Drawings.

B. Provide bituminous pavement shimming and leveling as required to ensure smooth, continuously aligned barriers and curbs.

C. Provide 1/2 inch wide joints between ends of barriers and curbs. At concrete barriers, fill joint with premolded bituminous joint filler.

D. Secure barriers against lateral displacement by use of drift pins or anchor bolts drilled into roadway surface.

E. Connect, and continuously operate, concrete barrier lights.

3.03 ADJUSTMENTS

A. Maintain, clean, relocate and replace barriers and curbs as required to protect motorists, pedestrians and workers throughout the Work of this Contract.

B. Remove barriers away from Authority property, when the need has ended, when replaced by approved use of permanent construction, or when directed by the Engineer.

C. Complete, or if necessary, restore permanent construction. Replace construction that cannot be satisfactorily repaired. Remove temporary paving that is not intended for or acceptable for integration into permanent paving.

END OF SECTION

SECTION 02842

TEMPORARY BARRIERS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

02842A01 Submit shop drawings of concrete barriers, including details of vertical joint connections, and details of proposed method of relocating concrete barriers in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 – GENERAL PROVISIONS.

END OF APPENDIX "A"

DIVISION 2

SECTION 02844

TEMPORARY CONCRETE BARRIER

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for temporary concrete barriers.

B. Coordinate the Work of this Section with the requirements of "MAINTENANCE OF TRAFFIC AND WORK AREA PROTECTION" of DIVISION 1 - GENERAL PROVISIONS.

C. Materials and constructions of this Section constitute temporary facilities that are and shall remain the property of the Contractor unless otherwise shown on the Contract Drawings.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM A 36	Structural Steel
ASTM A 123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 307	Carbon Steel Externally Threaded Standard Fasteners
ASTM C 150	Portland Cement

1.03 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 CONSTRUCTION FEATURES AND MATERIALS

A. General

Provide new barriers and materials or, if acceptable to the Engineer, undamaged previously used barriers and materials in serviceable condition conforming to the requirements specified in this Section, and as shown on the Contract Drawings.

After delivery, a construction site inspection of the barriers and equipment will be made by the Engineer. If any barriers and equipment has been damaged or if, for any reason, the equipment does not comply with the requirements herein, the Contractor shall repair or replace the barriers and equipment at its own cost and expense, even though the barriers and equipment had been inspected for shipment. After such satisfactory replacement and/or repair and subsequent Engineer written approval, the barriers shall be installed.

B. Precast Concrete Barriers

1. Shall be manufactured with white portland cement concrete in accordance with the Contract Drawings which depict New York and New Jersey requirements. If the Contract Drawings are superseded by later New York or New Jersey Standards, then the most recent Standards shall be used, and the Contractor shall furnish Shop Drawing(s) in accordance with paragraph 1.03 B highlighting the change(s).

2. Concrete shall be proportioned to produce 3000 psi reinforced concrete.

3. Barrier sections less than 10 feet shall have one drainage pocket, and sections greater than 10 feet shall have two drainage pockets conforming to the size shown on the Contract Drawings, or styrofoam pads shall be provided to allow adequate drainage, as shown on the Contract Drawings.

4. Connectors, Anchors and Accessories:- Fabricated ASTM A 36 shapes, plates and bars welded into assemblies required, with ASTM A 307 steel bolts, and other fasteners as required. Finish each assembly and fastener with ASTM A 123 hot-dip zinc coating.

C. Barrier Reflectors

If specified on the Contract Drawings, barrier reflectors shall be 6" x 6", high intensity reflectorized, spaced at 20 feet on center with a minimum mounting height of 30 inches to the bottom of the reflectors. The reflector shall be white or yellow, matching the pavement edgeline, or as shown on the Contract Drawings.

D. Barrier Lights

If specified on the Contract Drawings barrier lights shall be steady burn Type C, spaced at 20 feet on center with a minimum mounting height of 30 inches to the bottom of the lens or as specified on the Contract Drawings. Type B flashing lights shall be placed on the approach end of barrier at 10 feet on center or as shown on the Contract Drawings.

E. Chain Link Fence

If specified in the Contract Drawings, chain link fence shall be placed on top of the temporary concrete barrier as shown on the Contract Drawings.

F. Glare/Gawk Shield

Install glare / gawk shield as specified by the manufacturer or as shown on the Contract Drawings.

PART 3. EXECUTION

3.01 PREPARATION

Protect the installation, maintenance, relocation and removal by providing and placing temporary traffic control devices in accordance with the requirements of the specification titled "Maintenance of Traffic and Work Area Protection" in Division 1.

3.02 INSTALLATION

A. Install barriers at locations shown on the Contract Drawings.

B. Provide styrofoam pad shimming and leveling as required to ensure smooth and continuously aligned barriers.

C. Taper ends of barriers shall be flared away from traffic at a rate of 10 to 1 or flatter. Terminate blunt approach end with an impact attenuator as approved by the Engineer in accordance with paragraph 1.03 D or as specified on the Contract Drawings.

D. Secure barriers against lateral displacement by use of drift pins or anchor bolts drilled into roadway surface or as shown on the Contract Drawings.

E. Install reflectors and lights as specified herein, and as shown on the Contract Drawings.

3.03 MAINTENANCE

A. Maintain, clean, relocate and replace barriers, reflectors and lights as required to protect motorists, pedestrians, and workers throughout the Work of this Contract.

3.04 REMOVAL

A. Remove barriers away from Authority property, when the need has ended, when replaced by approved use of permanent construction, or when directed by the Engineer.

B. Restore damaged permanent construction, and replace construction that cannot be satisfactorily repaired, all at no cost to the Authority.

END OF SECTION

SECTION 02844

TEMPORARY CONCRETE BARRIERS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

02844A01 Shop Drawings detailing departures from the Standard Drawings included in the Contract Documents.

Catalog Cuts

02844B01 Proposed equipment Catalog Cuts and procedures to be used for installing, maintaining, relocating and removing the barrier(s).

Certificates

02844E01 Certification from the concrete barrier supplier stating that the concrete barrier(s) meet the requirements of the Contract Drawings.

Construction and Installation Procedures

02844G01 Proposed end treatment details and Catalog Cuts including but not limited to impact attenuator type.

END OF APPENDIX "A"

DIVISION 2

SECTION 02845

TEMPORARY TIMBER CURB

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for temporary timber curbs.

B. Coordinate the Work of this Section with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.

C. Materials and constructions of this Section constitute temporary facilities that are and shall remain the property of the Contractor unless otherwise shown on the Contract Drawings.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM A 36	Structural Steel
ASTM A 123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 307	Carbon Steel Externally Threaded Standard Fasteners

West Coast Lumber Inspection Bureau (WCLIB)

Standard Grading Rules

1.03 SUBMITTALS

Refer to Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 CONSTRUCTION FEATURES AND MATERIALS

A. General

Provide new materials or, if acceptable to the Engineer, undamaged previously used materials in serviceable condition conforming to the requirements specified in this Section. Provide materials suitable for the use intended.

After delivery, a construction site inspection of the timber curb and equipment will be made by the Engineer. If any timber curb or equipment has been damaged or if, for any reason, the timber curb or equipment does not comply with the requirements herein, the Contractor shall repair or replace the timber curb and equipment at its own cost and expense, even though the equipment had been inspected for shipment. After such satisfactory replacement and/or repair and subsequent Engineer written approval, the timber curb shall be installed.

B. Timber Curb

1. Lumber

Douglas Fir or Hem - Fir, WCLIB Standard Grade, dressed on 4 sides (S4S).

2. Fabrication

Fabricate timber curbs of type and size as shown on the Contract Drawings.

3. Paint Finish

Paint timber and splice block with two coats of reflectorized white paint, or as shown on the Contract Drawings

C. Delineator Posts

18 inch high delineator posts shall be installed at a uniform height and type, and spaced at 24 inches on center, or as shown on the Contract Drawings.

PART 3. EXECUTION

3.01 PREPARATION

Protect the installation, maintenance, relocation and removal by providing and placing temporary traffic control devices in accordance with the requirements of the specification titled "Maintenance of Traffic and Work Area Protection" in Division 1.

3:02 INSTALLATION

A. Install curbs at locations shown on the Contract Drawings.

B. Approach ends of timber curbs shall be flared away from traffic at a rate of 10 to 1 or as specified on the contract drawings.

C. Secure timber curbs against lateral displacement by use of drift pins or anchor bolts drilled into roadway surface or as shown on the Contract Drawings.

3.03 MAINTENANCE

A. Maintain, clean, relocate and replace timber curbs, reflectors as required to protect motorists, pedestrians, and workers throughout the Work of this Contract.

3.04 REMOVAL

A. Remove timber curbs away from Authority property, when the need has ended, when replaced by approved use of permanent construction, or when directed by the Engineer.

B. Restore damaged permanent construction and replace construction that cannot be satisfactorily repaired. all at no cost to the Authority.

END OF SECTION

SECTION 02845

TEMPORARY TIMBER CURB

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

02845A01 Shop Drawings detailing departures from the Standard Drawings included in the Contract Documents

END OF APPENDIX "A"

DIVISION 2

SECTION 02846

TEMPORARY WATER-FILLED BARRIER

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for temporary water-filled barriers.

B. Coordinate the Work of this Section with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.

C. Materials and constructions of this Section constitute temporary facilities that are and shall remain the property of the Contractor unless otherwise shown on the Contract Drawings.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American Society for Testing and Materials (ASTM)
ASTM A 36	Structural Steel
ASTM A 123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 307	Carbon Steel Externally Threaded Standard Fasteners

1.03 SUBMITTALS

Refer to Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 CONSTRUCTION FEATURES AND MATERIALS

A. General

B. Provide new barriers and materials or, if acceptable to the Engineer undamaged previously used barriers and materials in serviceable condition conforming to the requirements specified in this Section.

After delivery, a construction site inspection of the barrier and equipment will be made by the Engineer. If any barrier or equipment has been damaged or if, for any reason, the barrier or equipment does not comply with the requirements herein, the Contractor shall repair or replace the barrier and equipment at its own cost and expense, even though the equipment had been inspected for shipment. After such satisfactory replacement and/or repair and subsequent Engineer written approval, the barrier shall be installed.

C. Water-Filled Barriers

Shall be manufactured by Energy Absorption System Inc., or approved equal, and be installed in alternating white and orange sections.

D. Barrier Reflectors

Barrier reflectors shall be installed as specified by the manufacturer, or as shown on the Contract Drawings. Reflectors shall be high intensity reflectorized, with the color, white or yellow, matching the pavement edgeline, or as shown on the Contract Drawings.

E. Barrier Lights

Install low intensity steady burn type C barrier lights as specified by the manufacturer or as shown on the Contract Drawings.

F. Glare / Gawk Shield

Install glare / gawk shield as specified by the manufacturer or as shown on the Contract Drawings.

PART 3. EXECUTION

3.01 PREPARATION

Protect the installation, maintenance, relocation and removal by providing and placing temporary traffic control devices in accordance with the requirements of the specification titled "Maintenance of Traffic and Work Area Protection" in Division 1.

3.02 INSTALLATION

A. Install barriers at locations shown on the Contract Drawings, in alternating white and orange sections.

B. Approach ends of barriers shall be flared away from traffic at a rate of 10 to 1 or flatter or as shown on the Contract Drawings. End treatment shall be provided by leaving the water out of the first section, and the pin out of the exposed end, or as specified by the manufacturer.

C. Secure barriers against lateral displacement by use of drift pins or anchor bolts drilled into roadway surface or as shown on the Contract Drawings.

D. Install reflectors and lights as specified herein, or as shown on the Contract Drawings.

3.03 MAINTENANCE

A. Maintain, clean, relocate and replace barriers, reflectors and lights as required to protect motorists, pedestrians, and workers throughout the Work of this Contract.

3.04 REMOVAL

A. Remove barriers away from Authority property, when the need has ended, when replaced by approved use of permanent construction, or when directed by the Engineer.

B. Restore damaged permanent construction and replace construction that cannot be satisfactorily repaired, all at no cost to the Authority.

END OF SECTION

SECTION 02846

TEMPORARY WATER-FILLED BARRIER

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

02846A01 Shop Drawings detailing departures from the Standard Drawings included in the Contract Documents.

Catalog Cuts

02846B01 Proposed equipment Catalog Cuts and procedures to be used for installing, maintaining, relocating and removing the barrier(s).

Certificates

02846E01 Certification from the water-filled barrier supplier stating that the water-filled barriers meet the requirements of the Contract Drawings.

END OF APPENDIX "A"

DIVISION 2

SECTION 02849

TEMPORARY TRAFFIC SIGNAL EQUIPMENT

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for temporary traffic signal equipment.

B. Coordinate Work of this Section with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.

C. Materials and construction provided under this Section are considered temporary and shall remain the property of the Contractor unless specifically indicated otherwise on the Contract Drawings.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American Association of State Highway and Transportation Officials (AASHTO)
	Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.
	Federal Communications Commission (FCC)
Title 47	Telecommunication.
	Federal Highway Administration (FHWA)
MUTCD	Manual on Uniform Traffic Control Devices.
	Institute of Transportation Engineers (ITE)
ITE ST-017B	Equipment and Material Standards of the Institute of Transportation Engineers.
	Pedestrian Traffic Control Signal Indications – Part 2: Light Emitting Diode (LED) Pedestrian Traffic Signal Modules.
	Vehicle Traffic Control Signal Heads – Part 3: Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Modules.
ITE ST-052	Vehicle Traffic Control Signal Heads: Light Emitting Diode (LED) Circular Signal Supplement.
	National Electrical Manufacturers Association (NEMA)
NEMA TS 1	Traffic Control Systems.
NEMA TS 2	Traffic Controller Assemblies with NTCIP Requirements.
	The Port Authority of New York and New Jersey (PA)
	Traffic Signal Design and Drawing Preparation Guidelines.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Furnish, install and maintain temporary traffic signal equipment under the following conditions:

1. When roadway construction or other Work of the Contract requires the temporary disconnection or removal of any signal equipment such as vehicular signal heads, detectors, pedestrian signal heads and pushbuttons, poles, and controller cabinets, which is necessary to provide for a safe operation at the particular location;

2. When existing signal equipment is removed from a location but the required permanent replacement signal equipment is not yet operational;

3. When signal operation is necessary for a location but the related permanent signal equipment is not yet operational; or

4. When directed by the Engineer, or where indicated on the Contract Drawings.

B. The Engineer, in his sole discretion, will determine if such temporary signal equipment is required. If so required, construct the temporary traffic signal system in such a manner that minimizes interference with and inconvenience to the traveling public.

C. Temporary traffic signal equipment shall conform to the following requirements:

1. Temporary signal equipment may include vehicular signal heads, signal mounting poles, mast arms, span wire, detectors, pedestrian signal heads and pushbuttons, poles, controller cabinets and other equipment and shall meet the requirements stated in the Manual on Uniform Traffic Control Devices (MUTCD), latest edition, distributed by the Federal Highway Administration.

2. Coordinate Work of this Section with the requirements of electrical and traffic safety of Division 16, Electrical.

3. Temporary signal equipment shall be physically and functionally as similar as possible to the equipment that is removed, or to the permanent equipment to be installed, or as shown on the Contract Drawings.

4. Temporary traffic signal equipment shall conform to requirements specified in this Specification. Where specific requirements are not listed herein, the temporary traffic signal equipment shall, as a minimum, conform to the requirements of the standards and publications listed in 1.02.

5. Design and install temporary signal mounting poles and bases so that environmental conditions cannot twist or move the structures from their proper position. Provide guy wires, supports or ballast as required to ensure stable conditions.

6. The temporary traffic controller shall be subject to the Engineer's approval and shall be:

   a. Capable of providing adjustable green, as well as yellow and all red clearance intervals for each signal phase.

   b. Capable of an isolated flash operation. Flash operation shall be manually activated or automatically activated upon any failure of the controller equipment.

   c. Capable of accepting actuations from the detectors and extending the green interval for each phase.

d. Capable of operating multiple timing plans and Time of Day/ Day of Week scheduling plans.

7. Furnish and install the temporary traffic signal equipment, signal heads, mounting brackets, attachments, poles and fittings for a wind load pressure resulting from a wind speed of at least 90 miles per hour, in accordance with AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

8. Mount signal controllers and other related equipment in a weatherproof lockable cabinet. Provide access keys to the cabinet to the Engineer.

1.04 ENVIRONMENTAL REQUIREMENTS

A. The vehicular traffic signal head equipment 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 vehicular traffic signal head equipment shall not be degraded by rain, snow, fog or normally encountered ambient humidity conditions.

B. The equipment shall be protected against the intrusion of dust and moisture to protect all internal components.

C. The equipment shall operate as specified and without degradation or damage under ambient shock (thermal and mechanical), vibration, lightning and electromagnetic/ electrical interference at the construction site.

1.05 QUALITY ASSURANCE

A. After delivery of equipment, the Engineer may perform a construction site inspection of the equipment. If, in the Engineer's opinion, any equipment has been damaged or if, for any reason, the equipment does not comply with the requirements or testing hereof, the Contractor shall repair or replace the equipment at his own cost and expense, even though the equipment had been inspected for shipment. After such satisfactory replacement and/or repair and Engineer's subsequent written approval, the equipment may be installed.

B. After installation, test the equipment in the presence of the Engineer to show compliance with the requirements of this Section and with the Contract Drawings. Continue testing until the results are satisfactory to the Engineer. If any equipment has been damaged or if, for any reason, the equipment does not comply with the requirements or test standards specified, the Contractor shall repair or replace the equipment at his own expense. Provide installation process and test results documentation to the Engineer. Perform any repairs, construction or modifications required to comply with the Specifications and the Contract Drawings.

C. Maintain as-built drawings of all temporary traffic conditions during construction. In each traffic signal control cabinet, place traffic signal plans and timing plans conforming to the PA Traffic Signal Design and Drawing Preparation Guidelines.

D. Submit detailed traffic and structural design calculations conforming to the PA Traffic Signal Design and Drawing Preparation Guidelines, for all temporary installations not shown on the Contract Drawings. Structural design calculations of the temporary traffic signal layout shall include span pole, span wire, mast pole and mast arm load calculations for all signals and stages of construction.

E. Arrange for the entity performing Work of this Section to furnish on-site technical assistance during the installation of the equipment.

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 delivered materials to prevent deterioration or damage due to moisture, temperature change, contaminants and other causes.

1.07 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Provide new materials and equipment or, if approved by the Engineer, undamaged previously used materials in serviceable condition conforming to the requirements specified in this Section. Provide materials and equipment suitable for the use intended.

2.02 CONSTRUCTION FEATURES

A. General

1. The Work consists of furnishing, installing, maintaining and repairing a temporary traffic signal system to provide the timing and operation as shown on the Contract Drawings or as directed by the Engineer. The Work shall include, but not be limited to, temporary wiring, span and tether wire, signal heads, relamping, mast arms, poles, traffic signal cables, junction boxes, foundations, conduit, detectors, controllers and timing sequences, cabinets, associated highway lighting units, electric service, necessary hardware and all other incidentals deemed required by the Engineer.

2. Furnish and install signal head equipment for operation off a line voltage of 120 +/-3 VAC RMS nominal capable of operating over a voltage range from 80 VAC RMS to 135 VAC RMS, 60 Hz +/- 3 Hz, AC line power. Variations in operating line voltage shall have no visible effect on luminous intensity, which shall not vary by more than 10 percent over the entire operating voltage range.

3. Unless specified otherwise, fabricate equipment in accordance with ITE ST-017B and ITE ST-052.

4. Controller assembly equipment shall conform to the requirements specified in NEMA TS 1, TS 2 and ITE ST-017B. Where a conflict occurs between the Specifications, and the NEMA and ITE Standards, the requirements of the Specifications shall govern.

5. Ensure that the temporary traffic signal equipment electrical provision, including its circuitry, meets FCC Title 47, Subpart B, Section 15 regulations concerning the emission of noise.

PART 3. EXECUTION

3.01 PREPARATION

A. Maintain as-built drawings of each signal change and place a copy in each controller cabinet.

B. Obtain electric service for the temporary traffic signal system from the Authority. Coordinate with the Engineer to obtain the electrical service.

C. Pay for new temporary electric service from the Authority and for the furnishing and removal of junction boxes, conduit and service cable and installation and removal of the temporary traffic signal equipment. Repair at no cost to the Authority all damage to temporary electric service caused by third parties including, but not limited to, vehicular knockdown.

D. Before energizing the temporary traffic signal system, provide the Engineer with the names and telephone numbers of two individuals who may be contacted should a failure occur. These individuals shall be familiar with traffic signal construction and operation.

E. Furnish and install temporary traffic control devices in accordance with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1.

3.02 INSTALLATION

A. Furnish, install, maintain and repair all temporary traffic signal equipment that provides the signal timing and operation as shown on the Contract Drawings or as directed by the Engineer. The installation shall conform to the Authority's Traffic Signal Design and Drawing Preparation Guidelines and the Contract Drawings.

B. Install top of post and side of pole-mounted signals not less than 8 feet and no more than 12 feet above ground level. Mount overhead signals not less than 16 feet 6 inches and no more than 17 feet 6 inches above road level.

C. Furnish, install and connect the temporary traffic signal equipment so as to be ready for full function inspection and field test. Bag temporary signal heads until they are approved for operation.

D. Maintain the temporary traffic signal equipment from the time the Contractor commences work on the temporary traffic signal equipment until its removal.

E. Where incandescent vehicular and/or pedestrian signals are installed, annually re-lamp all displays.

F. Arrange for 24-hour, 7-days-per-week maintenance services to handle malfunctions that may occur.

1. If for any reason the temporary signal equipment is not functioning as required, commence repair work on the signal within 2 hours after being notified of a malfunction. Provide a flag person at each malfunctioning traffic signal during repair work until the temporary traffic signal is restored to proper operation. The following conditions shall require a 2-hour response:

a. A clearance between roadway and signal or aerial sign less than 15 feet 6 inches.

b. Any signal face enough out of alignment to be visible to drivers on opposing approaches.

c. A complete "Black Out" of all signal faces at an intersection.

d. Two or more ball signal indicators not illuminated, for three-color signals.

e. Two or more defective or missing lenses, including open lens door, for ball signal indicators.

f. One or more arrow indicators not illuminated, defective or missing lenses.

g. Signal sufficiently damaged to obscure signal visibility.

h. Visible appearance that indicates insecure signal mounting or suspension.

i. Poles or supports more than 15 degrees out of plumb or exhibiting other structural deficiencies.

j. The following controller and accessory equipment malfunctions:

(1) "Sticking" in such a manner that proper color sequence is not displayed, or color indications are not changing properly.

(2) The controller timing is off by five seconds or more (one second in the case of clearance intervals).

(3) A malfunctioning time switch or time clock.

(4) Any cabinet door swinging open which cannot be secured in the normal manner.

(5) Breakdown of established offset, cycle or split on any local or master controller in a coordinated and/or interconnected system.

(6) Wherein a failsafe type unit is activated, determine cause and correct the condition prior to the reactivation of the normal traffic signal sequence of operation.

(7) A signal that has tripped into emergency flash:

(8) In the event that a signal must be operated in a flashing mode, instead of its normal 3-color operation, and the Contractor cannot effect repairs to restore the signal to its normal 3-color operation, place temporary STOP signs on all intersecting side roads receiving a flashing red indication.

k. Any inoperative pedestrian signals.

l. When the Contractor responds to an emergency call and determines that such call resulted from a vehicular collision or other similar event resulting in damage to the traffic signal or any of its appurtenances not covered in Item 1.a, 1.b and 1.c, immediately notify the Engineer.

m. Other conditions, not enumerated above, and determined by the Engineer to be emergencies, shall be handled accordingly by the Contractor.

G. If the Contractor fails to respond to a failure or knockdown within two hours after notification, or does not begin work within the two hour limit specified, or does not continue to work until the traffic signal is back into normal signal operation, then, in the interests of public safety, the Authority may respond with its own forces to restore normal signal operation. If the Authority responds with its own forces to effect repairs of the signal(s), the Authority will deduct a sum of $7,500 from payments due the Contractor for costs of mobilizing its forces and equipment. In addition, the Authority will deduct from payments due the Contractor, the cost of materials used to effect the repair and the cost of maintenance of traffic and work area protection. Any such emergency work performed by the Authority will not in any way relieve the Contractor of its liabilities as provided for in the Contract.

H. When responding to a system failure or malfunction or vehicle knockdown, obtain a copy of the Cabinet Activity Log from the Engineer and submit to the Engineer a completed Log that documents the failure and corrective action taken. Place a second copy in each controller cabinet.

3.03 FIELD TESTS

A. Before the temporary traffic signal system is placed into operation, the Engineer will conduct a Turn-On Inspection using the Turn-On Checklist. A copy of the Turn-On Checklist may be obtained from the Engineer. In the event of a failure or non-compliance of any component the malfunction shall be corrected to the satisfaction of the Engineer. Said malfunctions shall include, but not be limited to equipment failures or the failure of the traffic signal controllers or non-compliance with the Contract Drawings or failure to comply with the requirements of this Section. After said malfunctions are corrected, at no expense to the Authority, the signals may be activated.

3.04 ADJUSTMENTS

A. Maintain, clean, relocate and replace equipment as required to protect motorists, pedestrians and workers throughout the Work of the Contract.

B. Remove equipment from Authority property when no longer required, when replaced by approved permanent signal equipment or when directed by the Engineer.

C. After removal of temporary traffic signal equipment, restore the site to its original condition or complete permanent construction as required. Restoration shall include replacing paving that cannot be satisfactorily repaired and removing temporary paving not acceptable for integration into the permanent paving.

END OF SECTION

SECTION 02849

TEMPORARY SIGNAL EQUIPMENT

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

02849A01 Submit the following to the Engineer in accordance with Division 1 – GENERAL PROVISIONS entitled "Shop Drawings, Catalog Cuts and Samples":
1. Detailed drawings for the layout of the temporary signal equipment including detailed signal phasing plans, wiring diagrams, and power and communication connections.
2. A complete set of reproducible shop drawings from which clear prints can be made.

END OF APPENDIX "A"

DIVISION 2

SECTION 02850

PLYWOOD SIGN PANELS AND WOOD SIGN POSTS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for the following:

A. Plywood sign panels for use in the construction of temporary (TYPE 1) and permanent (TYPE 2) guide, warning and regulatory roadway signs. Sign type usage, TYPE 1 or TYPE 2, shall be identified on the Contract Drawings for each required sign.

B. Wood sign posts and footings for both TYPE 1 and TYPE 2 sign panel side-of-road installations.

1.02 REFERENCES

The following is a listing of organizations and publications referenced in this Section:

American Association of State Highway and Transportation Officials (AASHTO)

Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals (LTS-2).

Manual for Signing and Pavement Markings of the National System for Interstate and Defense Highways (MUTCD)

AASHTO M 168	Wood Products

American Society for Testing and Materials (ASTM)

ASTM A 153	Zinc Coating (Hot Dip) on Iron and Steel Hardware
ASTM B 209	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 211	Aluminum-Alloy Bar, Rod and Wire
ASTM B 221	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
ASTM D 245	Methods for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber
ASTM A 307	Carbon Steel Externally Threaded Standard Fasteners
ASTM A 325	Quenched and Tampered-Steel Bolts and Studs with suitable Nuts and Plain Washers
ASTM D 2555	Methods for Establishing Clear Wood Strength Values

American Wood Preservers Association (AWPA)

AWPA C 1	Timber Products - Preservative Treatment by Pressure Processes
AWPA C 14	Wood for Highway Construction, Pressure Treatment

Douglas Fir Plywood Association

Federal Highway Administration (FHWA)

Manual on Uniform Traffic Control Devices for Streets and Highway (MUTCD)

Standard Alphabets for Highway Signs

Standard Lower-case Alphabets for Highways

United States Department of Commerce (USDC)

Product Standard PS-1 Soft Plywood, Construction and Industrial

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Design of signs and sign structure shall provide sufficient strength to withstand a wind loading of 80 miles per hour as per AASHTO LTS-2.

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 back fill, or by driving with hand or mechanical equipment.

1.04 QUALITY ASSURANCE

Each plywood sheet shall be grade marked and certified in accordance with the standards adopted by the Douglas Fir Plywood Association.

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. Sign components and materials to be stored shall be stored above ground.

1.06 SUBMITTALS

Refer to Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Plywood Sign Panels

1. Plywood sign panels shall conform to the requirements set forth in USDC Product Standard PS-1 for Douglas Fir Plywood.
2. The plywood panels for TYPE 1 signs shall be exterior-type plywood, 5-ply and A-C grade or better.
3. The plywood panels for TYPE 2 signs shall be high-density overlay, exterior marine-type plywood, 5 ply and B-B grade or better. Inner plies for TYPE 2 panels shall be B grade veneers or better.
4. The thickness of plywood sign panels and plywood battens shall be not less than 1/2 inch for TYPE 1 panels and not less than 3/4 inch for TYPE 2 signs.

5. The overlay surface for TYPE 2 plywood sign panels shall consist of a cellulose-fibre or sheet, in which not less than 40 percent by weight of the laminate shall be a thermo-setting resin of the phenol or melamine type. The resin-impregnated material shall be not less than 0.009 inches thick and shall weigh at least 60 lbs per 1000 square feet of single face, including both resin and fiber. The resin impregnation shall be sufficient to attach the surfacing material to the plywood. The bond shall be equal in performance to the glue lines between the sheets of veneer that make up the plywood.

6. The face of the cellulose-fibre overlay surface for TYPE 2 panels shall be hard, smooth, and of such quality that further finishing by paint or varnish is not required to fabricate the sign as specified in 2.03 of this Section.

B. Panel Sheeting and Screen Printing

1. Reflectorized Sheeting

   Shall be Scotchlite Brand Engineer Grade Series 2200 (heat activated adhesive) or Series 3200 (pressure sensitive adhesive) as manufactured by the Traffic Control Materials Division of the 3M Co., 223-3N 3M Center, St. Paul, Minnesota 55144, or approved equal.

2. Non-Reflectorized Sheeting

   Shall be Scotchcal Brand film Series 650 (heat activated adhesive) or Series 3600 (pressure sensitive adhesive) as manufactured by the Traffic Control Materials Division of the 3M Co., or approved equal.

3. Screen Printing Inks, Thinners and Toners

   a. Scotchlite Brand Process Colors Series 700 for use on Reflectorized Sheeting.

   b. Scotchcal Brand Process Colors Series 3900 and 4100 for use on Non-Reflectorized Sheeting.

   c. Approved equals for use on approved reflective and non-reflective sheetings.

4. Panel sheeting (reflective or non-reflective) and screen printing usage shall be shown on the Contract Drawing.

C. Wood Sign Posts

1. 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.

2. All the posts shall be pressure-treated with CCA in accordance with the applicable requirements of AWPA C1 and AWPA C 14.

3. 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 clean wood properties of ASTM D 2555, the bending stress of the post in a TYPE 1 panel installation shall be not less than 1200 psi, and not less than 4000 psi for a TYPE 2 panel installation.

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. Component designated as Alloy 2024-T4 shall be given a chromated sealed anodic coating.

3. High strength steel bolts, nuts and washers shall conform to ASTM A 325. High-strength bolts, nuts and washers shall be galvanized in accordance with ASTM A 153.

E. Footings

1. Soil bearing plates shall be attached at the bottom of the post as required in 1.03 of this Section, or as shown on the Contract Drawings.

2. Breakaway post, if required, shall be as shown on the Contract Drawings. Breakaway post and footings shall be designed in accordance with the requirements of 1.03 of this Section.

3. Concrete footings, if required by 1.03 of this Section, shall be Class "B" concrete conforming to the Section entitled "Concrete."

4. Portable sign supports shall be as described in "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.

2.02 CONSTRUCTION FEATURES

A. Sign face text, symbol, and border layouts shall be in accordance with "Maintenance of Traffic and Work Area Protection", of Division 1 - GENERAL PROVISIONS, or the Contract Drawings conforming to the requirements of:

1. The AASHTO Manual for Signing and Pavement Marking of the National System of Interstate and Defense Highways.

2. The FHWA MUTCD.

3. The FHWA Standard Alphabets for Highway Signs.

4. The FHWA Standard Lower-case Alphabets for Highways.

B. Sign characters shall be as shown on the Contract Drawings 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. 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 or 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 Reflectorized and Non-Reflectorized sheeting.

B. In preparing TYPE 1 panels for Reflectorized and Non-Reflectorized 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. In preparing TYPE 2 panels for Reflectorized and Non-Reflectorized Sheeting, the entire portion of the overlay surface to be covered, shall first be given a light, firm abrasion with steel wool (medium to fine grade) saturated with xydol, V.M.&P. Naphtha or similar commercial solvent. The surface shall then be wiped clean and dry. An alternate method of panel pre-treatment that consists of a solvent wipe, immediately followed by vapor degreasing (tri-chloroethylene) for a minimum period of 6 minutes may be used.

D. All panel and batten surfaces to be glued shall be slightly roughened and then glued with waterproof adhesive prior to assembly.

E. After panel preparation, the edges and back or rear surface of all TYPE 2 panels and battens shall be painted with two coats of approved white exterior paint.

PART 3. EXECUTION

3.01 INSTALLATION

A. The Contractor shall 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 the intersection angle measured between the sign face and the centerline of the travel lane, which the sign serves shall be 93 degrees. Where lanes divide or on curves, sign faces shall be oriented so as to be most effective both day and night, and to avoid the possibility of specular reflection.

C. The wood sign posts for side-of-road mounting shall be embedded in the soil to the depth required by the design specified in 1.03 of this Section. The hole for the embedment shall be excavated using a manual post-hole digger or appropriate size power driven auger. After the hole has been excavated, the post shall be aligned to the sign face direction, held vertical in the hole and suitable excavated material shall be tamped in the annular space. Holes resulting from sign post removals shall be filled by the Contractor to restore the area to its original state as directed by the Engineer.

D. All signs shall be securely fastened to their supports with bolts, nuts and washers of aluminum (2024-T4 alloy) or hot-dip galvanized steel conforming to 2.01 D of this Section, as required by the design specified in 1.03 of this Section.

E. Plywood battens and aluminum panel stiffeners shall be utilized as required by 1.03 of this Section and shall conforming to the applicable requirement of 2.01 of this Section.

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 in the Contract Drawings.

H. Concrete footings, if required by 1.03 of this Section, shall be placed in accordance with the requirements of the Section of these Specifications entitled "Concrete," and shall not extend more than 4 inches above grade.

3.02 FIELD INSPECTION

A. Immediately prior to erection, all material shall be inspected by the Engineer for damage.

B. The Engineer will inspect each completely erected sign for proper location, line and grade of signs, vertical post alignment, condition, appearance, reflectorization and visibility.

C. As the Work progresses, the location, position and condition of all signs shall be monitored by the Contractor in accordance with "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:

Shop Drawings

02850A01 Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 – GENERAL PROVISIONS: Detailed sign face layout for all TYPE 2 sign panels showing letter height, width, brush stroke, spacing between letters, words, symbols and lines, border width, symbols details, and overall dimensions of the sign panels. Detailed sign face layouts are not required for TYPE 1 sign panels.

02850A02 Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 – GENERAL PROVISIONS:
Shop drawings of sign panel and posts showing the sizes of the members and their connection details. The shop drawings shall also show the total length of the posts for each sign and give an elevation view of each of the completely erected signs with vertical clearance below the lowest sign panel to adjacent roadway, and other relevant dimensions.

Catalog Cuts

02850B01 Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 – GENERAL PROVISIONS: Catalog cuts of all the materials to be used for sign faces.

Calculations

02850H01 Prior to fabrication, submit computations for the design of the sign panels and supports, as required in 1.03 of this Section, signed by a Professional Engineer licensed to practice in the State where the Work is to be performed.

END OF APPENDIX "A"

DIVISION 2

SECTION 02851

ALUMINUM SIGN PANELS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for the following:

A. Aluminum sign panels for use in the construction of directional, guide, warning and regulatory roadway signs.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Association of State Highway and Transportation Officials (AASHTO)

Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals (LTS-2)

Manual for Signing and Pavement Markings of the National System for Interstate and Defense Highways

American Society for Testing and Materials (ASTM)

ASTM A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 193	Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194	Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A 325	High-Strength Bolts for Structural Steel Joints
ASTM A 325	High-Strength Bolts for Structural Steel Joints
ASTM B 209	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 211	Aluminum-Alloy Bar, Rod and Wire
ASTM B 221	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes

American Welding Society (AWS)

AWS D 1.2	Structural Welding Code - Aluminum

Federal Highway Administration (FHWA)

Manual on Uniform Traffic Control Devices for Streets and Highway (MUTCD)

Standard Alphabets for Highway Signs

Standard Lower-case Alphabets for Highways

Standard Traffic Signs

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Design of signs, supports and framing shall provide sufficient strength to withstand a wind loading of 80 miles per hour as per AASHTO LTS-2.

1.04 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. Sign components and materials to be stored shall be stored above ground.

1.05 SUBMITTALS

Refer to Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Aluminum Sign Panels

1. Aluminum sheets and plates shall comform 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. The 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. Panel Sheeting and Screen Printing

1. Reflectorized Sheeting

   Scotchlite Brand High Intensity Grade Series 2800 (heat activated adhesive) or Series 3800 (pressure sensitive adhesive) as manufactured by the Traffic Control Materials Division of the 3M Co., 223-3N 3M Center, St. Paul, Minnesota 55144, or approved equal, and shall meet or exceed the reflecting requirements associated with High Intensity Grade, sheetings.

2. Non-Reflectorized Sheeting

   Scotchcal Brand film Series 650 (heat activated adhesive) or Series 3600 (pressure sensitive adhesive) as manufactured by the Traffic Control Materials Division of the 3M Co., or approved equal.

3. Screen Printing Inks, Thinners and Toners

   a. Scotchlite Brand Process Colors Series 700 for use on Reflectorized Sheeting, or approved equal

   b. Scotchcal Brand Process Colors Series 3900 and 4100 for use on Non-Reflectorized Sheeting, or approved equal.

4. Panel sheeting (reflective or non-reflective) and screen printing usage shall be as shown on the Contract Drawings.

C. 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 B 211 for Alloy 2024-T4. Component designated as Alloy 2024-T4 shall be given a chromated sealed anodic coating.

3. High strength steel bolts, nuts and washers shall conform to ASTM A 325. High-strength bolts, nuts and washers shall be galvanized in accordance with ASTM A 153.

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.

2.02 CONSTRUCTION FEATURES

A. Sign face text, symbol, and border layouts shall be in accordance with the Contract Drawings and conform to the following requirements of:

1. The AASHTO Manual for Signing and Pavement Marking of the National System for Interstate and Defense Highways.

2. The FHWA Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD).

3. The FHWA Standard Alphabets for Highway Signs.

4. The FHWA Standard Lower-case Alphabets for Highways.

B. Sign characters shall be as shown on the Contract Drawings.

C. Sign corner and border radii shall be approximately one-eighth (1/8) of the height of the sign but shall not exceed 12 inches; or as shown in the FHWA Standard Traffic Sign. 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 or the sign, or as shown in the FWHA Standard Traffic Sign.

2.03 FABRICATION

A. All shearing, cutting and punching shall be performed prior to preparing the blanks for application of reflective 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 reflective 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 Reflectorized and Non-Reflectorized 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 or aluminum shall be permitted. All welders shall be qualified in accordance with the qualification procedures of AWS D 1.2.

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 the intersection angle measured between the sign face and the centerline of the travel lane, which the sign serves shall be 93 degrees. Where lanes divide or curve, sign faces shall be oriented so as to be most effective both day and night, and to avoid the possibility of specular reflection.

C. All sign panels shall be securely fastened to their supports with bolts, nuts and washers of aluminum (2024-T4 alloy), hot-dip galvanized steel, or stainless steel conforming to 2.01 D, and 1.03 of this Section.

D. Horizontal and vertical sign clearances shall be as shown on the Contract Drawings.

3.02 FIELD INSPECTION

A. Immediately prior to erection, all material will be inspected by the Engineer for damage that is attributable to improper transportation, handling or storage procedures.

B. An inspection of each completely erected sign shall be made in the daylight for proper location, line and grade of signs, vertical post alignment, condition, appearance and visibility. The completely erected signs may also be inspected at night by the Engineer.

C. 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.

D. Any deviation from the above-indicated procedure shall be approved by the Engineer.

END OF SECTION

SECTION 02851

ALUMINUM SIGN PANELS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

02851A01 Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 – GENERAL PROVISIONS: Detailed sign face layout for all sign panels showing letter height, width, brush stroke, spacing between letters, words, symbols and lines, border width, symbols details, and overall dimensions of the sign panels.

02851A02 Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 – GENERAL PROVISIONS: Shop drawings of sign panels showing the sizes of the members and their connection details including joining and anchorage, stiffening, and bracing.

Catalog Cuts

02851B01 Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 – GENERAL PROVISIONS: Catalog cuts of all the materials to be used for sign faces.

Calculations

02851H01 Prior to fabrication, submit computations for the design of the sign panels and supports, as required in 1.03 of this Section, signed by a Professional Engineer licensed to practice in the State where the Work is to be performed.

END OF APPENDIX "A"

DIVISION 2

SECTION 02920

SOIL TESTING

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for subgrade preparation and the testing of on-site fill material prior to seeding and/or planting operations.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. As a guide to determine local weather predictions use the National and Local Forecast, Hurricane, Radar and Report website at http://www.weather.com as published by the Weather Channel.

B. Soil Testing Procedures shall be as per "Recommended Soil Testing Procedures For The Northeastern United States, Current Edition, Northeastern Regional Publication No. 493 as provided by the Agricultural Experiment Stations of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and West Virginia.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Obtain soil samples only during the following weather conditions:

1. There shall be no frost in the ground and the soil temperature shall be above 32 degrees F.
2. There shall be no form of precipitation falling or forecast to fall within the next two hours. Following a period of precipitation, resume operations only after the soil has drained.

1.04 QUALITY ASSURANCE

A. Qualifications

1. Verify that the laboratory performing the soil testing of this Section is a certified testing laboratory such as the Rutgers Soil Testing Laboratory, Rutgers Cooperative Research & Extension, New Jersey Agricultural Experiment Station, Milltown, NJ 08850 or an approved equal in either the States of New Jersey or New York, that it has experience in soil testing for soil properties important for plant and turf management and that is capable of performing a "Technical Topsoil Evaluation" as specified in 2.01 and in accordance with Appendix B of this Section.

B. Test Requirements

1. Prior to seeding and/or planting, submit a representative sample of on-site soil material for analysis to a certified independent laboratory to ensure conformance to requirements specified in 2.01. Provide the number of soil samples to the testing laboratory in accordance with 1.04 B3. No substitutions for testing parameters will be permitted.
2. Take samples only in the presence of the Engineer and at sites ready for planting operations to commence.
3. Provide a minimum of three (3) test samples representative of the range of existing soil found within areas to receive seed.
4. Allow a minimum of 2 weeks for processing soil analysis at the testing laboratory.
5. Identify the type of "crop" to be grown as "Lawn" with each test sample requisition sent to the testing laboratory in order to obtain recommendations for nutrient and pH adjustments.

C. Do not commence seeding and/or planting until the Chief of Materials Engineering has approved in writing the certified results of the soil analysis and recommendations from the approved soil testing laboratory for the representative samples and approved a report from the Contractor verifying that the Contractor has reviewed the soil analysis and will comply with the recommendations.

1.05 SUBMITTALS

A. See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Soil Testing conforming to the following:

1. Soil to be tested shall be of uniform quality, free from hard clods, stiff clay, hard pan, sods, partially disintegrated stone, lime, cement, ashes, slag, concrete, tar residues, tarred paper, boards, chips, sticks, glass or any other undesirable material.
2. Provide a soil nutrient analysis providing the percentage Nitrogen (N), Phosphorus (P) and Potassium (K) in pounds per Acre.
3. Provide soil micronutrient analysis providing the percentage of Zinc, Copper, Manganese, Boron and Iron, in parts per million.
4. Provide a soil analysis for organic matter as determined by loss on ignition of moisture-free samples.
5. Provide soil pH range.
6. Provide soluble salts in micromhos per centimeter.
7. Soil shall be graded as follows:

PASSING	RETAINED ON	PERCENTAGE
1" screen		100%
1" screen	2 mm (No. 10) Sieve	%*

*The portion retained shall be no larger than 3/8" in size and composed of homogeneous clods and/or stones.

8. Provide a mechanical analysis of the portion of soil passing the 2 mm sieve, based on the mechanical analysis of the soil as determined by the Bouyoucous Hydrometer method, and shall consist of the following, based on dry (air-dried only) weight of sample:
   a. Sand min% - max%, inclusive;
   b. Silt min% - max%, inclusive;
   c. Clay min% - max%, inclusive.
9. Provide recommendations for pH adjustment, fertilization and micronutrients.

PART 3. EXECUTION

3.01 PREPARATION

A. Soil Sample(s) Taken From Areas of Changed Grades
1. Verify that areas of changed grades shown on the Contract Drawing have a smooth, uniform surface and finish grade elevations (excepting the addition of soil amendments) have been established.
2. Obtain grab samples for the minimum of test samples representative of the range of existing soil found within the each, separate area of existing soils to receive seed.
3. Grab sample shall be made up of a two-pound sample, each.
4. Remove stones over two inches in any dimension, roots, rubbish and other extraneous materials from the sample.
5. Implement all soil recommendations received from the soil testing laboratory.
6. Do not commence with any planting or soil related activities prior to receipt of written acceptance of the soil sample analysis and recommendations, by the Chief of Materials Engineering as per 1.04 and 2.01.

B. Soil Sample(s) Taken From Unaltered Areas
1. Verify that subgrade areas shown on the Contract Drawings are unaltered or undisturbed by excavation, grading or stripping operations as follows:
   a. Follow steps listed in 3.01 A., 1-4 above.

END OF SECTION

SECTION 02920

SOIL TESTING

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Product Data

02920D01 Submit in accordance with the requirements of "Inspections and Rejections" of Division 1 - GENERAL PROVISIONS a complete "Product List", listing the product to be used under this Section, to the Engineer.

02920D02 Submit the locations of grab samples of soil (as many as required), the individual results of the soil analyses, and the amendment recommendations to the Chief of Materials Engineer in accordance with 1.04 and 2.01.

Certificates

02920E01 Submit to the Chief of Materials Engineering certification required by 1.04 A & B.

Qualifications

02920K01 Submit qualifications of the entity performing the laboratory testing of this Section to the Engineer in accordance with 1.04 A. Include the name, address and telephone number of the testing laboratory performing the Work of this Section.

Information

02920S01 Submit laboratory analyses of soil and the results of the "Technical Topsoil Evaluation" to the Chief of Materials Engineering, Materials Engineering Unit, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397, in accordance with 1.04, 2.01, Appendix B.

END OF APPENDIX "A"

SECTION 02920

SOIL TESTING

APPENDIX "B"

The following is a sample testing form to be used by the Contractor:

Material: Soil

Specification: Section 02920 – "Technical Topsoil Evaluation"

Crop: Lawn

Source of Sample:

Contract or P.O.#:

Quality Characteristics:	Spec.		
Visual Examination:	No hard clods, etc.		
Nutrients: Inorganic Nitrogen-Nitrate (ppm)			
Nutrients: Inorganic Nitrogen-Ammonium (ppm)			
Total Kjeldahl Nitrogen (%)			
Nutrients: P (pounds/acre)			
Nutrients: K (pounds/acre)			
Micro Nutrients: Zinc (ppm)			
Micro Nutrients: Copper (ppm)			
Micro Nutrients: Manganese (ppm)			
Micro Nutrients: Boron (ppm)			
Micro Nutrients: Iron (ppm)			
Organic Matter: (Loss of Ignition)	Min. % Max. %		
Soluble Salts: - Micromhos/Cm - PPM	Max. Max.		
pH:			
Mechanical Analysis: Passing - 1"	100%		
Passing - 1" Retain 2 mm (#10)	Max. % The portion retained shall be no larger than 3/8" in size and shall be composed of homogeneous clods and/or stones		

Passing 2mm (#10) Retain Pan	Min. %		
Bouyoucous Hydrometer Test of Material:			
Passing 2 mm (#10) Percent - Sand	min%-max%		
Percent – Silt	min%-max%		
Percent – Clay	min%-max%		

END OF APPENDIX "B"

DIVISION 2

SECTION 02930

SEEDING

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for endophyte seed, seeding, the application of flexible growth medium (FGM) and dust retardant at Airports.

1.02 DEFINITIONS

A. The term "Blue Tag Certified" refers to the original certification tag, blue in color, that certifies that the seed was produced in Oregon, of the latest crop, bearing the lot number that matches the lot number on the Oregon State University Seed Laboratory Report of Seed Analysis.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Use product-testing methods adopted and published by the Association of Official Analytical Chemists, 1111 19th Street Suite 210, Arlington, VA 22209.

B. As a guide to determine local weather predictions use the National and Local Forecast, Hurricane, Radar and Report website at http://www.weather.com as published by the Weather Channel.

C. Seed and installation practices shall comply with Federal Aviation Administration (FAA) Advisory Circular 150/5200-33B, Hazardous Wildlife Attractants On Or Near Airports, August 28, 2007.

D. Pest control for turfgrass shall be in accordance with the "2006 Pest Management Guidelines for Commercial Turfgrass", published by Cornell University, Ithaca, NY. This publication is available from The Resource Center, Cornell University, Ithaca, NY 14853. Telephone (607) 255-9946.

E. Grass seed shall have attached thereto or in a conspicuous place on the exterior of the container a plainly printed label in the English language, in legible type specifying:

1. All endophyte seed lots shall be Blue Tag Certified, produced in Oregon, of the latest crop. The state of origin shall be Oregon, no exceptions.

2. Provide a copy of the Oregon State University Seed Laboratory Report of Seed Analysis bearing the lot number matching all the bags of seed delivered to the Work site.

3. Provide the name of Seed Company located in Oregon, along with the Blue Tag Certified seed variety, date of harvest and proof of storage in cold and dry conditions of the seed delivered to the Work site.

4. Provide the name and address of the person who labeled said seed, or who sells or offers the seed for sale to the Contractor if the seed being delivered to the Work site is not the originating seed company from Oregon.

5. Provide certification from 4 above that the seed delivered to the Work site shall have been shipped directly from Oregon and never stored anywhere else except the production facility in Oregon.

6. Provide the commonly accepted name of the kind or kind and variety, or both, of each agricultural seed component in excess of 5.0% of the whole and the percentage by weight of pure seed of each.

7. Percentage by weight of all weed seeds. Maximum weed seed content shall not exceed 1% by weight.

8. Lot number or other lot identification.

9. The percentage of germination, exclusive of hard seed; hard seed, if present, and the calendar month and year that the germination test was completed. If a single test date is used, it shall be that of the oldest tested component.

10. 10. All delivered endophyte seed shall be fresh seed, having a proof of harvest date, and delivered to the Work site for immediate application. Seed delivered to the Work site for immediate application exceeding two months from the date it left storage in Oregon shall not be accepted.

11. 11. Any bag of seed without a blue tag and corresponding Oregon State University Seed Laboratory Report of Seed Analysis bearing the lot number matching all the bags of seed delivered to the Work site will be rejected by the Engineer and the Contractor shall immediately remove it from the Work site and replace with seed that complies with this Specification.

12. The percentage of endophyte level shall meet or exceed the level specified herein. Any test results as per 1.05 B. 4 of the bags of seed with a seed label indicating that the percentage level of endophyte is less than specified shall be rejected by the Engineer and the Contractor shall immediately remove it from the Work site and replace with seed that complies with this Specification.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Perform operations only during the following weather conditions:

1. There shall be no frost in the ground and the soil temperature at each planting area shall be above 32 degrees F.

2. There shall be no form of precipitation falling or forecast to fall within the next two hours. Following a period of precipitation, resume operations only after the soil has drained.

3. Apply chemicals only when wind velocity is below 5 mph, drift hazard is negligible, the air temperature is above 40 degrees F and below 70 degrees F.

4. Do not perform any product application if precipitation has fallen within two hours prior to the planned application time or is forecast during the next 12-hour period.

B. Seeding Calendar Limitations

1. Seed as per Appendix "B" of this Section.

1.05 QUALITY ASSURANCE

A. Qualifications

1. Verify that the entity and its workers performing the Work of this Section are experienced in landscaping and have been engaged in work of a complexity similar to that required under this Section for a period of at least three years.

2. Verify that the entity performing pesticide applications has a valid license as a commercial applicator from the state in which the Work is being performed.

3. Verify that the entity performing the Work has a Brillion Turfmaker II Seeder to install the seed for this Work. Hydroseeding will not be permitted.

4. Verify that the entity performing the Work has a Hydromulcher with a "mechanical agitator paddle" as manufactured by one of the following: Aqua Mulcher, Bowie, Finn, Kincaide and Turfmaker. A hydromulcher that uses "jet agitation" will not be permitted to be used.

B. General Requirements for Operations and Products

1. After delivery to the construction site, allow the Engineer, at his discretion, to take for analysis representative samples of any item listed in PART 2 - PRODUCTS.

2. Seed

a. Submit all the information specified in 1.03 E. 1 – 12 to the Engineer for review and approval prior to delivery to the construction site.

b. Do not supply or plant the following turfgrasses under any circumstance:

(1) Winter Wheat

(2) Tall Fescue Grass with less than 90% Endophyte levels

(3) Tall Fescue Grass without Endophyte

(4) Kentucky Blue Grass

(5) Buffalo Grass

(6) Bent Grass

(7) Bermuda Grass

(8) Fine Fescue Grass

(9) Annual Rye Grass

(10) Perennial Rye Grass with less than 90% Endophyte levels

(11) Perennial Rye Grass without Endophyte

(12) Native Grasses

3. Pesticide

a. Select to act on identified pest and use the manufacturer's recommended formula, application rate and safety instructions at all times.

b. Keep all records that are or may be required by Federal, State or Local laws. Submit copies of these records to the Engineer within 5 days when so requested.

c. Not less than forty-eight hours prior to a proposed spray operation, submit to the Engineer for his review and approval a tabulated list indicating the target to be treated, the chemical trade name and quantity of mix being prepared.

4. Testing for Endophytes

a. Submit the test result for "Seed immunoblot assay testing". No later than two months prior to delivery of endophyte seed to the Work site, submit a sample of seed for testing in accordance with Appendix "C" and submit the results to the Engineer prior to delivery. Submit a minimum of one (1) pint of seed per every twenty (20) bags of seed delivered to the Work site.

b. Submit the test results for "Seed Grow-out testing". No later than two months prior to delivery of endophyte seed to the Work site, submit a sample of seed for testing in accordance with Appendix "C" and submit the results to the Engineer prior to delivery. Submit a minimum of one hundred (100) seeds per every twenty (20) bags of seed delivered to the Work site.

c. Submit the test results for "Tiller testing". No later than two months after on-site germination, submit tiller samples for testing in accordance with Appendix "C" and submit the results to the Engineer. Submit a minimum of fifty tillers per every one (1) Acre of seeded area.

5. Soil Testing

a. Submit to the Engineer the "Landscape Level 3 Topsoil Evaluation" from the Rutgers Soil Testing Laboratory as specified in Section 02920 – Soil Testing. "Landscape Level 3 Topsoil Evaluation" lab request shall specify the crop to be grown as lawn.

b. Perform nutrient controls as recommended in the "Landscape Level 3 Topsoil Evaluation" for establishing lawn. Nutrient control adjustments shall be provided by the Contractor at no additional cost to the Authority.

6. Lawn Mower Equipment

a. Verify that the entity performing lawn mowing utilizes a Mulching Mower, capable of producing a fine mulch and produce no windrows. Provide a list of lawns mowers to be used as well as the manufacturer catalog cuts describing how the mulching mower operates to produce a fine mulch and produce no windrows.

C. Reseeding

1. Replace unsatisfactory seeded areas for a period of six months from the date of rendition of the Certificate of Final Completion. Reseed all areas, at no additional cost to the Authority, that are:

a. dead

b. have weed and/or pest infestations

c. <90% endophyte viability proved by tiller testing performed on seed grow-outs and/or germinated seed at the construction site.

2. Perform replacement of unsatisfactory seeded areas with products and by operations that comply with all requirements of this Specification, and on such date(s) as ordered by the Engineer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver all products in the manufacturer's unopened containers bearing the trade name, manufacturer's name, weight and analysis.

B. Store products away from moisture and extreme temperatures and in such a manner that their effectiveness will not be impaired.

C. Formulation, Application and Equipment

1. Use the manufacturer's recommended formula, application rate and safety instructions at all times.

2. Mix and agitate products and use equipment according to the manufacturer's directions. Mix and agitate only in an area designated by the Engineer.

3. Dispose of spilled materials and surplus products away from Authority property.

1.07 SUBMITTALS

A. See Appendix "A" for submittals requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Nutrient Controls

1. Fertilizer

a. Granular - 10-6-4, slow release fertilizer conforming to the following:

(1) Commercial fertilizer 10-6-4, dust-free, homogenous, granular fertilizer with 50% nitrogen derived from ureaform

(2) Guaranteed analysis shall be

(a.) 10% Nitrogen,

(b.) 3.0%-3.5% W.I.N. (water-insoluble nitrogen)

(c.) 2.8 % Water Soluble Nitrogen* (*Contains slowly available

(d.) Nitrogen from Methylene Urea)

(e.) 4.2 % Ammoniacal Nitrogen

(3) 6% P_2O_5

(4) 4% K_20

(5) 2.0 % Magnesium (Mg)

(6) 1.0 % Iron (Fe)

2. Soil pH adjustment

a. Granulated dolomitic limestone conforming to the following:

(1) Total carbonates not less than 86% of 48.2% calcium oxide equivalent. For purposes of calculation, total carbonates shall be considers as calcium oxide. Magnesium oxide content shall be between 15 – 22%.

(2) A dust-free, homogenous, granular material.

b. Soil pH adjustment - Elemental Sulfur

(1) Guaranteed analysis shall be

(a.) 0% Nitrogen

(b.) 0% Phosphorus

(c.) 0% Potassium

(d.) 90% Sulfur

B. Turf Seed

1. Turf seed shall be the latest crop, clean, pure and free of noxious weed seed, of the variety and mix as provided in Appendix "B" and accordance to 1.03 E and 1.05 B. 4.

C. Dust Retardant

1. "Coherex" as manufactured by Golden Bear Division of the Witco Corporation, Chandler, AZ 85244

2. "Soil-Sement" as manufactured by Midwest Industrial Supply, Inc., Canton, OH 44711

3. "Soil Seal Concentrate" as manufactured by Soil Seal Corporation, Los Angeles, CA 90017

4. Or approved equal.

D. Flexible Growth Medium

1. "Flexterra FGM" as manufactured by Profile Products, LLC. Buffalo Grove, IL 60089.

2. Or approved equal conforming to the following:

   a. Clean, uniform, nontoxic, and free of seeds, fungi, and other plant pathogens;

   b. Heat-processed in such a manner as to contain no growth or germination inhibiting factors.

   c. Interlocking crimped polyester fibers combined with wood fiber and crosslinked tackifier having the following physical properties:

(1)	Moisture Content	12% +-3
(2)	Wood Fiber	85% Max
(3)	Locking Fibers	5.0% +-1
(4)	Crosslinked Tackifier	10% +-1
(5)	Water Holding Capacity	1500% Min
(6)	Organic Material	95% Min
(7)	pH	4.8 +-2

3. Flexible Growth Medium is available from the following suppliers:

   a. Pinelands Nursery, 232 Island Avenue, Columbus, NJ 08022

   b. All Pro Horticulture, 55 Motor Avenue, Farmingdale, NY 11735

   c. ACF Environmental, 48 Old Grays Brook Rd., Brookfield, CT 06804

   d. AH Harris & Sons, 17 Commercial Drive, Albany, NY 12205

   e. Pennington Seed, 9327 US RTE 1, Laurel, MD 20723

E. Weed Control/Glyphosate

1. "Round-up Pro" as manufactured by Monsanto, St. Louis, MO 63167 or approved equal.

   41% - Glyphosate N - (phosphonomethyl) glycine

   59% - Inert Ingredients

F. "Futerra F4NETLESS" as manufactured by Profile Products, LLC, Buffalo Grove, IL 60089 or approved equal conforming to the following:

1.	Thickness	0.2 inches
2.	Wood Fiber	85%
3.	Locking Fibers	5.0%

4. Tensile Strength 4.3 lbs/ft

5. Water Holding Capacity 395%

G. Futerra F4NETLESS is available from the following suppliers:

1. Pinelands Nursery, 232 Island Avenue, Columbus, NJ 08022
2. All Pro Horticulture, 55 Motor Avenue, Farmingdale, NY 11735
3. ACF Environmental, 48 Old Grays Brook Rd., Brookfield, CT 06804
4. AH Harris & Sons, 17 Commercial Drive, Albany, NY 12205
5. Pennington Seed, 9327 US RTE 1, Laurel, MD 20723

H. Biodegradable Staple

1. Biodegradable staples shall be Round Top Bio-Pin, Turtac, EcoPin, e-Staple or an approved equal.
2. Staples shall be biodegradable, able to biodegrade within 8-24 months and have sufficient strength and length to securely hold the erosion control mat.

PART 3. EXECUTION

3.01 PREPARATION

A. Areas of Changed Grades

1. Verify that areas of changed grades, which are to be seeded as shown on the Contract Drawings, are in conformance with the grading plans and have a smooth, uniform surface. Rototill subgrade to a minimum six (6) inch depth. Remove stones over two inches in any dimension, roots, rubbish and other extraneous materials. Limit preparation to areas, which will be seeded promptly after preparation.
2. Subgrade shall be defined as either existing in-place soil or clean fill placed after removing unsuitable existing soil or existing pavement and base aggregate.

B. Unaltered Areas

1. Where seeding is to be performed within areas that have not been altered or disturbed by excavation, grading or stripping operations, as shown on the Contract Drawings, prepare subgrade as follows:
   a. Remove existing vegetation. Apply "Roundup Pro" as per manufacturers instructions, at least ten days prior to seeding. Dispose of such materials away from Authority property.
   b. Rototill to a depth of not less than six inches to produce a homogenous mixture of fine texture, free of clods, stones, roots and other extraneous materials. Dispose of such materials away from Authority property.
   c. Rake and drag soil surface to remove high areas and fill depressions.
   d. Limit preparation to areas, which will be seeded promptly after preparation.

C. Sustainable Measures

1. Remove all debris resulting from the soil preparation operations promptly. Thoroughly clean the Work area to the satisfaction of the Engineer. Remove and transport off Authority property all debris materials resulting from the soil preparation operation in accordance with Division 1 clause entitled "Recycling of Construction Debris Materials".

D. Erosion Control and Sedimentation Measures

1. Apply erosion and sediment control measures at all times as required by this Contract and the governing regulatory agencies.

3.02 INSTALLATION

A. Seeding Operations

1. Apply two (2) inches of compost as per Section 02960 to all areas to be seeded.
2. Apply 10 pounds of "Soil pH adjustment" per 1000 square feet to all areas to be seeded. Rototill "soil pH adjustment" to six (6) inch depth prior to seeding.
3. Apply 10-6-4 fertilizer uniformly by machine at the rate of 1 pound of Nitrogen per 1000 square feet. Work lightly into the top six inches of soil.
4. Sow grass seed at the rate provided in Appendix B "Permanent Seeding" of this Section and cover in such manner that a uniform stand would result.
5. Seed the area uniformly in two passes using a Brillion Turfmaker II Seeder and in uniform rows that cross each other at an angle of 30 degrees. Apply seed at designated seeding rates for both passes as per Appendix B "Permanent Seeding".
6. For areas too small for the use of a Brillion Turfmaker II Seeder, apply seed at the designated seeding rates per 1000 square feet with a broadcast spreader. Roll seeded area with a roller suitable enough to establish adequate soil – seed contact.
7. Hydroseeding shall not be permitted.

B. Mulching Seeded Areas

1. Strictly comply with manufacturer's installation instructions and recommendations. Use approved mechanically agitated, hydraulic mulching machines with a fan-type nozzle (50-degree tip).
   a. Fill tank to middle of agitator or tank about 1/3 full of water. Turn on pump to wet or purge lines. Begin agitating. Keep adding water slowly while adding the FGM at a steady rate.
   b. Mix at a rate of 50 lbs of FGM per 125 gallons of water. Verify with the equipment manufacturer the optimum mixing rates for the FGM.
   c. All FGM should be added once the tank is approximately ¾ full.
   d. Thoroughly agitate and mix slurry for at least 10 minutes after adding the last of the FGM to fully activate all the bonding additives and to attain proper viscosity.

e. Turn off recirculation valve to minimize potential for air entrainment within the slurry.

2. Apply FGM uniformly in successive layers, from two or more directions, to fully cover 100% of the soil surface at following rates:

a. Minimum application shall be 3,000 lbs/acre for slopes <3:1.

b. Minimum application shall be 3,500 lbs/acre for slopes >3:1.

3. Do not over-spray the hydromulch onto runways, taxiways, roadway, sidewalks, signs, fences, gravel swales or any structure or surface feature. Any over-spray found anywhere except where seed is required, shall be thoroughly cleaned and repaired, all at no cost to the Authority.

4. For areas too small for hydromulching with Flexible Growth Medium (FGM), install a netless flexible growth medium blanket such as the Futerra F4NETLESS blanket as per manufacturers instructions. Use only biodegradable staples to secure Futerra F4NETLESS blanket to the soil surface.

C. Application of Dust Retardant

1. Apply dust retardant on all completed areas that have not been seeded and/or where seed germination is less that 50% after 3 weeks from date seed was sown and when the calendar seeding date limits (See Appendix "B") have expired and seeding can no longer be performed or as approved by the Engineer.

2. Apply dust retardant with an approved pressurized sprayer with a rating of 40-60 PSI.

3. Do not apply dust retardant if precipitation is forecast within 24-hours after application.

D. Care of Seeded Areas

1. As per Appendix "B" of this Section, provide "Full" Care conforming to the following:

2. Full Care

a. Upon completion of seeding operations, maintain seeded area(s) in accordance with Appendix "B" for Permanent Seeding of this Section.

END OF SECTION

SECTION 02930

SEEDING

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Product Data

02930D01 Submit in accordance with the requirements of "Inspections and Rejections" of Division 1 - GENERAL PROVISIONS, a complete "Product List", listing all products to be used under this Section.

02930D02 Submit for approval to the Engineer the seed requirements in accordance with 1.03 E, 1 – 12.

02930D05 Submit certification from the manufacturer of Flexible Growth Medium that the installation meets or exceeds the required product preparation and application rates.

02930D06 Submit to the Engineer one copy of U.S. Department of Labor Material Safety Data Sheets (MSDS) and product labels for all hazardous chemicals utilized during the Work of this Section.

Manufacturer Test Reports

02930F02 Submit to the Engineer the test results for Endophyte level analysis as specified in 1.05 B. 4 of this Section.

02930F03 Submit to the Engineer the test results for "Technical Topsoil Evaluation" as specified in Section 02920 and 1.05 B. 5. of this Section.

02930F04 Submit to the Engineer the test results for the nutrient controls as recommended in the "Technical Topsoil Evaluation" as specified in Section 02920 " Crop – Lawn".

Qualifications

02930K01 Submit qualifications of the entity and its workers performing the Work of this Section to the Engineer in accordance with 1.05 A. Include names of clients, telephone numbers, and contract amounts for work performed in the last three years and experience records of workers performing the Work of this Section.

02930K02 Submit evidence of a valid pesticide applicator's license.

02930K03 Submit a list of equipment owned and to be used in this Contract by the entity as listed under 1.05.

END OF APPENDIX "A"

APPENDIX "B"

SECTION 02930

SEEDING

A. SEED MIX

Permanent Seeding

1. Seed Mixture shall have originated in Oregon and be as distributed by F M Brown Seed, Sinking Spring, PA 19608 (800) 345-3344, Lesco, Inc., Mountainside, NJ 07092 (908) 317-0509, National Seed, New Brunswick, NJ 08901 (800) 828-5856, Jonathan Green, Farmingdale, NJ, (732) 938-7007 or approved equal and as follows:

Kind of Seed	**% Mix:**	**% Min. Purity:**	**% Min. Germ:**	**% Min. Endophyte Infection:**
Firecracker or Spider *LS Tall Fescue*	100	99	95	>90

2. Seeding rate shall be 6 pounds per 1000 square feet.
3. Seeding shall be performed only during the following periods:

   April 1 - May 31 (latest crop, subject to proper storage and testing results)

   August 16 - October 15 (latest crop, fresh seed, subject to proper storage and testing results)

4. Provide full care upon completion of seeding until issuance of certificate of final completion. Full care shall include irrigation when bi-weekly rainfall does not exceed one (1) inch of rainfall per week at the construction site and a weed-free installation at all times, at no additional cost to the Authority.
5. Successful seeding shall be defined by the following:

   b. 85% survival of the specified turfgrass at the end of the Full care period as determined solely by the Engineer.

   b. Endophyte test results for tillers that meet the minimum % endophyte viability levels as specified on the "blue tag certified" label and matching Oregon State University Seed Laboratory Report Seed Analysis when submitted to the Engineer.

B. SEED MIX

Temporary Seeding for Soil Erosion and Sedimentation Control

1. Seed Mix shall be as distributed by F M Brown Seed, Sinking Spring, PA 19608 (800) 345-3344, Lesco, Inc., Mountainside, NJ 07092 (908) 317-0509, National Seed, New Brunswick, NJ 08901 (800) 828-5856, Jonathan Green, Farmingdale, NJ, (732) 938-7007 or approved equal and as follows:

Kind of Seed	% Mix:	% Min. Purity:	% Min. Germ:	% Min. Endophyte Infection:
Assure, Legacy II or Wilmington Perennial Ryegrass	100	97	90	>90

2. Seeding rate shall be 6 pounds per 1000 square feet.
3. Seeding shall be performed:

   April 1 - October 15 (latest crop, fresh seed, subject to proper storage and testing results)

4. Provide full care upon completion of seeding. Full care shall include irrigation when weekly rainfall does not exceed one (1) inch of rainfall per week at the construction site.
5. Successful seeding shall be defined by the following:
   a. 85% survival of the specified turfgrass at the end of the Full care period as determined solely by the Engineer.

END OF APPENDIX "B"

APPENDIX "C"

SECTION 02930

SEEDING

TESTING LABS/CONTACTS

1.) Oregon State University Seed Laboratory
3291 SW Campus Way
Corvallis, OR 97331-3801
Contact: Dr. Adriel Garay, Lab Manager
e-mail: adriel.garay@oregonstate.edu
Website: www.seedlab.oscs.oregonstate.edu
Tele: (541)-737-4464
Fax: (541)-737-2126
Endophyte Tests offered:

- Seed Testing: Immunoblot assay*
  Lab requires one-pint seed sample
- Seed Grow-out/Plant Tissue Endophyte Analysis*
- Plant Tissue: Grass Tillers Endophyte Analysis*

2.) Agrinostics Ltd. Co
2850 Elder Mill Road
Watkinsville, GA 30677
Contact: Nick Hill (cell: 706-614-2485)
Tele: 706-769-2397
Web: www.agrinostics.com
Endophyte Tests offered:

- Seed Testing: Immunoblot assay*
  Lab requires minimum sample of 100 seeds
- Seed Grow-out Endophyte Analysis*
  Lab requires minimum sample of 100 seeds
- Plant Tissue: Grass Tillers Endophyte Analysis*

Lab requires minimum of 50 tillers for tissue testing.

3.) Plant Diagnostic Lab
New Jersey Agricultural Experiment Station
Rutgers University
P.O. Box 550
Milltown, NJ 08850-0550
Contact: Richard Buckley
Tele: (732)-932-9140
Website: www.njaes.rutgers.edu/services

Endophyte Tests offered:

- Seed Testing: Endophyte Screening*
  Lab requires one pint of seed for testing.
- Plant Tissue: Grass Tiller Endophyte Analysis Test *
  Lab requires minimum of 50 tillers for tissue testing.

* Verify Fees/Sampling Procedures with Lab

END OF APPENDIX "C"

DIVISION 2

SECTION 02959

LANDSCAPE PROTECTION DURING CONSTRUCTION

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for maintenance and protection of existing landscape plants and irrigation system during construction.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. Perform landscape protection and maintenance operations using materials and methods in accordance with this Specification and Contract Drawings.

B. For botanical names of trees, shrubs and ground cover, refer to the names listed in "Hortus III: A Concise Dictionary of Plants Cultivated in the United States and Canada" published by MacMillan Publishing Co., New York, NY 10022.

C. Pruning methods shall be in accordance with the 'Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance, - Standard Practices,' ANSI - A 300, as published by the Tree Care Industry Association, 136 Harvey Road, Suite 101, Londonderry, NH 03053.

D. As a guide to determine local weather predictions use the National and Local Forecast, Hurricane, Radar and Report website at http://www.weather.com as published by the Weather Channel.

E. Mulch shall conform to current standards established by the Mulch and Soil Council, 10210 Leatherleaf Ct., Manassas, VA 201114245.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Do not perform any product application if precipitation has fallen within 2 hours prior to planned application, or is forecasted during the next 12-hour period.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Verify that the entity performing the Work of this Section shall employ workers experienced in landscape protection and landscape maintenance and shall have engaged in Work similar to the requirements of this Section for a period of at least five years.

2. Verify that the entity performing location of protection fencing and pruning of this Section is a ISA Certified Arborist and a member of the International Society of Arboriculture and State Chapter where they are residing.

3. Verify that the Contractor has an ISA Certified Arborist (NY) available within (24) twenty-four hours upon request.

   a. Verify that the entity performing the Work of this Contract has a New York Certified Arborist on staff who possesses a minimum of the following:

      (1) Associates Degree in Horticulture from a recognized college.

      (2) A total of five (5) years of work experience.

      (3) A member of the International Society of Arboriculture (ISA) and State Chapter where they are residing.

      (4) Qualified by International Society of Arboriculture during the year(s) this individual is working on this Contract.

   b. Quality Assurance

      (1) Qualifications: Verify that the entity performing the Work of this Contract utilizes the services of an ISA Certified Arborist (NY) who shall act as superintendent for tree protection and maintenance of all trees for this Contract and shall be on site at all times including but not limited to: demarcating the Primary Root Zone (PRZ), with the Engineer prior to installation of landscape protection fencing, verifying the landscaping to be protected, mulching, application of bio-stimulants to all trees, pruning, irrigation, and notifying the Engineer of any discrepancies or non-compliance to the Contract Specifications and Drawings.

B. General Requirements for Operations and Products

1. Products listed in PART 2 - PRODUCTS shall be approved in writing by the Engineer prior to delivery to the construction site.

2. After delivery to a construction site, the Engineer, at his discretion, may take representative samples of any item listed in Part 2 – Products for analysis. Products which fail to comply with these specifications shall be immediately removed from the construction site and replaced with products which comply. No Work will be permitted until the non-complying product is removed from the construction site and replaced with one which complies with these specifications.

C. Specific Requirements for Operations and Products

1. Trees, Shrubs and Ground Cover

   a. The Contractor shall protect all existing landscaping during the Work of this Contract. In the event that any existing landscaping and irrigation is damaged or destroyed, the Contractor shall replace in kind with materials and workmanship equal to or better than the existing materials, at no expense to the Authority.

   b. The Contractor and his ISA certified arborist shall coordinate all arrangements and accompany the Engineer on all inspections of the trees, shrubs and ground cover to be protected. Provide a minimum of 48 hours prior notice to the Engineer. Do not perform any construction work around any existing landscape to be protected prior to inspection by the Engineer.

c. Prior to starting any work the Contractor's ISA certified arborist shall demarcate the Primary Root Zone (PRZ) with stakes around the trees, shrubs and ground cover to be protected.

d. Verify that the Contractor has erected a "landscape protection fence" protecting the PRZ of all trees, shrubs and ground cover to be protected. Prior to starting any work.

e. Once the landscape protection fence is in place, the Contractor shall not enter, store any equipment or supplies, damage or diminish the health and vigor of the tree/landscape within the area to be protected.

e. Provisions shall be made to protect the root systems of all trees within the construction site. Under no circumstances shall vehicles, heavy equipment, or material stockpiling be allowed within the drip line of protected trees. PRZ fencing and posts shall be erected by the Contractor around all existing trees to remain.

g. If a tree limb, root or part hinders a proposed construction activity, the Contractor and the Contractor's NY Certified Arborist shall arrange with the Engineer, for an inspection and recommendation on how to proceed. Under no circumstances shall the Contractor or his crew, break off or cut any tree parts. Absolutely no tree work is to be undertaken without the prior approval of the Engineer.

2. Irrigation

a. Verify that the Contractor has contacted and has performed a field verification of all existing irrigation systems in the area of Work with the Maintenance Unit Supervisor, JFK Garden & Housekeeping (718) 244-3622.

b. The Contractor shall erect and maintain a protection fence, protecting the irrigation system throughout the duration of the Contract Work, at no expense to the Authority.

c. The Contractor shall ensure that the existing irrigation system is operational throughout the growing season and that any damage at any time. The Contractor shall replace and repair with matching material and workmanship within one week of sail damage, all at no expense to the Authority.

3. Drive/Walk Through Site Inspections

a. During the installation and maintenance period the Contractor's New York Certified Arborist along with the Contractor shall be available to perform bi-weekly drive and walk through site inspections of the construction site, accompanied by the Engineer, identifying the status of the work, issues or problems requiring immediate action by the Contractor or items affecting the Contractor's work.

b. Within 48 hours of each site inspection, the Contractor's ISA Certified Tree Arborist shall submit a report listing individuals who attended the site inspection, the item(s) discussed, a brief description of the issues or problems found and recommendations for solutions to be implemented by the Contractor and a schedule designating dates when the Contractor will implement said work.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver all products in the manufacturer's unopened containers bearing the trade name, manufacturer's name, weight and analysis.

B. Store products away from moisture and extreme temperatures and in such a manner that their effectiveness will not be impaired.

C. Formulation, Application and Equipment

1. Use the manufacturer's recommended formula, application rate and safety instructions at all times.

2. Mix and agitate products and use equipment according to the manufacturer's directions. Mix and agitate only in an area designated by the Engineer.

3. Dispose of spilled materials and surplus products in a legal manner.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Bio-Stimulants

1. Bio-Stimulant shall be a dry, water soluble root growth stimulant with nitrogen-fixing, phosphorus solubilizing and growth promoting bacteria packaged in ¼ pound (114 grams), pre-measured packs conforming to the following:

Ingredients:	% by Weight
Humates and Humic Acid	40%
Cold Water Sea Kelp Extract	35%
Essential Amino Acids (18)	7%
Sucrose and other Natural Sugars	6%
Citric Acid	5%
Vitamins and Growth Factors	2% (including B1, B2, B6, B12, Biotin, Folic Acid, Niacin and Vitamin K)
Nitrogen Fixing Bacteria	Approx. 60 Billion per Pound
Phosphorus Solubilizing Bacteria	Approx. 60 Billion per Pound
Growth Promoting Bacteria	Approx. 60 Billion per Pound
12% Potassium (K2O) derived from Humate and Kelp Extracts	

2. Bio-Stimulant shall be "PHC BioPak Water Soluble Powder" as manufactured by Plant Health Care, Inc., Pittsburgh, PA 15238, or an approved equal.

B. Pruning Alcohol

A commercial ethylalcohol or "Ethanol" 70-95%.

C. Shredded Hardwood Bark Mulch

Shredded hardwood bark mulch shall be double hammermilled hardwoods, cedar, hemlock hardwood blend.

D. TreeGator

1. TreeGator portable drip irrigation system shall conform to the following:

   a. Constructed of ultra-violet light stabilized, reinforced, rip-stop polyethylene with reinforced nylon zippers.

   b. Each TreeGator bag to have a 20 gallon water capacity and weigh 1 ½ pounds empty.

   c. Each tree shall have a minimum number of bags based on the following:

Caliper size tree	Number of TreeGator bags
1" – 4"	1
4" – 10"	2
10" – 18"	3
18"+	4

2. TreeGator portable drip irrigation systems shall be as manufactured by Spectrum Products, Raleigh, NC, 27619-8187 or approved equal.

E. Primary Root Zone (PRZ) Fencing

1. 48" rolled, medium weight extruded polymeric mesh grid fabric of high density polyethylene, fully stabilized for ultraviolet resistance; temperature range –60 degrees F to 180 degrees F; tensile strength 2600 psi. Mesh 1 ½". Color Forest Green.

2. Painted steel u-posts. Color to match fabric. Post height 6 feet.

PART 3. EXECUTION

3.01 PREPARATION

A. Landscape Protection Measures

1. The Contractor's ISA Certified Arborist (NY) shall demarcate the PRZ around existing landscaping with stakes. Upon the approval of the Engineer, install PRZ fencing prior to commencing any construction activity.

2. Comply with 1.04 at all times.

3. For pruning, conform to 3.03 D of this Section.

B. Irrigation Protection Measures

1. The Contractor shall coordinate, erect and maintain a protection fence, protecting the irrigation system throughout the duration of the Contract Work in accordance with 1.04 C. 2. here in.

3.02 WORK PERFORMED

A. *Grade Changes*

1. Do not change the grade around existing trees, shrubs or ground cover unless otherwise shown on the Contract Drawings.

B. Demolition and Excavation

1. When trenching for utility lines or demolishing existing paved surfaces, subsurfaces, etc. the Contractor shall use hand labor or an airspade to excavate within the PRZ.
2. When continuous footings for curbs, fences or other structures are shown, the Contractor shall bridge the area occupied by any tree roots immediately adjacent to and within the dripline of existing trees.
3. When installing underground utilities within the dripline of a tree, airspading shall be used instead of trenching to reduce the extent of root damage.
4. Do not cut tree roots during excavation.
5. Prior to completion of each days work around tree roots, protect the tree roots from damage, drying and freezing by placing burlap, shredded hardwood bark mulch on top of the tree roots.

C. Landscaping and Irrigation Affected By Construction Activity

1. All existing trees, shrubs, ground cover and irrigation within and adjacent to the Work area shall be regularly monitored by the Contractor's ISA Certified Arborist (NY) on a bi-weekly basis.
2. All trees within and adjacent to the Work area shall be pruned as needed and receive two applications of Bio-Stimulant. One at the time the protection fence is installed and the second immediately prior to closing over the soil/root area with new paving and /or finished grade.
3. All trees within and adjacent to the Work area shall be irrigated on a regular basis in accordance with Appendix 'B'.

3.03 ADJUSTMENTS

A. Bio-Stimulant Applications

1. The Contractor shall provide two (2) applications of Bio-Stimulants to all existing trees to be maintained under this Contract in accordance with 3.03 C 2 of this Section.

2. Bio-Stimulants shall be applied under the supervision of the Contractor's ISA Certified Arborist and the Engineer.

3. Application of Bio-Stimulant as per the manufacturer's directions and as follows:

   One (1) pound of Bio-Stimulant powder per 100 gallons water.

B. Perform maintenance operations in accordance with Item B of Appendix "B" to this Section.

C. Sanitation

1. Weeding

   Maintain the landscaping within the "PRZ", "weed-free" at all times.

2. Litter Removal

   Maintain the landscaping within the "PRZ" free of litter or debris of any type at all times.

3. PRZ fence removal

   Remove the PRZ after all construction activity has been completed.

D. Pruning

1. Prune in accordance with the National Arborist Association's ANSI A300 "Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices" and in accordance with Appendix "B" and as follows:

   a. Perform pruning with sharp tools. Disinfect tools by dipping in alcohol at the commencement of the day's operation and again after finishing each plant known to be diseased. Use fresh alcohol each day for this operation.

   b. Prune to remove dead, weak, interfering, suckered, damaged or unsightly twigs or branches.

2. Prune to maintain the species' characteristic shape.. Pollard and tree topping shall not be allowed.

3. No tree climbing permitted. For trees less than 15 feet in height, use free standing ladders and do not touch the tree trunk.

4. Do not disturb utility lines during pruning operations.

5. Do not use anvil-type, pruning tools.

6. Make pruning cuts at the branch collar. Crushed, jagged cuts or cuts leaving too much stub and existing improper cuts shall be properly re-cut.

7. Carefully clean and shape large wounds.

8. Remove remnants, including, but not limited to stumps, trunk, limbs, branches, and foliage shall be disposed of as expeditiously as possible and in an approved manner.

I. Irrigation

1. Frequency will vary depending on environmental factors. The total amount of water, from natural or applied irrigation shall be not less than one inch per week.

2. The Contractor shall be required to irrigate all existing trees within the "PRZ" during construction with TreeGator bags if the existing irrigation system is not operating in the Work area.

3. The contractor shall remove all TreeGator bags when the PRZ fence is removed or when the existing irrigation system is fully operable within the PRZ.

4. In the event, that the Engineer, in his sole opinion determines that the Contractor has failed to water the plantings according to these Specifications, he will notify the Contractor who, at his own expense, shall immediately make corrections as directed. In the event that the plants die due to lack of water, the Contractor shall replace the plants with materials and workmanship that match the existing at no cost to the Authority.

J. Arborist's Site Inspections/Reports

1. The Contractor's ISA Certified Arborist (NY) along with the Contractor shall be available to perform bi-weekly drive and walk through site inspections of the construction site, accompanied by the Engineer, identifying the status of the work, issues or problems requiring immediate action by the Contractor or items affecting the Contractor's work. Site inspection frequency shall be as follows:

   Bi-weekly Site Inspections

2. Within 48 hours of each site inspection, the Contractor's ISA New York Certified Arborist shall submit to the Engineer a Maintenance Inspection Report, to include but not be limited to: list of inspection attendees, the item(s) discussed, a brief description of the issues or problems found and recommendations for solutions to be implemented by the Contractor and a schedule designating dates when the Contractor will implement said work.

END OF SECTION

SECTION 02959

LANDSCAPE PROTECTION

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Construction and Installation Procedures

02959G01 Prior to erecting the Landscape Protection Fence, Submit verifications, that any irrigation lines have identified, and the delineation of the Protection Fence is staked out and approved by the Engineer.

END OF APPENDIX "A"

SECTION 02959

LANDSCAPE PROTECTION DURING CONSTRUCTION

APPENDIX "B"

A. Maintenance To Be Performed While Plants are protected

Function	Schedule	Description
Irrigation-(Manual & Tree Gator Bags)	April, May, Oct. & Nov. June, July, Aug. & Sept.	Water once per week. Water twice per week.
Weed Removal	April – November	Identify/remove once/week
Litter Removal	January - December	Once a week
Bio-Stimulant Applications:		Two Applications
		1st at time construction fence is installed.
		2nd just prior to time pavement or finished grade is set.
Pruning – Deciduous Trees	January - December	Prune damaged twigs/branches. All pruning operations shall be supervised by NY Certified Arborist.
NY Certified Arborist's Walk-thru Site Inspections	April – December	Twice per month.
	January – March	Once per month (Certified Arborist's Inspection Reports due within 48 hours of each inspection).

END OF APPENDIX "B"

DIVISION 2

SECTION 02960

ADDING COMPOST

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for amending soil with compost prior to seeding and/or landscaping.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. Use product testing methods adopted and published by the Association of Official Analytical Chemists, 1111 19th Street Suite 210, Arlington, VA 22209.

B. As a guide to determine local weather predictions, use the National and Local Forecast, Hurricane, Radar and Report website at http://www.weather.com as published by the Weather Channel.

C. Use testing methods for 'Assessing Compost Quality' as provided by the Rutgers Soil Testing Laboratory, Rutgers New Jersey Agicultural Experiment Station, New Brunswick, NJ 08901.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Perform operations only during the following weather conditions:

1. There shall be no frost in the ground and the topsoil temperature shall be above 32 degrees F.

2. There shall be no form of precipitation falling or forecast to fall within the next two hours. Following a period of precipitation, resume operations only after the soil has drained.

1.04 QUALITY ASSURANCE

A. Verify that the entity and its workers performing the Work of this Section are experienced in landscaping and have been engaged in work of a complexity similar to that required under this Section for a period of at least three years. Include names of clients, telephone numbers, and contract amounts for work performed in the last three years and experience records of workers performing the Work of this Section.

B. Test Requirements

1. Submit a representative sample of compost material for analysis to a certified independent laboratory to ensure conformance to requirements specified in 2.01 prior to delivery and at the commencement of each 100 cubic yards of compost delivered to the construction site. No substitutions for testing parameters will be permitted.

2. Take on-site samples only in the presence of the Engineer and at sites ready for operations to commence.

3. Test Soluble salts in Compost utilizing the Saturated Paste Extract method.

B. General Requirements for Operations and Products

1. Products listed in PART 2 - PRODUCTS shall be approved in writing by the Engineer prior to delivery to the construction site.

2. Prior to delivery of compost to the construction site, submit to the Chief of Materials Engineering the following:

   a. The location of the source of compost and the name and address of the supplier.

   b. A certified analysis of the compost that it meets the requirements of this Section. Any analysis of which the date of testing by the certified independent laboratory is in excess of one month prior to the actual date of delivery to the construction site will not be accepted.

   c. A ¼ pound sample.

   d. In the event that the sample/analysis does not conform to the specified requirements, submit additional samples/analyses until the results do conform to this Section, all at no additional cost to the Authority.

3. After delivery to the construction site, the Engineer may, at his discretion, take for analysis representative samples of any item listed in PART 2 - PRODUCTS.

4. At the commencement of each 100 cubic yards of compost delivered to the construction site, the Engineer may, at his discretion, take a sample of compost for analysis to determine if the product is in conformance to this Section.

5. In the event that the analysis of the compost sample is not consistent with the requirements specified in 2.01, remove the delivered compost from the construction site and replace it with material that does conform, all at no additional cost to the Authority.

1.05 DELIVERY, STORAGE AND HANDLING

A. Do not deliver bulk compost to the construction site until the Engineer has approved in writing that the product meets requirements of this Section.

B. Deliver all products in the manufacturer's unopened containers bearing the trade name, manufacturer's name, weight and analysis.

C. Store products away from moisture and extreme temperatures and in such a manner that their effectiveness will not be impaired.

1.06 SUBMITTALS

A. See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Compost

1. Compost shall be derived from biosolids, free of viable weed seeds and contain material of a generally humus nature. The product shall not contain any materials toxic to plant growth or produce objectionable odors. Compost shall meet EPA Exceptional Quality Standards and all State Environmental Agency requirements. Variations in the following specified physical properties are not acceptable. Compost shall conform to the following:

Parameters:	Allowable Range:	Test Method:
Moisture Content		Wet Basis
% water	35% - 60%	
% solids	65% - 40%	
pH	5.7 – 7.7	Saturated Media Extract (SME)
Soluble Salt Level		
SME	<5.0 mmhos/cm (ds/m)	Saturated Media Extract
1:5 dilution	<1.5 mmhos/cm (ds/m)	1:5 dilution
Inorganic Nitrogen		
ppm nitrate-N	50 -200 ppm	SME
ppm ammonium-N	6 – 18 ppm	SME
Organic Matter Content	40% - 60%	
Organic Carbon Content	20% - 25%	
Total Kjeldahl	1.0% - 2.5%	
Carbon-to-Nitrogen Ratio	15 – 30:1	
Maturity Index	6 – 8	Solvita Test

*See Appendix "B" for allowable compost application rates based upon soluble salts levels.

PART 3. EXECUTION

3.01 PREPARATION

A. Areas of Changed Grades

1. Areas of changed grades shown on the Contract Drawings that have a smooth, uniform surface, where compost is to be spread:

   a. Rototill existing soil to a depth of not less than six inches to produce a homogeneous mixture of fine texture, free of clods, stones, roots and other extraneous materials. Remove and dispose of such materials away from Authority property.

   b. Rake and drag soil surface to remove high areas and fill depressions.

   c. Limit preparation to areas that will receive compost immediately following preparation.

2. Areas of changed grades shown on the Contract Drawings that are due to pavement or other material removal which requires adding clean fill and topping with six-inches of screened loam soil and adding 2-inches of compost:

   a. Rototill clean fill to a depth of not less than six inches to produce a homogeneous mixture of fine texture, free of clods, stones, roots and other extraneous materials. Remove and dispose of such materials away from Authority property.

   b. Rake and drag to remove high areas and fill depressions.

   c. Limit preparation to areas that will receive compost immediately after preparation.

B. Unaltered Areas

Prepare areas shown on the Contract Drawings as unaltered or undisturbed by excavation, grading or stripping operations as follows:

1. Remove existing vegetation and turf. Dispose of vegetative matter away from Authority property.

2. Rototill to a depth of not less than six inches to produce a homogeneous mixture of fine texture, free of clods, stones, roots and other extraneous materials. Remove and dispose of such materials away from Authority property.

3. Rake and drag to remove high areas and fill depressions.

4. Limit preparation to areas that will receive compost immediately after preparation.

C. Sustainable Measures

Remove all debris resulting from the soil preparation operations promptly. Thoroughly clean the Work area to the satisfaction of the Engineer. Remove and transport off Authority property all debris materials resulting from the soil preparation operation in accordance with Division 1 clause entitled "Recycling of Construction Debris Material".

3.02 INSTALLATION

A. Formulation, Application, and Equipment - General

1. Use the manufacturer's recommended formula, application rate and safety instructions at all times.

2. Mix and agitate products and use equipment according to the manufacturer's directions. Mix and agitate only in an area designated by the Engineer.

3. Dispose of spilled materials and surplus products away from Authority property.

B. Apply a minimum of 2" of compost evenly over area and uniformly incorporate (rototill) into the soil to a minimum depth of six inches.

C. Commence seeding and/or landscaping applications immediately after incorporating compost.

END OF SECTION

SECTION 02960

ADDING COMPOST

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Samples

02960C01 Submit the location of the source of the compost and a two-pound representative sample of compost (as many as required) to the Chief of Materials Engineering.

Product Data

02960D01 A complete "Products List", listing all products to be used under this Section including: Product name, manufacturer, catalog cuts, details, samples, manufacturer's specifications and certified test data/analysis of each product.

02960D02 Material Data Safety Sheets for all toxic or hazardous materials to be used under this Section.

Manufacturer Test Reports

02960F01 Submit laboratory analyses of the compost to the Chief of Materials Engineering, Materials Engineering Unit, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397, in accordance with 1.04 B and 2.01 B.

END OF APPENDIX "A"

SECTION 02960

ADDING COMPOST

APPENDIX "B"

COMPOST – SOLUBLE SALTS LEVELS

Use the following table to determine the maximum allowable ECe(dS/m of saturation extract) of compost at the desired application rate:

Desired Use Rate		Salinity (ECe) of On-Site Soil		
Cubic Yards Amendment per 1000 Sq. Ft. for incorporation to 6" depth	Volume Percentage of Amendment	3 dS/m	2 dS/m	1 dS/m
		Maximum ECe of Compost		
1	5	14	28	42
2	11	7	14	21
3	16	5	9. 5	14
4	22	3. 5	7	10. 5
5	27	3	5. 5	8. 5
6	32	2. 5	4. 5	7

Example: If Specification calls for 6 cubic yards compost per 1000/sq. ft. to be incorporated into the top 6" depth, and site soil has an ECe of 2.0. In order to avoid exceeding an ECe of 4 in the final blend, compost ECe should be less than 4.5 dS/m.

END OF APPENDIX "B"

DIVISION 3

SECTION 03100

CONCRETE FORMWORK

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for cast-in-place concrete formwork.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American Concrete Institute (ACI)
ACI 347	Guide to Formwork for Concrete
ACI 117	Standard Specifications for Tolerances for Concrete Construction and Materials
ACI 318	Building Code Requirements for Reinforced Concrete
	American Society for Testing and Materials (ASTM)
ASTM D 1751	Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types)
	National Forest Products Association (NFPA)
	National Design Specifications for Wood Construction
	West Coast Lumber Inspection Bureau
	American Plywood Association (APA)
	Douglas Fir Plywood Association (DFPA)

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Design calculations shall be prepared by a Professional Engineer licensed in the State where the Work is to be performed. Design calculations shall be made available to the Engineer to facilitate inspection.

B. For wood products furnished for the Work of this Section, the Contractor shall comply with the applicable provisions of "National Design Specifications for Wood Construction" of the National Forest Products Association (NFPA).

C. For all other products furnished for the Work of this section, the contractor shall comply with the reference standards of the local building code.

D. Shop Drawings

1. All formwork and shoring shop drawings shall be signed and sealed by a Professional Engineer licensed in the State where the Work is to be performed. Shop drawings shall be made available to the Engineer to facilitate inspection.

2. Shop drawings shall indicate:

a. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports;

b. Means of leakage prevention for concrete exposed to view in the finished construction;

c. Sequence and timing of erection and stripping, assumed compressive strength at time of stripping, height of lift and height of drop during placement;

d. Vertical, horizontal and special loads in accordance with "Loads" of ACI 347 (Section 2.2) and camber diagrams, if applicable;

e. Notes to formwork erector showing size and location of conduits and pipes embedded in concrete according to ACI 318 (Section 6.3).

1.04 SUBMITTALS

For Submittals - see Appendix "A".

PART 2. PRODUCTS

2.01 MATERIALS

A. Earth Forms

Use only for footings where shown on the Contract Drawings.

B. Lumber Forms

Use for edge forms and unexposed finish concrete. Boards shall be 6 inches or 8 inches in width, shiplapped or tongue and groove, "Standard" Grade Douglas Fir, conforming to the "Standard Grading and Dressing Rules No. 17", of the West Coast Lumber Inspection Bureau. Boards shall be four sides surfaced.

C. Plywood Forms

Use for exposed finish concrete. Forms shall conform to U.S. Product Standard PA 1-66. Each panel shall carry the grade trademark of the American Plywood Association along with the Douglas Fir Plywood Association (DFPA) Quality stamp and shall be full size (4-foot x 8-foot) panels.

1. Plywood for surfaces to receive membrane waterproofing shall be a minimum of 5/8 inch thick and shall be "B-B Plyform Class 1 Exterior" grade.

2. Plywood where "Smooth Finish" is required, as shown on the Contract Drawings, shall be "HD Overlay Plyform Class 1 Exterior" grade, a minimum of 3/4 inch thick.

D. Prefabricated Forms

Prefabricated forms shall be as listed below and where shown on the Contract Drawings:

1. Pan Type Void Forms

   Removable steel or reinforced plastic of sizes and profiles required to produce completed Work shown.

2. Tubular Column Type

   Metal, fiberglass-reinforced plastic, or spirally wound laminated fiber materials; inside surface treated with release agent; of sizes required to produce completed Work shown.

E. Steel Forms

Sheet steel, suitably reinforced and designed for the particular use shown on the Contract Drawings.

F. Form Liners

Smooth, durable, grainless and non-staining hardboard, unless otherwise shown on the Contract Drawings.

G. Framing, Studding, and Bracing

Stud or No. 3 Structural Light Framing grade.

H. Form Ties and Spreaders

Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. No wire ties, wood spreaders or through bolts will be permitted.

I. Form Anchors and Hangers

Anchors and hangers used for exposed concrete shall not leave exposed metal at surface. Hangers supporting forms from structural steel shall be symmetrically arranged on supporting members to minimize twisting or rotation of member. Penetration of structural steel members will not be permitted.

J. Form Coating Agent

Provide one of the following unless otherwise shown on the Contract Drawings:

1. "Arcal-80"; Arcal Chemical Corporation
2. "Synthex"; Industrial Synthetics Company
3. "Nox-Crete Form Coating"; Nox-Crete Company

K. Vapor Retarder

Where shown on the Contract Drawings, 8 mil thick poly-ethylene sheet

L. Bituminous Joint Filler: ASTM D 1751

PART 3. EXECUTION

3.01 PREPARATION

A. Earth Forms

Trench earth forms neatly and accurately and at least 2 inches wider than footing widths shown on the Contract Drawings, unless otherwise indicated. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing. Form sides of footings where earth sloughs. Earth forms shall be tamped firm and cleaned of all debris and loose material before depositing concrete.

B. Formwork – General

Sloped surfaces steeper than 1.5 horizontal to 1 vertical should be provided with a top form to hold the shape of the concrete during placement, unless it can be demonstrated to the engineer that top forms can be omitted. Construct forms to the correct shape and dimensions, mortar tight, of sufficient strength, and so braced and tied together that the movement of men, equipment, materials or the placing and vibrating of the concrete shall not throw them out of line or position. Forms shall be strong enough to maintain their shape under all imposed loads. Camber where necessary to assure level finished soffits unless otherwise shown on the Contract Drawings. Carefully verify the horizontal and vertical positions of forms and correct all inaccuracies to the satisfaction of the Engineer before placing concrete in any form. Complete all wedging and bracing before placing concrete.

C. Forms for "Smooth Finish" Concrete

Use steel, plywood or lined board forms. Plywood and form liners shall be clean, smooth, uniform in size and free from damaged edges and holes. Form lining shall have close-fitting square joints between separate sheets and shall not be sprung into place. Sheets of form liners and plywood shall be full size wherever possible and joints shall be taped to prevent protrusions in concrete. Use special care in forming and stripping wood forms to protect corners and edges. All horizontal joints shall be level and continuous. Wood forms shall be kept wet at all times until stripping.

D. Forms for Surfaces to Receive Membrane Waterproofing

Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

E. Framing, Studding and Bracing

Space studs at 16 inches on center maximum for boards and 12 inches on center maximum for plywood. Framing, bracing, centering and supporting members shall be of ample size and strength to carry safely, without deflection, all dead and live loads to which forms may be subjected, and shall be spaced sufficiently close to prevent any bulging or sagging of forms. Soffits of all beam forms shall be constructed of material a minimum of two inches thick. Concrete out of line, level or plumb will be cause for rejection by the Engineer of the whole Work affected. Distribute bracing loads over base area on which bracing is erected. When placed on ground, protect against undermining, settlement or accidental impact.

3.02 INSTALLATION

A. Tolerances

Formwork shall be constructed so that concrete surfaces shall be within construction tolerances specified in "Standard Specifications for Tolerance for Concrete Construction and Materials" of ACI 117. Tolerances not met will be corrected to the satisfaction of the Engineer at no cost to the Authority.

B. Chamfered Corners

As shown on the Contract Drawings, provide moldings in forms for all chamfering required. Moldings shall be 45-degree right triangles in profile, of size required, milled from wood free from visible defects.

C. Forms Ties

Form ties shall be of sufficient strength and used in sufficient quantities to prevent spreading of the forms. Place ties at least one inch away from the finished surface of the concrete. Leave inner rods in concrete when forms are stripped. Space all form ties to be equidistant, and symmetrical and lined up both vertically and horizontally unless otherwise shown on the Contract Drawings.

D. Cleanouts and Access Panels

Provide removable cleanout sections or access panels at the bottoms of all forms to permit inspection and effective cleaning of loose dirt, debris, and waste material. Clean all forms and surfaces against which concrete is to be placed of all chips, sawdust, and other debris and thoroughly blow out with compressed air just before concrete is placed.

E. Arrangement

Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

F. Construction Joints

Provide a surfaced pouring strip where construction joints intersect exposed surfaces to provide a straight line at joints. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage. Construction joints shall show no overlapping of concrete and shall, as closely as possible, present the same appearance as butted plywood joints. Joints in a continuous line shall be straight, true, and sharp.

G. Embedded Items

Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, waterstops and other features. No wood or uncoated aluminum shall be embedded in concrete. Obtain any required information pertaining to embedded items to be furnished for the Work specified in other Sections. Securely anchor all embedded items in correct location and alignment prior to placing concrete. Conduits and pipes, including those made of coated aluminum, must meet the requirements of ACI 318 (Section 6.3). Approved coatings for aluminum shall be as follows unless otherwise shown on the Contract Drawings:

1. Conlux

   Primer - Bond Plex 46 or 66 (water borne urethane)
   Topcoat - Epolon Multi-Mil 39 (epoxy polyamide)

2. Sherwin Williams

   Topcoat - Heavy Duty Epoxy B67/B60B3 (epoxy polyamide)
   Note: self-priming

3. Benjamin Moore

   Primer - Epoxy Rust Inhibitive Primer (epoxy polyamide)
   Topcoat - Epoxy Enamel (epoxy polyamide)

H. Openings for Items Passing Through Concrete

Frame openings in concrete where shown on the Contract Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of Work specified under other Sections. Coordinate all Work of this nature in order that there shall be no unnecessary cutting and patching of concrete. Perform any cutting and repairing of concrete required as a result of failure to provide for such openings at no cost to the Authority.

I. Screeds

Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs. Slope slabs to drain where required or as shown on the Contract Drawings. Before depositing concrete, remove all debris from the space to be occupied by the concrete and thoroughly wet all forms. Remove freestanding water.

J. Screed Supports

For concrete over waterproof membranes and vapor barrier membranes, use screed supports of a cradle, pad or base type which shall not puncture the membrane. Staking through the membrane will not be permitted.

K. Shores and Falsework

Provide shores and falsework of adequate strength to protect persons and adjacent structures. Falsework and supports shall be adequate in size and strength to resist the loads imposed upon them without deformation, deflection, or settlement. All members must be straight and true without twists or bends. Use wedges in pairs or jacks where required to bring forms, shoring, or falsework for beams, girders, slabs, and other parts of the structure to the necessary elevations and uniform bearing before placing concrete. Do not use single wedges. Vertical and lateral loads shall be carried to ground by the formwork system or by bracing. Where shores rest on ground, provide adequate mud sills or other bases. Construct forms to permit their removal without disturbing the original shoring. Ensure that there is no movement of shores, braces or other supports during placement of concrete.

L. Reuse and Coating of Forms

Thoroughly clean forms and reapply form coating before each reuse. For exposed Work, do not reuse any form which cannot be reconditioned to "like new" condition. Discard forms considered unsatisfactory by the Engineer. Apply form coating to all forms in accordance with the manufacturer's specifications, except where "Scored Finish" is required as shown on the Contract Drawings. Do not coat forms for concrete that is to receive a "Scored Finish". Apply form coatings before placing reinforcing steel.

M. Inspection

Notify the Engineer after placement of reinforcing steel in the forms, but prior to placing any concrete, so that his inspection may be made.

3.03 REMOVAL OF FORMS AND SHORES

A. The forms and supporting shoring shall not be removed until the members have acquired sufficient strength to support their weight and the loads superimposed thereon safely and until the time and sequence of removal have been approved by the Engineer. Formwork shall be removed without damage to the concrete, in a sequence that does not allow the members to be subject to impact or loading eccentricities. Any repair required as a result of damage to the concrete shall be made to the satisfaction of the Engineer at no cost to the Authority.

B. Except when otherwise approved by the Engineer, or when minimum attained concrete strengths are specified on the Contract Drawings, forms shall be left in place for not less than the total number of days as specified in ACI 347.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

03100A01 From work and shoring shop drawings for areas accessible to the public and/or concrete exposed to view in the finished construction shall be submitted to the Engineer (as indicated in Section 1.03 D) at least 21 days prior to ordering any material or constructing any formwork.

03100A02 Provide a layout of all embedded items, including electrical and telephoneconduit and lumbing and drainage pipes, at least 15 days prior to concrete placement.

Samples

03100C03 Water stops and premolded expansion joint filler;

03100C05 From coating agent with manufacturer's literature

Calculations

03100H01 Design computations for areas accessible to the public and/or concrete exposed to view in the finished construction shall be submitted to the Engineer (as indicated in Section 1.03 A) at least 21 days prior to ordering any material or constructing any formwork.

END OF APPENDIX "A"

DIVISION 3

SECTION 03200

CONCRETE REINFORCEMENT

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for furnishing and installing concrete reinforcement.

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 M32	Steel Wire, Plain, for Concrete Reinforcement
AASHTO M55	Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement
AASHTO M221	Welded Deformed Steel Wire Fabric for Concrete Reinforcement
AASHTO M31	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
AASHTO M284	Epoxy-Coated Reinforcing Steel Bars
	American Concrete Institute (ACI)
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318	Building Code Requirements for Reinforced Concrete
	American Society for Testing and Materials (ASTM)
ASTM A 82	Steel Wire, Plain, for Concrete Reinforcement
ASTM A 184	Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement
ASTM A 497	Welded Deformed Steel Wire Fabric for Concrete Reinforcement
ASTM A 615	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 767	Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
ASTM A 775	Epoxy-Coated Reinforcing Steel Bars
	American Welding Society (AWS)
AWS D 1.4	Structural Welding Code - Reinforcing Steel
	Concrete Reinforcing Steel Institute (CRSI)
	Manual of Standard Practice Placing Reinforcing Bars

1.03 BRIDGE WORK

For Work of this Section involving bridges, the Contractor shall comply with the applicable provisions of "Standard Specifications for Highway Bridges" of the American Association of State Highway and Transportation Officials (AASHTO). Materials shall be in accordance with AASHTO designations where shown after the ASTM designation in parenthesis. Where not shown, comply with ASTM Designation.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver concrete reinforcement in bundles marked with metal tags indicating size, length and mark number.

B. Store and handle materials to prevent corrosion, damage to coating or contamination that could impair bond.

1.05 SUBMITTALS

For submittals see Appendix "A".

PART 2. PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars: ASTM A 615 (AASHTO M31), deformed, Grade 60, unless otherwise shown on the Contract Drawings.

Coated bars where shown on the Contract Drawings shall comply with the following:

1. Galvanized Reinforcing Bars

ASTM A 767, Class-I hot-dip galvanized, after fabrication and bending.

Repair sheared and cut ends and damaged coating with a zinc-rich formulation conforming to ASTM A 767 in accordance with the material manufacturers' recommendations.

2. Epoxy-coated Reinforcing Bars: ASTM A 775 (AASHTO M284)

Repair sheared and cut ends and damaged coating with an epoxy patching material conforming to ASTM A 775 (AASHTO M284) in accordance with the patching material manufacturers recommendations.

B. Welded Wire Fabric

Types shall be as shown on the Contract Drawings and shall comply with the following:

1. Plain, ASTM A 185 (AASHTO M55), flat sheets for size W5 and larger and coiled rolls for sizes below W5.

2. Deformed, ASTM A 497 (AASHTO M221), flat sheets for sizes D5 and larger and coiled rolls for sizes below D5.

C. Fabricated Steel Bar Mats

Fabricated steel bar mats shall be in accordance with ASTM A 184, when shown on the Contract Drawings, and as follows:

1. Bar grade, size and spacing as shown on the Contract Drawings.
2. Welded connections, unless otherwise shown on the Contract Drawings.

D. Steel Wire

Steel wire shall comply with ASTM A 82 (AASHTO M32), plain finish, unless otherwise shown on the Contract Drawings.

2.02 ACCESSORIES

A. Tie Wire

Provide minimum 16-gage, annealed type. Provide nylon, plastic or epoxy-coated wire for use with epoxy-coated and galvanized reinforcing bars, if any.

B. Supports for Reinforcement

Provide bolsters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use galvanized steel wire bar type supports complying with CRSI standards and as follows:

1. For supporting epoxy-coated reinforcing bars, use plastic coated supports, or supports fabricated from or coated with a dielectric material.
2. For slabs-on-grade, use supports with horizontal plate runners.
3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, use supports with plastic capped legs (CRSI, Class 1).
4. Where architectural concrete is shown on the Contract Drawings, use plastic side form spacers.

2.03 FABRICATION

A. Fabricate concrete reinforcement as shown on the Contract Drawings and on approved shop drawings, in accordance with ACI 315 "Tolerances".

B. Bend all concrete reinforcement cold. Heating of bars or wire fabric is prohibited.

C. Where welding of concrete reinforcement is shown on the Contract Drawings, weld in accordance with AWS Dl.4.

PART 3. EXECUTION

3.01 INSTALLATION

A. Place concrete reinforcement as shown on the Contract Drawings and on approved shop drawings. Where not shown on the Contract Drawings, comply with CRSI "Placing Reinforcing Bars".

B. Clean concrete reinforcement of loose rust, mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support and secure concrete reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support concrete reinforcement by chairs, runners, bolsters, spacers, and hangers in accordance with CRSI Manual of Standard Practice". Do not interfere with placement of embedded items.

D. When a vapor barrier is shown on the Contract Drawings, do not cut or puncture during concrete reinforcement placement.

E. Place concrete reinforcement to obtain covers shown on the Contract Drawings for concrete protection, or in accordance with ACI 318 "Concrete Protection for Reinforcement", if not shown on the Contract Drawings. Arrange, space and securely tie bars and bar supports to hold concrete reinforcement in position during concrete placement operations. Set ties so ends are directed into concrete, not toward exposed concrete surfaces.

F. Install welded wire fabric in lengths as long as practical. Lap adjoining pieces at least one full mesh and lace splices with wire, but in no case shall lap be less than requirements of ACI 318 "Splices of Welded Deformed Wire Fabric in Tension" or "Splices of Welded Plain Wire Fabric in Tension". Offset end laps in adjacent widths to prevent continuous laps in either direction.

G. After concrete placement, do not field bend partially embedded concrete reinforcement except as shown on the Contract Drawings.

H. Repair damaged bars and welds, if any, in accordance with 2.O1A.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

03200A01 Detailed indicating placement, cover, splice locations, lap lengths, mechanical splice hardware, grade, bar size, length, mark number, bending schedule, bending diagram, weld designations, type of coating, material used to repair coating, and types of chairs, spacers, hangers and tie wire for all concrete reinforcement.

Catalog Cuts

03200B01 Catalog cuts for chair, spacers, hangers

Samples

03200C01 Mechanical Splice Hardware

Certificates

03200E01 Certification from the applicator of epoxy that the epoxy-coated reinforcing bars meet the requirements of ASTM A 775 (AASHTO M284).

Manufacturer Test Reports

03200F01 Certified mill test reports for all concrete reinforcement.

Calculations

03200H01 Design computations for all proposed changes to the size, spacing or arrangement of the concrete reinforcement shown on the Contract Drawings.

END OF APPENDIX "A"

DIVISION 3

SECTION 03301

PORTLAND CEMENT CONCRETE, LONG FORM

PART 1. GENERAL

1.01 SUMMARY

This Section and its appendices specify requirements for Portland Cement Concrete mix proportions, materials used in concrete mixes, placing, finishing (with the exception of concrete for pavements), curing, control joints, end result property requirements of the in-place concrete, and the evaluation of these properties through Quality Acceptance testing performed by the Authority for determining Adjustments to Contract Compensation. The Specifications herein establish minimum standards for concrete construction. This does not relieve the Contractor from following more stringent standards to achieve the quality acceptance limits for applicable performance parameters and their respective Percent Within Limit (PWL) measurements.

1.02 REFERENCES

The following is a listing of the publications, standards and codes referenced in this Section, of which the latest edition shall govern:

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO HB	Standard Specifications for Highway Bridges.
AASHTO M182	Burlap Cloth Made From Jute or Kenaf.
AASHTO T 26	Standard Method of Test for Quality of Water to Be Used in Concrete.
AASHTO T 277	Electrical Indication of Concrete's Ability to Resist Chloride.
AASHTO T 318	Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.

American Concrete Institute (ACI)

ACI 207	Mass Concrete.
ACI 211	Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
ACI 213	Guide for Structural Lightweight-Aggregate Concrete.
ACI 222R	Protection of Metals in Concrete Against Corrosion.
ACI 301	Specifications for Structural Concrete for Buildings.
ACI 302.1	Guide for Concrete Floor and Slab Construction.
ACI 303.1	Specification for Cast in Place Architectural Concrete.
ACI 304R	Guide for Measuring, Mixing, Transporting, and Placing Concrete. Chapter 8: Concrete Placed Under Water.
ACI 305R	Hot Weather Concreting.
ACI 306R	Cold Weather Concreting.

ACI 308	Standard Practice for Curing Concrete.
ACI 309R	Guide for Consolidation of Concrete.
ACI 318	Building Code Requirements for Structural Concrete.
ACI 548.4	Standard Specification for Latex-Modified Concrete (LMC) Overlays.

ASTM International (ASTM)

ASTM C 31	Practice for Making and Curing Concrete Test Specimens in the Field.
ASTM C 33	Specification for Concrete Aggregates.
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C 42	Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
ASTM C 78	Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
ASTM C 88	Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
ASTM C 94	Specification for Ready-Mixed Concrete.
ASTM C 114	Test Methods for Chemical Analysis of Hydraulic Cement.
ASTM C 131	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM C 136	Test Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM C 138	Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
ASTM C 143	Test Method for Slump of Hydraulic-Cement Concrete.
ASTM C 150	Specification for Portland Cement.
ASTM C 156	Test Method for Water Retention by Liquid Membrane-Forming Curing Compounds for Concrete.
ASTM C 157	Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
ASTM C 171	Specification for Sheet Materials for Curing Concrete.
ASTM C 172	Practice for Sampling Freshly Mixed Concrete.
ASTM C 173	Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
ASTM C 174	Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores.
ASTM C 191	Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle.
ASTM C 227	Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).
ASTM C 231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
ASTM C 260	Specification for Air-Entraining Admixtures for Concrete.
ASTM C 289	Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).

ASTM C 309	Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
ASTM C 311	Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete.
ASTM C 330	Specification for Lightweight Aggregates for Structural Concrete.
ASTM C 494	Specification for Chemical Admixtures for Concrete.
ASTM C 535	Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM C 566	Test Method for Total Evaporable Moisture Content of Aggregate by Drying.
ASTM C 567	Test Method for Determining Density of Structural Lightweight Concrete.
ASTM C 618	Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
ASTM C 979	Specification for Pigments for Integrally Colored Concrete.
ASTM C 989	Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
ASTM C 1064	Test Method for Temperature of Freshly Mixed Hydraulic Cement Concrete.
ASTM C 1116	Specification for Fiber-Reinforced Concrete.
ASTM C 1152	Test Method for Acid-Soluble Chloride in Mortar and Concrete.
ASTM C 1218	Test Method for Water-Soluble Chloride in Mortar and Concrete.
ASTM C 1240	Specification for Silica Fume Used in Cementitious Mixtures.
ASTM C 1260	Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
ASTM C 1399	Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete.
ASTM C 1583	Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials By Direct Tension (Pull-Off Method).
ASTM C 1611	Slump Flow of Self-Consolidating Concrete.
ASTM D 1751	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
ASTM D 1752	Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
ASTM D 3665	Practice for Random Sampling of Construction Materials.
ASTM D 4580	Practice for Measuring Delaminations in Concrete Bridge Decks by Sounding.
ASTM D 4791	Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
ASTM D 4833	Test Method for Index Puncture Resistance of Geomembranes, and Related Products.
ASTM D 5199	Test Method for Measuring the Nominal Thickness of Geosynthetics.

ASTM E 965	Test Method for Measuring Pavement Macrotexture Depth Using a Volumetric Technique.
ASTM E 1347	Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry.

Federal Aviation Administration (FAA) Advisory Circular (AC)

FAA AC 150/ 5370, Item P-501-6	Standards for Specifying Construction of Airports - Portland Cement Concrete Pavement - Contractor Quality Control Program.

Federal Specifications

SS-S-1401	Sealants, Joint, Non-Jet-Fuel-Resistant, Hot-Applied, for Portland Cement and Asphalt Concrete Pavements.

New Jersey Department of Transportation (NJDOT)

Standard Specifications for Road and Bridge Construction/2007.

US Army Corps of Engineers (USACE)

Handbook of Concrete and Cement.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Requirements

1. Cold weather concrete construction shall conform to ACI 306R.

2. Submit a Cold Weather Concrete Construction Plan, and have it approved prior to concrete placements when the ambient temperature falls below 50 deg F. This Plan shall conform to ACI 306R and shall include but not be limited to the demonstration of how the in situ concrete temperature will be maintained at 50 deg F and monitored, or at temperatures specified in ACI 306R, Table 3.1, whichever is more stringent. In addition, demonstrate that the specified concrete properties can be achieved within the time requirements specified while maintaining a minimum curing temperature of 50 deg F.

3. Do not mix or place concrete when the ambient temperature is below 35 deg F, or when conditions indicate that the temperature will fall below 35 deg F within 72 hours, unless the areas to receive fresh concrete are insulated or enclosed, and maintain the concrete temperature at 50 deg F or in accordance with Table 3.1 in ACI 306.

4. Reinforcement, forms and soils with which concrete will be in contact shall not be frozen and must be maintained completely frost-free. If required, apply heat to raise their temperature to a minimum of 35 deg F. The use of chemicals to eliminate frost will not be permitted.

B. Hot Weather Requirements

1. Hot weather concrete construction shall conform to ACI 305R.

2. Submit a Hot Weather Concrete Construction Plan and have it approved prior to concrete placements when the ambient temperature exceeds 80 deg F. This Plan shall conform to ACI 305R and shall include but not be limited to the demonstration of how the concrete temperature during batching and mixing will be kept below 90 deg F, how the concrete will be protected from rapid evaporation of surface moisture, the proper use of water reducing retarders with re-dosing charts and procedures and curing procedures.

3. Do not place concrete for pavements, overlays, bridge decks or ramps when the ambient temperature exceeds 85 deg F; schedule Work so that concrete can be placed during the coolest part of the day. Do not place concrete for structural decks, slabs or pavements when the rate of concrete surface evaporation exceeds 0.15 lbs/ft^2/hr, as defined in ACI 305R, Figure 2.1.5. If ambient conditions exceed this limit, demonstrate through the use of windscreens, fogging or other suitable means that the concrete evaporation rate is less than 0.15 lbs/ft^2/hr.

4. If the concrete temperature reaches 92 deg F as measured at the construction site in accordance with ASTM C 1064, it may be rejected.

1.04 QUALITY CONTROL

A. General

1. Maintain a level of Quality Control sufficient to consistently achieve the end result performance properties specified herein. In addition:

   a. Submit the approved mix proportions including an automated, time-date stamp on each delivery ticket indicating the batch weights of all batching constituents.

   b. Ensure that all plant mixing equipment and trucks are calibrated and approved by either the New Jersey or New York State Department of Transportation. Documentation of such conformance shall be available to the Engineer at all times.

   c. Ensure that all personnel performing concrete testing are certified ACI Grade I Concrete Laboratory Testing Technicians or Concrete Field Testing Technicians, as appropriate.

   d. When placing aeronautical pavement concrete, the quality control plan shall conform to the provisions of the Federal Aviation Administration Advisory Circular 150/5730-10D- Rigid Pavement Items P-501 Contractor Quality Control Program.

B. Quality Control Plan: Submit a Quality Control Plan a minimum of 10 days prior to the pre-concrete construction meeting described in 1.06. Do not start production before the Quality Control Plan has been approved by the Engineer. The Quality Control Plan shall include the following:

1. Quality Control Organization

   a. A chart showing all Quality Control personnel and a description of how these personnel integrate with and report to other management or field construction personnel. Include names, company name and each person's function, telephone number and fax number.

b. The quality control organization chart shall include a Program Administrator who shall ensure that all QA procedures are followed and enforced and who shall have a minimum of 5 years experience on projects of size and scope comparable to the Work of the Contract. The Program Administrator shall be a full-time employee of the Contractor or a consultant engaged by the Contractor. Additional qualifications shall include at least one of the following:

(1) Professional Engineer, Engineer-In-Training, Bachelor of Science in Civil Engineering, Civil Engineering Technology or five years experience with airport and/or highway concrete construction.

(2) Completed New Jersey ACI Chapter's "Concrete Construction Technology" course with 5 years of airport and/or highway concrete construction experience.

(3) Qualified as ACI Concrete Transportation Construction Inspector or possessing Concrete Construction Special Inspector certification with 5 years of airport and/or highway concrete construction experience.

2. Intended project progress schedule for each mix and application, including quantities and a submittal schedule.

3. Quality Control Testing Plan, including a list of testing standards and the frequency at which each test is to be performed.

a. Include gradation and moisture content testing for fine and coarse aggregates in accordance with ASTM C 136 and ASTM C 566, respectively. Perform both tests (1) prior to production, (2) every 3 hours during production or every 100 cubic yards of concrete produced (whichever is longer in time) and (3) when aggregates are used from a new stockpile that has not been tested for gradation or moisture content.

4. Documentation of Quality Control activities, including the location where recorded test results and other information such as mill test certificates for all cementitious material will be stored, which shall be made available to the Engineer at any time upon request.

5. Procedures for corrective action when QA and/or QC test results do not conform to the requirements of the Contract.

1.05 TRIAL BATCHING AND TEST POUR VERIFICATIONS

A. Trial Batching

1. The Engineer may prepare and test trial batches as specified herein and in accordance with ACI 318, Section 5.3. At the Engineer's request, submit representative samples of all materials in sufficient quantities to the Port Authority Materials Engineering Unit. In the event of a conflict between tests performed by the Engineer and tests performed by or for the Contractor, all tests performed by the Engineer shall control.

2. The Engineer may perform the following tests to verify trial batches submitted by the Contractor: compressive strength, flexural strength, permeability by the Coulomb test, air content, unit weight, water content of freshly mixed concrete using the microwave oven drying test, shrinkage, chloride ion concentration, corrosion inhibitor concentration, bond strength, slump, time of set, gradation of fine and coarse aggregates, and the fineness modulus of the fine aggregate.

B. Test Pours

1. Unless otherwise noted on the Contract Drawings, perform a test pour a minimum of 14 calendar days prior to production pouring in order to demonstrate and verify proper workability, finishability, setting characteristics, consolidation and curing procedures and to confirm that specified physical properties are attained for the approved mix proportions. For tremie concrete applications, construct a mock-up to verify acceptable consolidation and that the specified compressive strength is achieved by testing three in-place cores taken from the test placement at locations designated by the Engineer. In addition, for architectural cast in place concrete, construct a full-scale mock-up in accordance with 2.03 C.3. If in the sole opinion of the Engineer the test pour is acceptable, follow the procedures established during the test pour during production.

2. Test Pour Size: For flatwork, the minimum test pour size shall be a length of 100 feet for the entire thickness of the pavement and width of the screed planned to be used. For all other concrete construction, the test pour size shall be full-size for the cross sectional area, including the location of all steel reinforcement. However, at the option of the Engineer, the length of the member may be reduced from its design size, provided it is adequate to demonstrate workability, finishability, setting characteristics, consolidation, finish and curing procedures, as determined solely by the Engineer. Perform all test pours using the same personnel, equipment, procedures and materials that will be used for full production.

3. The test section will be considered acceptable if, in the sole opinion of the Engineer, it meets the specifications for surface preparation, batching, mixing, placement, consolidation, curing, finish and applicable performance properties of the concrete. In addition, for architectural concrete, color and texture will be considered acceptable according to the sole opinion of the Engineer.

4. In the event that the Engineer deems the test section unsatisfactory, remove the test section and repeat the test at no cost to the Authority.

5. The test pour location will be determined by the Engineer at the pre-concrete construction meeting, and will be located close to, if not within, the area of Work, unless otherwise noted on the Contract Drawings.

1.06 PRE-CONCRETE CONSTRUCTION MEETING

A. A pre concrete placement meeting will be conducted at the construction site by the Engineer a minimum of 20 days prior to the first pour to review the Contractor's submitted mix proportions, hot and cold weather concreting plans (as applicable), curing procedures plan and test pour and to discuss the methods and procedures to achieve the specified concrete quality. Notify the Engineer and send a pre-concrete meeting agenda to all attendees a minimum of 15 days prior to the scheduled date of the meeting indicating review subjects. At no additional cost to the Authority make arrangements for the Contractor's superintendent and a qualified representative from each segment of the concrete operations to be present, including, but not limited to the following:

1. Concrete supplier.

2. Laboratory representative responsible for the concrete proportion mix and Quality Control.

3. Contractor's Program Administrator for Quality Control.

4. Concrete subcontractor.
5. Admixtures and curing membrane suppliers.
6. Concrete pumping subcontractor.
7. Mobile mixer subcontractor.
8. Precast concrete fabricator and installer.
9. Joint sawing subcontractor.
10. The Engineer.

B. Record, type, and print meeting minutes and distribute them to all attendees of the meeting within 5 days of the date of the meeting.

C. Do not schedule the pre-concrete construction meeting until all of the following have *been submitted and approved, as applicable to the Work of the Contract:*

1. Mix Proportions.
2. Admixture dosage charts showing the effects of concrete temperatures from 50 deg F to 90 deg F.
3. Sample panels (12" x 12" x 2" for architectural concrete).
4. Hot and Cold Weather Concrete Construction Plans.
5. Independent testing laboratory AASHTO Accreditation Certification.
6. ACI Grade I certifications for concrete testing personnel.
7. Placement methods and procedures, including surface preparation.
8. Pumping Procedure Plan.
9. Curing Procedure Plan.
10. Joint Location Plan and Timing of Cuts.
11. Quality Control Plan.
12. Procedure for Curing Field Concrete Specimens.

1.07 SUBMITTALS

A. See Appendix "A" for submittal requirements.

B. Do not deliver any concrete to the construction site until all approvals have been obtained.

PART 2. PRODUCTS

2.01 MANUFACTURERS AND SOURCES OF SUPPLY

A. Use no cement, fly ash, slag, silica fume, metakaolin or fine or coarse aggregates that have not been approved by either the New Jersey or New York State Department of Transportation.

2.02 MATERIALS

A. Cement: Conforming to ASTM C 150, Type I and II, and Type III where early strength gain is required, or others specified on the Contract Drawings.

B. Very High Early Strength Cement: Defined as cement used to produce concrete with the compressive strength shown on the Contract Drawings within 12 hours or less and conforming to the following:

1. The compressive strength shall be greater than or equal to the specified strength at the curing time specified on the Contract Drawings, when tested in accordance with ASTM C 39. During cold weather concrete construction, demonstrate that the specified compressive strength can be obtained at a curing temperature of 50 deg F.

2. Absolute drying shrinkage less than or equal to 0.04% at 28 days for the mix proportions containing the Very High Early Strength Cement in accordance with ASTM C 157 modified (Air Drying Method), where the initial reading shall be taken at 3 hours after the addition of the mixing water to the dry materials in the mix.

3. Setting time, determined in accordance with ASTM C 191, shall be sufficient to provide adequate workability, meet the specified strength requirement, and allow enough time in the field to finish and begin curing the concrete for its intended use.

4. The Very High Early Strength Cement shall meet the properties in 2.02 B.1, 2.02 B.2 and 2.02 B.3, for each Lot of cement not to exceed every 50,000 pounds. Submit certification from an independent testing laboratory employed by the Contractor and approved by the Engineer that the cement meets these properties.

C. Silica Fume: Shall conform to ASTM C 1240 and the following:

1. Silicon Dioxide Content: 90% minimum.

2. Loss On Ignition: 6% maximum.

3. Surface Area: (nitrogen absorption): 15,000 m2kg.

4. Crystallinity: Non-crystalline within limits of detection by XRD.

5. Oversize Foreign Materials (in fume): 5% maximum on 45-micron sieve (wet).

D. Metakaolin: Conforming to ASTM C 618, Class N. Use one of the following products, or approved equal:

1. "MetaMax", as manufactured by Engelhard, Iselin, New Jersey.

2. "PowerPozz", as manufactured by Advanced Cement Technologies, LLC, Blaine, Washington.

E. Fly Ash: Conforming to ASTM C 311 and ASTM C 618, Class F except the maximum loss on ignition shall be less than 4%.

F. Slag: Conforming to ASTM C 989, Grade 100 or 120.

G. Fine Aggregate: Conforming to ASTM C 33, ASTM C 227, ASTM C 289 and ASTM C 131 with a maximum percentage of wear of 30%.

H. Coarse Aggregate (Normal Weight Concrete): Conforming to ASTM C 33, ASTM C 227, ASTM C 289, ASTM C 535 with a maximum percentage of wear of 40%, and ASTM C 88 with a magnesium sulfate loss of not more than 12% for a five-cycle test period. Use trap rock or gneiss for all pavement wearing surfaces. The aggregate in any size group shall not contain more than 8% by weight of flat or elongated pieces, as tested in accordance with ASTM D 4791. A flat or elongated piece is one having a ratio between the maximum and minimum dimensions of a circumscribing rectangular prism exceeding 5 to 1. In accordance with ACI 318, Section 3.3.2, the nominal maximum size of coarse aggregate shall be not larger than: (1) one-fifth the narrowest dimension between sides of forms, (2) one-third the depth of slabs, or (3) three-quarters the minimum clear spacing between individual reinforcing bars or wires, bundles of bars, or prestressing tendons or ducts. The nominal maximum size of coarse aggregate used shall be the largest size aggregate that conforms to ACI 318, Section 3.3.2, unless otherwise noted herein or shown on the Contract Drawings.

1. For full depth pavement concretes unless otherwise shown on the Contract Drawings the combined aggregate volume shall be a minimum of 70 percent. The combined gradation of the fine and coarse aggregate shall conform to the following, when tested in accordance with ASTM C 136:

	For Pavement 10 Inches or Greater in Thickness		For Pavement Less Than 10 Inches in Thickness	
Sieve Size % Passing	Min.	Max.	Min.	Max.
2-1/2"	100			
2"	90	98	100	
1-1/2"	76	88	89	98
1"	67	79	74	86
3/4"	65	77	64	76
3/8"	48	60	48	60
No. 4	30	42	30	42
No. 8	27	37	27	37
No. 16	20	30	20	30
No. 30	16	22	16	22
No. 50	4	10	4	10
No. 100	0	4	0	4

2. Pile Jackets: As a minimum, the mix proportion shall contain an ASTM C 33 Size No. 8 coarse aggregate. The ratio of coarse aggregate to fine aggregate by volume shall be not less than one to one.

3. Pipe Piles: Reduce the amount of coarse aggregate to minimize segregation. The volume of coarse aggregate shall not exceed 9.0 cubic feet per cubic yard of concrete. The maximum size coarse aggregate shall be ASTM C 33 Size No. 8.

4. Minimum Volume of Coarse Aggregate: All mixes shall contain a minimum of 39% coarse aggregate by volume, with the exception of 1) applications specified in Part 2.02 H.1-4, H.2), Performance Category VI applications, 3) bridge decks and 4) mixes containing ASTM C 33 Size No. 8 aggregate. Bridge deck concrete mixes shall contain a minimum of 41% coarse aggregate and total minimum aggregate volume of 67%. Mixes containing ASTM C 33 Size No. 8 stone not covered in 2.02 H.2-4 shall contain a minimum of 36% coarse aggregate by volume. These minimum requirements apply to all methods of placement, including pump mixes.

5. When requested by the Engineer, supply independent laboratory test results in accordance with ASTM C 1260 indicating the potential alkali reactivity of the aggregates and cementitious materials proposed for use. Expansion at 16 days shall be less than 0.10%.

I. Coarse Aggregate (Lightweight Concrete)

1. Expanded clay or shale produced by the rotary kiln process conforming to ASTM C 330 shall be graded in accordance with the requirements for 3/4" to No. 4 sieve sizes shown in Table I of that specification.

2. The oven dry unit weight of plant-tested, lightweight aggregate shall vary not more than +/- 3.0 pounds from the unit weight (pounds per cubic foot) determined from the sample quantity submitted in accordance with 1.05 A.1.

J. Water: Conforming to AASHTO T 26. Clean and potable for both mixing and curing concrete.

K. Formulated Latex Modifier: Latex modifier shall be modifier "A/NA", as manufactured by Dow Chemical, Midland, Michigan. Add latex emulsion at a rate of 3.5 gallons per 94 lbs. of cementitious material in the concrete mix.

L. Air Entraining Agent: Conforming to ASTM C 260.

M. Admixtures: All admixtures shall conform to ASTM C 494. They shall contain not more than 0.05% chloride ions, and shall be used in accordance with the manufacturer's recommendations. Submit dosage charts, including the effects of concrete temperatures from 50 deg F to 90 deg F, to the Engineer. All admixtures shall be manufactured by one of the following:

1. Euclid Chemical Company.
2. W.R. Grace & Company.
3. Master Builders Technologies.
4. Sika Corporation.

N. Polycarboxylate High Range Water Reducer: For use when self-compacting concrete is desired and approved by the Engineer. Conforming to ASTM C 494, Type F or Type G. Dosage rate shall be as recommended by the manufacturer to produce a spread of the concrete mixture measuring between 21 and 27 inches in diameter without segregation when released from a slump cone in accordance with ASTM C 1611. Use one of the following products, no substitutions:

1. "Plastol 5000" or "Plastol 341", as manufactured by The Euclid Chemical Company.

2. "ADVA Flow 530" or "ADVA Flow 540", as manufactured by W.R. Grace & Company.

3. "Glenium 3030 NS" or "Glenium 3200 HES", as manufactured by Master Builders Technologies.

O. Corrosion Inhibitors

1. Corrosion inhibitor shall be one of the following:

a. For cast in place or precast:

(1) "DCI-S", as manufactured by W.R. Grace & Company.

(2) "Eucon CIA", as manufactured by Euclid Chemical Company.

(3) An approved equal.

b. For precast applications only:

(1) "Sika CNI", as manufactured by Sika Corporation.

(2) "Rheocrete CNI", as manufactured by Master Builders Technologies.

(3) "DCI", as manufactured by W.R. Grace & Company.

2. The concentration of calcium nitrite shall be 30% +/- 2% by weight of solids per gallon.

3. The Engineer will sample the corrosion inhibitor for testing to verify the calcium nitrite solids content. The amount of calcium nitrite in fresh concrete may also be tested at any time, to verify if the proper quantity of the corrosion inhibitor is being batched in the mix.

4. Corrosion inhibitor admixtures shall not accelerate the setting time of the concrete mixture. Use a retarder and/or other admixtures to ensure that acceleration of setting time does not occur, while maintaining the applicable performance criteria, as stipulated in 2.04. Submit procedures for the placement of concrete mixes containing a corrosion inhibitor when a retarder is required for the range of concrete temperatures from 50 deg F to 90 deg F.

P. Viscosity Modifying and/or Self-Consolidating Admixtures: May be required for tremie concrete applications at the rate recommended by the manufacturer. Test concrete in accordance with CRD-C6189A US Army Corps of Engineers "Handbook of Concrete and Cement". Maximum percentage of washout weight loss shall not exceed 5% after three standard test drops in water.

Q. Pigments: Conforming to ASTM C 979.

R. Curing Materials

1. Curing compound shall be one of the following:

a. "DOT Resin Cure (Type II)", as manufactured by Conspec Marketing & Manufacturing Company, Inc.

b. "Euco Kurez Vox (White)", as manufactured by Euclid Chemical Company.

c. "1200 White", as manufactured by W.R. Meadows.

d. "AHT Type II Class B Cure", as manufactured by American Highway Technology, a Dayton Superior Company.

e. "Certi-Vex Envio Cure White-1000", as manufactured by Vexcon Chemicals Inc.

f. "Day-Chem White Pigmented Cure (J-10-W)", as manufactured by Dayton Superior.

g. Or an approved equal meeting the requirements specified in 2.02 R.2.

2. Liquid Membrane Forming Curing Compound conforming to the following:

a. For horizontal exterior applications, curing membranes are restricted to ASTM C 309 Type 2, Class B materials. ASTM C 309 Type 1-D, Class B membranes are acceptable for other exterior applications. ASTM C 309 Type 1, Class B membranes are acceptable for interior applications only.

b. Curing membranes shall be wax free when used on concrete where overlays, coatings, paints, sealers or any topping is to be applied, or where vehicular, pedestrian or aircraft traffic will pass over.

c. Membranes shall be volatile organic compound (VOC) compliant for the states of both New York and New Jersey. Submit certification of compliance to the Engineer upon request.

d. The membrane shall restrict the loss of water to not more than 0.40 kilograms per square meter in 72 hours at a coverage rate of 300 square feet per gallon per coat for Type I curing compounds, and 200 square feet per gallon per coat for Type 2 curing compounds when tested in accordance with ASTM C 156.

3. Burlap: Conforming to AASHTO M 182, Class 3, weighing approximately 9 oz./sq. yd. dry.

4. Sheet Material: Conforming to ASTM C 171.

a. Shall be White Burlap Polyethylene Sheet.

5. Cotton Mats: conforming to ASTM D 5199 with a minimum thickness of 40 mils, ASTM C 156 with a maximum water loss of 0.0065 oz./in.^{2}, ASTM D 4833 with a minimum puncture strength of 70 pounds and ASTM E 1347 with a minimum reflectance of 75%. The following cotton mats may be used in lieu of burlap for wet curing operations:

a. "Transguard 4000", as manufactured by Reef Industries, Inc., Houston, Texas, or

b. An approved equal conforming to the requirements specified in 2.02 R.5.

S. Evaporation Retardant: This material shall be used to retain moisture in the concrete during finishing operations. Use one of the following:

1. "Euco-Bar", as manufactured by Euclid Chemical Company.

2. "E-Con", as manufactured by L&M Construction Chemicals, Inc.

3. "Confilm", as manufactured by Master Builders Technologies.

4. "SikaFilm", as manufactured by Sika Corporation.

5. "Aquafilm", as manufactured by Conspec Marketing & Manufacturing Company, Inc.

T. Fiber Reinforcement:

1. Polypropylene Micro Fibers

a. Use one of the following products, subject to compliance with the Contract requirements:

(1) "Fiberstrand", as manufactured by Euclid Chemical Company.

(2) "Fibermesh", as manufactured by Fibermesh, Inc.

(3) "Forta", as manufactured by Forta Corporation.

(4) "Grace Fibers" or "Grace Microfibers", as manufactured by W.R. Grace & Company.

(5) "Durafiber", as manufactured by Industrial Systems, Ltd.

(6) Or an approved equal.

b. Additional requirements:

(1) Collated fibrillated materials: Dosage rate shall be a minimum of 1.5 lb./cu. yd.

(2) Multifilament fibers: Dosage rate shall be a minimum of 1 lb./cu. yd. The minimum length shall be 0.75 inches.

(3) Conformance with ASTM C 1116, designation Type III, 4.1.3.

(4) Conformance with a minimum plastic shrinkage crack reduction of 70 percent when tested in accordance with ICBO ES, Appendix B (7-92).

(5) Use of fibers shall not change the water requirements of the mix.

(6) Conform to the manufacturer's recommendations for the quantity of fiber, which shall be not less than the minimum requirements of 2.02 T.1.b.1 and 2.02 T.1.b.2.

(7) Arrange for the fiber manufacturer to provide the services of a qualified representative at the pre-concrete construction meeting and for the first two days of fibrous concrete placement production.

2. Structural Polypropylene/Polyethylene Macro Fibers

a. Use one of the following products, subject to compliance with the Contract requirements:

(1) "Tuf-Strand SF", as manufactured by Euclid Chemical Company.

(2) "Strux 90/40", as manufactured by W.R. Grace & Company.

(3) Or approved equal.

b. Additional requirements:

(1) Dosage rate shall be a minimum of 4.0 lb./cu. yd. Higher dosages may be noted on Contract Drawings.

(2) The minimum length shall be 1.50 inches.

(3) Fiber shall have an Aspect Ratio of 50 to 90.

(4) Conformance with ASTM C 1116, designation Type III, 4.1.3.

(5) The structural macro fiber concrete shall have an average residual strength of 200 psi when tested in accordance with ASTM C 1399.

(6) Use of fibers shall not change the water requirements of the mix.

(7) Conform to the manufacturer's recommendations for the quantity of fiber, which shall be not less than the minimum requirements of 2.02 T.2.b.1.

(8) Arrange for the fiber manufacturer to provide the services of a qualified representative at the pre-concrete construction meeting and for the first two days of fibrous concrete placement production.

U. Expansion Joints (Except for Bridge Decks) and Contraction Joints (Except for Pavements)

1. Vinyl plastic water stops shall be of types and sizes shown on the Contract Drawings and conforming to Corps of Engineers "Specifications for Polyvinylchloride Waterstop" (Designation: CRD-C 572-60, latest revision).

2. Premoulded expansion joint filler, when shown on the Contract Drawings:

a. Cork type shall be ASTM D 1752, Type II.

b. Bituminous type shall be ASTM D 1751.

3. Joint Sealant when shown on Contract Drawings: Federal Specification SS-S-1401, latest revision.

2.03 MIX PROPORTIONS

A. Develop mixes in accordance with the latest editions of ACI 211, ACI 301 and ACI 318 to achieve the proportion performance criteria in accordance with the Contract Documents, with a degree of excess as determined by Chapter 5 of ACI 318, and meet all of the applicable performance criteria as specified in the Contract Documents. In addition, all concrete placed underwater shall conform to ACI 304R, Chapter 8, and lightweight aggregate concrete shall conform to ACI 213. Submit an underwater concrete placement procedure that is in conformance with ACI 304R, Chapter 8. Prior to concrete construction and after approval of all materials to be used in the concrete, submit a mix proportion showing that all performance criteria have been met. Mix proportions submitted shall be based upon laboratory trial mix test results and/or mixes successfully used within the two years preceding the date of the submittal of the mix for the Work of this Section. The independent testing laboratory used to develop the mix proportions and to perform testing shall have AASHTO Accreditation for all test methods required to be performed and to develop the required mix. Submit proof of certification to the Engineer prior to the start of development of the mix proportions and testing. The mix proportions shall include copies of test reports, including test dates, and a complete list of materials, including type, brand and source. The trial mix design performed in the testing laboratory shall use the same materials, cement, pozzolons, aggregates and admixtures that will be used at the proposed batch plant. Show fineness modulus, gradations and absorptions of aggregates. If any of the approved mix constituents change in source, properties or proportion, submit a new mix. The mix proportions shall also conform to the following:

1. Substitute either fly ash or slag at the minimum rate of 20% by weight of cement. The maximum rates of substitution shall be 30% for fly ash and 40% for slag, unless otherwise approved by the Engineer. Fly ash and slag substitution in the same mix may be permitted upon approval by the Engineer.

2. For concrete placed underwater, the minimum cementitious material content shall be 700 pounds per cubic yard of concrete.

3. Compute water to cement ratio using the weight of cementitious material that is equal to the total weight of cement plus fly ash, slag and silica fume. Any admixtures which increase the water to cement ratio by 0.01 or greater shall be accounted for in the mix proportion to meet the specified water to cement ratio.

4. For Categories II, III and IV concrete applications, the mix water to cement ratio shall not exceed 0.40 and the absolute drying shrinkage at 28 days shall not exceed 0.04% in accordance with ASTM C 157 (Air Drying Method), modified to start measuring at 10 hours. In addition for Categories III and IV, the maximum Coulomb count at 28 days shall be 1,000 for mixes without calcium nitrite and 1,500 when the mix contains calcium nitrite. For mixes that do not have silica fume, latex or metakaolin but contain either fly ash or slag, the Coulomb count requirements shall remain the same; however, the test shall be performed at 90 days instead of 28 days. For concrete pavements and Categories I and V applications where the concrete will be exposed to freeze-thaw cycles and/or sulfates, the mix proportion water to cement ratio shall not exceed 0.40 and the absolute drying shrinkage at 28 days shall not exceed 0.04% in accordance with ASTM C 157 (Air Drying Method). For other concrete applications, the mix water to cement ratio shall not exceed 0.50, unless otherwise shown on the Contract Drawings.

5. High Range Water Reducer shall not be added to the concrete mix at the plant. It shall be delivered to the construction site in a tank fixed to the truck that discharges directly into the mixing drum, or it may be added to the drum from a calibrated dispensing unit. A calibrated dispensing unit shall be defined as a manufactured dispenser with clear volume indications marked on the outside of the unit. It shall be available at all times during the concrete placement for re-dosing purposes. Submit a re-dosing chart showing the dosages necessary to increase the slump, in inches per cubic yard of concrete remaining in the drum, over the range of concrete temperatures from 50 deg F to 90 deg F. If re-dosing occurs, the re-dosing chart shall be used, but under no circumstances shall the total dosage exceed the maximum dosage recommended by the manufacturer. The truck shall mix the load for a minimum of an additional 5 minutes prior to releasing the load.

6. The percentage of air in the mix shall fall within the range of the Lower Quality Limit (LQL) and the Upper Quality Limit (UQL) as outlined in the table shown in 2.04 A.6 entitled "Air Content Target Range for Freshly Mixed Concrete". Air content shall be determined by testing in accordance with ASTM C 231 for normal and heavyweight concrete mixes and ASTM C 173 for porous, lightweight aggregate.

7. Make adjustments to the weight of coarse, lightweight aggregate in accordance with the following:

   a. Design lightweight concrete mix proportions not to exceed 123 pounds per cubic foot, unless otherwise specified.

b. Adjust the proportion of lightweight aggregate to compensate for the difference between the wet unit weight determined in 3.05 B.5 and the dry unit weight of the material submitted in accordance with 1.05 A.1 and the approved mix proportions.

c. For lightweight aggregate mixes, advise the batch plant 72 hours prior to pouring in order to saturate the aggregate. Presoak lightweight coarse aggregate a minimum of 72 hours prior to mixing of concrete. The lightweight aggregate shall reach an absorbed moisture content not less than the manufacturer's written recommendations or the concrete will be rejected.

B. Where Latex Modified Concrete is specified in the Contract Documents, conform to ACI 548.4. The mix maximum water to cement ratio shall not exceed 0.37. The minimum volume of coarse aggregate shall be not less than 7.6 cubic feet (absolute volume) per cubic yard.

C. Architectural Concrete

Concrete that will be permanently exposed to view and which therefore requires special care in selection of concrete ingredients including color, forming, placing, consolidating and finishing to obtain the desired architectural appearance is designated as "Architectural Concrete".

1. A minimum of 35 days prior to construction of a mock-up, submit mix proportions and two sample panels (a minimum of 12" x 12" x 2") for each mix to the Engineer for approval. The materials used for the sample panels shall be from the same sources of material supply for all constituents in the approved mix. When requested by the Engineer, submit samples of all constituents for trial batching to the Port Authority Materials Engineering Unit to verify that the physical property requirements are met. Obtain approval for both sample panels for color and texture, as well as for the mix proportions for physical properties prior to constructing a mock-up.

2. Pigments, in conformance with ASTM C 979, shall be used when matching the color of existing concrete or when a specific color of concrete is required by the Engineer.

3. Construct mock-up only after the Engineer has approved both the mix proportions for physical properties and the sample panels for color and texture. For cast in place concrete, a mock-up in accordance with ACI 303.1 Section 1.6 Quality Assurance will be required for approval by the Engineer. For walls, a mock-up shall include all details that will be encountered in a typical day's pour. The mock-up may be constructed at the construction site as part of the permanent Work at the sole risk of the Contractor. If the Engineer rejects the mock-up, it shall be removed and recast at the sole expense of the Contractor. For precast architectural concrete, the mock-up shall consist of a full member selected in advance by the Engineer. Keep the approved mock-up at the precast concrete production facility for the Engineer to compare with the production units for acceptance or rejection. Acceptance or rejection shall be determined solely by the Engineer.

4. Construct mock-ups only with all of the actual constituents of the approved mix proportions. Do not proceed with production until the mix proportions, sample panels, full-scale mock-up and shop drawings have been approved by the Engineer. Once production begins, do not change suppliers or sources of supply for any of the constituents in the approved mix for the duration of the Contract.

5. In addition to the mix proportions and sample panels, submit the following for approval: forms, form liners and form oil or release agents.

6. Architectural Concrete shall conform to the Quality Assurance performance criteria specified in 4.01 B, Table 2 for the appropriate placement application and the associated Quality Acceptance Limits specified in 2.04.

7. Noticeable differences in color and/or texture of the finished product, as determined solely by the Engineer, shall be corrected by means and materials approved by the Engineer.

D. Pipe Piles: The target range for slump shall be 4 to 6 inches.

2.04 QUALITY ACCEPTANCE LIMITS

A. Develop mixes to meet the following performance criteria Quality Acceptance Limits in accordance with the relevant application properties specified in 4.01.B., Table 2, unless otherwise noted on the Contract Drawings:

1. Compressive Strength (ASTM C 39): The Lower Quality Limit, LQL, shall be the specified mix compressive strength at 28 days, unless otherwise noted on the Contract Drawings.

2. Flexural Strength (ASTM C 78): The Lower Quality Limit, LQL, shall be 700 psi at 28 days, unless otherwise noted on the Contract Drawings.

3. Permeability (AASHTO T 277): The Upper Quality Limit, UQL, shall be 1700 Coulombs for mixes not containing a corrosion inhibitor and 2200 Coulombs for mixes that do contain a corrosion inhibitor. Performance testing shall be performed at 28 days, except for mixes containing only fly ash and/or slag substitution for cement but no silica fume or metakaolin, which shall be evaluated at 90 days.

4. Bond Strength (ASTM C 1583): The Lower Quality Limit, LQL, shall be 150 psi at 28 days.

5. Water Content (AASHTO T 318): The Upper Quality Limit, UQL, for water content shall be the specified water to cementitious ratio specified in 2.03 A.4 plus 0.05.

6. Air Content (ASTM C 138, ASTM C 173 or ASTM C 231): Both the Lower Quality Limit, LQL, and the Upper Quality Limit, UQL, shall be as specified in the table below:

AIR CONTENT TARGET RANGE FOR FRESHLY MIXED CONCRETE

MAXIMUM SIZE AGGREGATE (SIZE #)	AIR CONTENT LQL	AIR CONTENT UQL
2" or above (# 467 and above)	3.5%	7.5%
1-1/2" (# 57)	4.0%	8.0%
1" (# 67)	4.5%	8.5%
1/2" (# 8)	5.5%	9.5%
3/8"	6.0%	10.0%
Latex modified concrete	2.5%	6.5%

Note: For a specified compressive strength greater than 5000 psi, the LQL and UQL for air content, as indicated above, shall both be reduced by 1.0%. For all concrete applications not exposed to freeze-thaw cycling or chlorides, no air entrainment is required.

7. Chloride Ion Concentration by Weight of Cementitious Material (ASTM C 1152, ASTM C 1218, ASTM C 114, ACI 222R): The acid soluble chloride ions by weight of cementitious material in the concrete mix shall be less than or equal to 0.10% for reinforced concrete and 0.08% for prestressed concrete, as per ACI 222R. The water soluble chloride ions by weight of cementitious material in the concrete mix shall be less than or equal to 0.08% for reinforced concrete and 0.06% for prestressed concrete, as per ACI 222R.

8. Pavement Thickness: The Lower Quality Limit, LQL, for pavement thickness shall be 97.0% of the thickness shown on the Contract Drawings.

9. Delaminations: The total surface area tested for any given Lot of concrete shall indicate less than 5.00% delaminated area when tested using the chain drag in accordance with ASTM D 4580.

B. For concrete bridge decks where riding surface tolerances are required, as shown on the Contract Drawings, the following requirements shall be met:

1. Surface smoothness deviations shall not exceed 1/4 inch in 16 feet.

2. Vertical deviation from the grade shown on the Contract Drawings shall not exceed plus or minus 0.04 foot at any point.

C. For mass concrete as defined in ACI 207 or as specified on Contract Drawings the temperature at the core of the in situ concrete shall not exceed 160 deg F nor shall the maximum difference in temperature between the core and the surface of the structure exceed 35 deg F at any time. The drop in temperature in the first 24 hours after the end of protection shall not exceed the limits of ACI 306R Table 3.1.

D. Unless otherwise specified on the Contract Drawings, the above specified Quality Acceptance Limits will be used to calculate Adjustments to Contract Compensation in accordance with Part 4 of this Section.

PART 3. EXECUTION

3.01 SURFACE PREPARATION

A. Bonded Overlays and Patching Applications

1. Bond strength tests will be performed by the Engineer in accordance with ASTM C 1583, using 4-inch by 4-inch steel plates, to determine the adequacy of the surface preparation. A minimum average bond strength of 200 psi shall be attained, with no single test value less than 180 psi. If time does not permit the above test to be performed, as determined solely by the Engineer, the Engineer will measure the macrotexture depth in accordance with ASTM E 965. A minimum of four tests will be performed and the average macrotexture depth shall be a minimum of 0.06 inches. Prior to the placement of any overlay or patching material, obtain the Engineer's approval of the surface preparation.

B. Latex Modified Concrete and Silica Fume Concrete

1. The Engineer will sound the concrete surface to identify areas of unsound or deteriorated concrete. Areas so identified shall be removed to the limits and depths as ordered by the Engineer. Perform abrasive blasting of all exposed reinforcing steel that is to remain in place.

C. Construction Joints (excluding joints in pavements)

1. Number, locations and details shall be as shown on the approved shop drawings.

2. Planes of joints shall be normal to direction of pressure and shall include suitable keys and dowels.

3. Locate joints at points of minimum shear, unless otherwise shown on approved shop drawings or directed by the Engineer.

4. Avoid lips and other irregularities between adjoining sections of concrete. Secure forms tightly against previously placed concrete.

D. Expansion and Contraction Joints (excluding joints in pavements)

1. After curing concrete, clean grooves or saw cuts to receive joint sealant by scrubbing with a mechanical wire brush to loosen dirt and other foreign matter and blowing out loose matter with compressed air.

2. Install joint sealant to finish flush with concrete surface, except where otherwise shown on the Contract Drawings.

E. Preparation for Placing Concrete (excluding pavements)

1. Straighten bent dowels, whether placed under this Contract or by others, using tools approved by the Engineer. Do not apply heat to dowels.

2. Clean all dowels and all steel, that will be embedded in concrete, of all loose rust, scale, paint, grease and other objectionable materials.

3. Examine coated reinforcement for integrity of coating. Repair all damaged areas in accordance with the requirements of Specification Section 03200 entitled "Concrete Reinforcement". Make the repair crew available at the time of examination.

4. Check all formwork locking devices to ensure that they are in place and properly secured.

5. Do not place concrete for piles, footings, pile caps or slabs supported on pile caps or piles until the pile survey has been completed and additional reinforcing steel, if necessary, has been added as directed by the Engineer.

6. For preparation of surfaces to receive concrete, conform to the Contract Drawings for all procedures, equipment limitations and requirements to be performed prior to placing concrete.

7. Do not place concrete for slabs-on-grade, grade beams or footings until the subgrade has been inspected and approved by the Engineer, and until any base course or fill has been properly compacted in accordance with the Contract requirements.

8. Provide vent holes (1/4 inch diameter, minimum) edge angles or embedded plates at joints where vibrating alone will not ensure elimination of voids. Locate such holes at high points and with uniform spacing along joints for escape of air during concreting operations. Evidence of voids adjacent to embedments will be cause for rejection of work. Submit all vent holes and procedures for placement of concrete at joints with the shop drawings for review and approval.

9. Make provisions for the concrete to pass through the reinforcing steel without segregating during placement.

F. For preparations for placing concrete pavements, see Section 02513 entitled "PLACEMENT OF PORTLAND CEMENT CONCRETE PAVING (FAA)".

3.02 BATCHING AND MIXING CONCRETE

A. Measurement of Proportions

1. All concrete batching shall be in conformance with ASTM C 94 and ACI 304R.

2. For Very High Early Strength Concrete requiring 2000 psi or greater in 6 hours or less time, the method of batching will be restricted to a calibrated mobile mixer, or to a transit mixer that is loaded at the construction site with bulk bags of the Very High Early Strength Cement. Bulk bags shall contain sufficient Very High Early Strength Cement by weight to batch for a minimum of 3 cubic yards of concrete.

B. Mixing Concrete

1. Arrange for transit mix trucks to be inspected and approved annually by either the New Jersey or New York State Departments of Transportation.

   a. Mixers shall be equipped with a metal plate attached by the manufacturer, indicating the volume of mixed concrete the equipment is intended to produce. The quantities of materials transported and the volume of mixed concrete produced shall not exceed the mixer's rated capacity. In locations where the rate of depositing is slow, the Engineer may restrict the volume of concrete that may be mixed in a mixer to a volume less than the manufacturer's rated capacity of the mixer.

   b. Immediately repair or withdraw from use any mixer which is determined to be mechanically unsatisfactory.

2. If truck mixers are used, keep available a sufficient number to ensure continuous delivery of the concrete at the rate required for the proper handling, placing, finishing and curing of the concrete. If a plant at the construction site is used, it shall be of sufficient capacity to meet such requirements.

   a. Mixers shall be of the revolving-drum type, with drums suitably mounted and fitted with adequate blades capable of discharging the mixture without segregation. All truck mixers shall be equipped with an accurate, operable counter to measure the number of drum revolutions and an accurate, working water site gage or manometer to measure the volume of water introduced into the drum. Truck mixers without an accurately operating counter or water site gage shall be immediately withdrawn from use.

3. The Engineer may permit one re-tempering of the concrete subject to the following:

   a. When the measured water content in the batch is less than the water in the approved mix proportion.

   b. The redosage of high range water reducer shall conform to the Engineer-approved redosage chart and shall not exceed the manufacturer's recommended limitation, nor shall it retard the initial set of the concrete by more than 30 minutes.

   c. When air content is below the lower quality limit specified in 2.04 A.6.

4. The Engineer may reject concrete in the following instances:

   a. Concrete has not been placed within 90 minutes from the time the cement had first contact with water.

   b. Concrete temperature reaches 92 deg F.

   c. The mix appears to be segregated.

5. The Engineer will reject concrete subject to the following:

   a. Concrete that has partially hardened or has attained its initial set prior to placement.

   b. The water to cement ratio as determined by AASHTO T 318 exceeds that given in 2.03 A.4 by 25%.

6. Construction Site Mixing: Measure mix components in accordance with tolerances given in ASTM C 94. Weigh all non-liquid components and measure all liquid components immediately prior to batching. Use a calibrated flask with clear indication markings for ounces, pints, etc. when measuring liquid components. Measures without calibrated clear indication markings will not be permitted. Mix concrete materials in an approved drum-type batch machine mixer.

   a. For a mixer capacity of 1 cubic yard or less, continue mixing a minimum of 3 minutes, but not more than 5 minutes after ingredients are in the mixer and before any portion of the batch is released.

   b. For a mixer capacity of greater than 1 cubic yard, increase the mixing time by 1 minute for each additional 1 cubic yard.

   c. Provide a batch ticket to the Engineer for each batch discharged and used in the Work, indicating the Contract number and title, date, time, mix type, mixing time, quantity of each constituent, volume of concrete and amount of water added. Record a location of the deposit in the structure that can be easily identified.

C. *Mobile Mixers: When application requires the use of a mobile mixer, it shall meet the* following criteria:

1. Proportioning and Mixing Equipment

   a. Mixer shall be a self-contained, self-propelled, continuous mixing type capable of carrying sufficient unmixed dry cement, aggregates, water and admixtures to produce not less than 6 cubic yards of concrete. Maintain a calibrated back-up unit at the construction site ready for use.

b. Mixer shall be capable of positive measurement of cement being introduced into the mix. A recording meter, visible at all times and equipped with a ticket printout, shall indicate this quantity.

c. Mixer shall provide positive control of the flow of water and admixtures. Water flow shall be indicated by flow meter and shall be readily adjustable to accommodate minor variations in aggregate moisture.

d. Mixer shall be capable of being calibrated to automatically proportion and blend all components of indicated composition on continuous or intermittent basis as required by the finishing operation, and shall discharge mixed material through a chute directly in front of the finishing machine. Notify the Engineer a minimum of 48 hours prior to calibration of the mobile mixers. Before approving the calibration of the mobile mixer, the Engineer will witness the calibration of the mobile mixer. However, the Contractor is responsible for testing the mix produced. Allow the Engineer to test the concrete mix at any time.

e. Calibrate mixer to accurately proportion the specified mix. Certification of calibration by an Engineer approved testing agency will be accepted as evidence of this accuracy, provided such certification attests the yield to be true within the following tolerances (by weight):

Coarse Aggregate	+/- 2%
Fine Aggregate	+/- 2%
Cement	+/- 1%
Water	+/- 1%
Admixtures	+/- 3%
Latex	+/- 1%

f. Mix in accordance with the specified requirements for the equipment used. The concrete, as discharged from the mixer, shall be such that finishing operations can proceed at a steady pace with final finishing completed before the formation of the plastic surface film.

g. Repair mixers not functioning in a manner the Engineer considers acceptable. If repair is not practical, remove the mobile mixer from the construction site and replace it with one which functions properly.

h. Prior to production, test the moisture content of the fine aggregate and coarse aggregate. Adjust the water gage setting only in the presence of the Engineer, to produce the approved mix water to cement ratio. Test the moisture content of the fine aggregate and coarse aggregate every 3 hours during production, or when the mobile mixer is loaded with aggregates from a stockpile different from the one for which moisture content tests were performed, whichever occurs first. Make adjustments in the presence of the Engineer. For Latex Modified Concrete, the maximum permissible moisture content of fine aggregate and coarse aggregate shall be 6.0% and 3.0%, respectively, as determined in accordance with ASTM C 566. If these limits are exceeded, stop concreting operations until drier aggregates are obtained. Allow the Engineer to view and copy all records for moisture content testing at any time.

3.03 PLACEMENT FIELD REQUIREMENTS

A. During all concrete placements at the construction site, the Contractor shall have an individual in a supervisory capacity present with a valid certification from one of the following programs:

1. ACI Concrete Transportation Construction Inspector or Concrete Construction Special Inspector.
2. New Jersey ACI Chapter's "Concrete Construction Technology" course.

B. Prior to any construction site delivery of concrete, furnish, deliver and maintain insulated curing boxes of sufficient size and strength to contain all the specimens (cylinders and beams) made by the Engineer in any two (2) consecutive Work periods. Such boxes shall be equipped to regulate the temperature in the range of 60 deg F to 80 deg F or 68 deg F to 78 deg F when the design compressive strength is 6000 psi or greater, and to provide the moisture to maintain the curing conditions specified in ASTM C 31. During hot weather when the temperature is greater than 80 deg F, maintain the temperature of the concrete specimens in the required range by immersing them in a water bath. Cover the water bath to prevent direct sunlight from raising the water temperature. Completely remove and replace the water in the bath every day. Locate the boxes where directed by the Engineer. Protect boxes from vibration and other disturbances during specimen curing.

C. Keep this Specification and the following ACI publications available at all times at the construction site:

1. ACI 301.
2. ACI 302.1R.
3. ACI 305R.
4. ACI 306R.
5. ACI 308.
6. ACI 309R.
7. ACI 318.

D. Ensure that the concrete supplier keeps this Specification and the following ACI publications available at all times at the batching location:

1. ACI 211.
2. ACI 213.
3. ACI 304R.

E. Bonding New Concrete to Existing Concrete

Where new concrete will be placed against existing concrete surfaces:

1. Surface to receive concrete shall be soaked and kept wet with water for one (1) hour prior to placement of material. Puddles of standing water shall be removed immediately prior to placement.

2. A thin layer of material from the leading edge of the concrete being placed shall be broomed into the wetted surface. Care shall be exercised to ensure that all vertical as well as horizontal surfaces receive a thorough, even coating and that the rate of progress is controlled so that the broomed material does not dry before being covered with additional material as required for final grade.

F. Placing Concrete (excluding pavements)

1. Place concrete only in the presence of the Engineer and by methods approved by him.
2. For concrete cast against earth or an approved compacted subgrade, and for concrete overlays, place concrete against surfaces in a saturated surface dry condition.
3. Prior to placing concrete, remove all standing water or puddles.
4. Do not place concrete on or next to frozen surfaces.
5. Transfer concrete from mixer to place of deposit as rapidly as practical to prevent formation of cold joints.
6. Use equipment and methods for placing which permit rapid placement of concrete of the required consistency and which preclude segregation.
7. The method and equipment used to transfer concrete from mixer to forms will be subject to prior approval by the Engineer. Do not use any pipes, chutes or other equipment made of aluminum.
8. Subject to the foregoing requirements, convey concrete by approved conveyors, pipes, chutes or spouts to a point not more than five feet horizontally or vertically from its final position, unless otherwise approved by the Engineer.
9. Concrete for fill in steel reinforced pipe piles, steel shells or caissons shall be deposited using a metal (not aluminum) hopper and an elephant trunk. The hopper and elephant trunk shall be set above the top of piles, steel shells or caissons to permit the escape of air as the concrete is placed. Elephant trunks shall be removed in sections while filling piles, steel shells or caissons from bottom of reinforcing cage to top of piles, steel shells or caissons. Elephant trunks shall extend a minimum distance of 10 feet below top of pile, steel shell or caisson or to bottom of reinforcing cage, whichever is greater. The top 15 feet of the concrete poured from the top shall be vibrated or rodded. No cold joints will be permitted during concreting operations, unless otherwise noted on the Contract Drawings.
10. Except where otherwise approved by the Engineer, consolidate concrete by internal mechanical vibration subject to the following:
    a. Type, number and method of application of vibrators will be subject to prior approval by the Engineer.
    b. Apply vibrators at points not more than 30 inches apart for time intervals of approximately 10 seconds.
    c. Do not use vibrators to move concrete horizontally.
    d. In locations where spading is approved in lieu of mechanical vibration, spade coarse aggregate away from the forms and into the plastic mass; rod concrete around embedded materials and into corners and spaces to be filled and use only approved equipment.

11. Prevent formation of laitance and accumulation of excessive water on surface of concrete as it is deposited. Remove any accumulated bleed water by approved means before placing other concrete.

12. Place concrete so as to require as little rehandling as possible. Place and spread concrete using an approved mechanical spreading device that prevents segregation of the materials. Place continuously between contraction joints. Perform necessary hand spreading with shovels, not rakes.

13. Deposit concrete as near to joints as possible without disturbing them but do not discharge onto a joint assembly unless placement is centered above the joint assembly.

14. Thoroughly consolidate concrete against and along the faces of all forms and previously placed concrete and along the full length and on both sides of all joint assemblies by means of vibrators inserted in the concrete. Do not permit vibrators to come in contact with a joint assembly, base course or a side form. In no case shall the vibrators be used to move the concrete.

15. Screed and float concrete for riding surfaces as it is placed and use an approved evaporation retardant or fog spray.

G. Concrete Placing and Finishing Equipment for Bridge Decks and other Riding Surfaces (except for FAA pavements)

1. For slab or overlays 8 inches or more thick use internal vibrators. Internal vibrators shall be gang-mounted and supplemented with manual vibrators subject to the following:

a. Use manual, hand-held vibrators adjacent to joint assemblies and similar locations where gang-mounted vibrators are not practical.

b. Check all vibrators prior to the start of Work and periodically during construction progress to verify that they are working properly.

2. For slab or overlays less than 8 inches thick, vibrating surface pans or screeds will be allowed.

3. Manual tools such as bull floats, trowels, brooms and other similar hand tools are acceptable.

H. For placement and finishing of concrete pavements, see Section 02513 entitled "PLACEMENT OF PORTLAND CEMENT CONCRETE PAVING (FAA)".

I. Consolidation and Finishing

1. Bridge Decks and other Riding Surfaces

a. Machine finishing shall conform to NJDOT Standard Specifications for Road and Bridge Construction 2007 Subsection 1005.02, .03 and .04.

b. Finishing at and adjacent to joints shall conform to NJDOT Standard Specifications for Road and Bridge Construction 2007 Subsection 405.03.02 Item C.

c. Hand finishing methods will not be permitted, except under the following conditions: (1) in the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade; (2) in areas of narrow widths or of irregular dimensions where operation of the mechanical equipment is impractical. Concrete, as soon as placed, shall be struck off and screeded using an approved portable screed. Use a second screed shall for striking off the bottom layer of concrete when reinforcement is used.

The screed for the surface shall be at least 2 feet longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and shall be constructed either of metal (not aluminum) or of other suitable material covered with metal. Consolidation shall be achieved by the use of suitable vibrators.

d. After the concrete has been struck off and consolidated, it shall be further smoothed and trued by means of a longitudinal float using one of the following methods:

(1) Long-handled floats shall be not less than 12 feet in length and 6 inches in width, stiffened to prevent flexibility and warping. The float shall be operated from foot bridges spanning but not touching the concrete or from the edge of the pavement. Floating shall pass gradually from one side of the bridge deck to the other. Forward movement along the centerline of the pavement shall be in successive advances of not more than one-half the length of the float. Any excess water or laitance in excess of 1/8-inch thick shall be removed and wasted.

(2) The Contractor may use a machine composed of a cutting and smoothing float(s), suspended from and guided by a rigid frame and constantly in contact with, the side forms or underlying surface. If necessary, long-handled floats having blades not less than 5 feet in length and 6 inches in width may be used to smooth and fill in open-textured areas in the pavement. When the crown of the bridge deck will not permit the use of the mechanical float, the surface shall be floated transversely by means of a long-handled float. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and laitance in excess of 1/8-inch thick shall be removed and wasted. Successive drags shall be lapped one-half the length of the blade.

e. While the concrete is still in a workable condition, test it for trueness with a Contractor-furnished 16-foot straightedge swung from handles 3 feet (1 m) longer than one-half the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary. Advance in successive stages of not more than one-half the length of the straightedge. Any excess water and laitance in excess of 1/8-inch thick shall be removed from the surface of the bridge deck and wasted. Any depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated and refinished. High areas shall be cut down and refinished. Special attention shall be given to ensure that the surface across joints meets the smoothness requirements set forth in 2.04 B. Straightedge testing and surface corrections shall continue until the entire surface is free from observable departures from the straightedge and until the slab conforms to the required grade and cross section. The use of long-handled wood floats shall be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment. Test the surface across the joints with a 16-foot straightedge as the joints are finished and correct any irregularities in excess of 1/4 inch before the concrete has hardened.

2. Specified concrete finishes, as shown on the Contract Drawings, shall be in accordance with the following requirements:

a. "Smooth Finish": A surface of concrete obtained by the use of special forms as specified in Division 3 Section entitled "Concrete Formwork". Remove all fins and other irregularities in the exposed surfaces of concrete by rubbing the irregularities with a carborundum brick and clean fresh water. Any mortar patches shall be rubbed with a carborundum brick as above specified.

b. "Scored Finish": A surface of concrete obtained by roughening in an approved manner or by etching with sharp-pointed steel tools to key or otherwise improve the mechanical bond of the surface. Such scoring shall roughen at least ten percent of the area so scored.

c. "Float Finish": A surface of concrete obtained by the use of a wood float. Apply float finish to horizontal surfaces immediately after screeding and before initial setting has begun.

d. "Trowel Finish": A surface of concrete obtained by the use of a steel trowel, after screeding and floating the surface of the concrete to produce a dense, smooth, even surface suitable for painting or the application of floor covering. The troweling shall not take place until the surfaces have set sufficiently to sustain knee boards without damage. Troweling shall eliminate all irregularities and leave the concrete surface with a smooth, hard finish, free from marks and blemishes to the satisfaction of the Engineer.

e. "Traction Finish": A monolithic layer of abrasive concrete having a minimum thickness of 3/4 inch and which shall be "Emericrete SH", as manufactured by the Sika Corporation, or approved equal. Prepare the base and install the monolithic finish in accordance with the recommendations of the manufacturer of the abrasive concrete. The surface shall be given a wood float finish. The sides and edges of pavement slabs shall be rounded with an approved edging tool to the minimum radius obtainable in the sole opinion of the Engineer.

f. "Burlap Finish": A surface of concrete obtained by the use of a burlap drag, after screeding and floating the surface of the concrete. Drag the burlap in one direction in a straight line before initial setting has begun and in such a manner that the full width of the slab being finished is dragged in one operation. Prepare the surface prior to dragging by working from a bridge that does not come in contact with the fresh concrete at any point. The use of any burlap that causes irregularities or grooves greater than 1/16 inch in depth in the concrete surface will not be permitted. Rinse or wash burlap as often as is necessary to prevent the presence of hardened particles and consequent scarring of the concrete.

g. Stair treads and platforms of steel stairs shall be filled with mortar mixed in the proportions of one part Portland cement to three parts of fine aggregate, mixed with water to a satisfactory consistency. Coat the surface of the mortar with three pounds of aluminum oxide crystals per square yard of surface, uniformly applied, and trowel the surface to a smooth hard finish. Aluminum oxide crystals shall be grade AL203 crystals ranging from No. 12 to No. 30 in size and shall contain not more than six percent of iron or other impurities.

h. "Broom Finish" shall be subject to the following:

(1) Finish the concrete when the water sheen has practically disappeared. Use push broom or floor brush type, not less than 18 inches wide and made of good quality bass or bassine fibers not more than 4-1/2 inches long and with handles longer than half the width of the slab.

(2) Use an adequate number of brooms to keep up with other operations. Achieve proper finish prior to initial set of the concrete.

(3) Wash and thoroughly dry brooms at frequent intervals and remove worn or damaged brooms from the construction site.

(4) Draw broom across previously finished surface from the centerline to each edge of the slab with a slight overlap of strokes.

(5) Corrugations made in surface shall be uniform, approximately 1/16 inch in depth, and not more than 1/8 inch in depth.

(6) Complete brooming before concrete reaches a condition that would result in the surface becoming torn or unduly roughened and before initial set of concrete.

(7) Immediately following brooming, carefully finish the edges of slab along sides and at joints with an approved edging tool to form a smooth rounded surface of required radius and subject to the following:

(a.) Where corners or edges of slabs have crumbled and at any areas which have leaked sufficient mortar to make proper finishing difficult, remove loose fragments and soupy mortar, fill solidly with a mixture of correct proportions and consistency and finish.

(b.) Edges shall be smooth, true to line and free of unnecessary tool marks.

i. "Saw Cut Grooved Surface" for deck slabs and overlays shall conform to the requirements of the NJDOT Standard Specifications, Division 500 Subsection 507.03.02, Item L.

j. Concrete Curbs and Sidewalks

(1) Give sidewalks a "Float Finish", tool edges and joints for a width of 2 inches and round corners to a radius of 1/4 inch with an approved edging tool.

(2) Install expansion joints at not more than 20-foot intervals in sidewalks with matching joints in curbs. Use 1/4-inch bituminous joint filler.

(3) Score sidewalks in squares as approved by the Engineer.

J. Pump Concrete

1. Grout used to prime the pump line shall not be included in the placement. Dispose of the grout at the end of the pump line off Authority property. Do not begin placement until concrete is visible at the end of the pump line.

2. Allow no water to enter the pump hopper at any time during placement operations.

3. Submit written procedures for pumping to the Engineer for approval. The procedures shall contain, but shall not be limited to, pumping scheme, pump description, line diameter, line length and the number of turns and line offsets.

K. Silica Fume Concrete and Fibrous Concrete

1. Arrange for qualified technical representatives from the silica fume and the fiber suppliers, who are experienced in the batching and placement of silica fume and fibrous concrete, to be present for the pre-concrete construction meeting, all test pours and the first two production pours.

L. Fog spray forms, steel reinforcement and subgrade with potable water immediately prior to the placement of fresh concrete. Maintain uniform moisture of the subgrade without standing water, soft spots or dry areas.

3.04 CURING

A. Carefully cure all concrete. Submit a curing procedure plan for approval by the Engineer prior to placing any fresh concrete. Perform curing in accordance with ACI 308 and the following specifications. Commence curing procedures immediately after fresh concrete has been placed.

1. Provide suitable means, such as insulating blankets or heated enclosures, for maintaining a concrete temperature of at least 50 deg F after placement. At the end of this period, remove protection in such a manner that the drop in temperature of any portion of concrete is gradual and does not exceed the following within the first 24 hours after removal of protection, in accordance with ACI 306R, Table 3.1: 50 deg F for applications with a minimum dimension less than 12 inches; 40 deg F for applications with a minimum dimension between 12 and 36 inches; 30 deg F for applications with a minimum dimension between 36 and 72 inches; and 20 deg F for applications with a minimum dimension greater than 72 inches.

2. Allow all concrete to attain 4,000 psi compressive strength before exposure to freeze-thaw cycles.

3. Choice of curing material and method shall be as approved by the Engineer.

B. Wet Curing

1. All pavement concrete and structural slabs: Immediately after screeding of the concrete, apply an evaporation retardant, or commence the operation of a fog spraying system to keep moisture in the atmosphere surrounding the concrete until all concrete finishing has been completed. Do not direct fogging at the fresh concrete and do not permit ponding of water on the fresh concrete surface.

2. Perform wet curing for the following concrete applications: overlays, deck slabs, ramps, any concrete mixes containing silica fume, Very High Early Strength Cement and formulated latex modifier.

3. Immediately after finishing concrete, cover the surfaces with wet burlap or cotton mats which have been presoaked for a minimum of 24 hours in potable water, so that no marring of the surface occurs. Keep the burlap or cotton mats continuously moist, 24 hours per day, through the use of a fog spraying system or soaker hoses arranged at the high points of the concrete pour. Burlap, which shall consist of two or more layers, or cotton mats shall overlap a minimum of one foot, and shall be at least one foot longer than necessary to cover the entire width and edges of the pavement lane. The burlap or cotton mats shall be weighted down to prevent displacement.

   a. Inspect sheet material before reuse. Repair all holes and tears with cemented patches, subject to approval by the Engineer.

4. Wet curing procedures may be stopped only (1) when the ambient temperature is expected to fall below 35 deg F within 24 hours, (2) when placing concrete for slabs directly adjacent to the fog spraying system or soaker hoses or (3) when concrete is to receive traffic.

   a. When the ambient temperature at the surface of placement is 35 deg F and falling, wet curing will not be permitted; instead, apply a liquid membrane forming curing compound in accordance with 2.02 R and 3.04 C.1.a.

   b. When wet curing is temporarily interrupted for an adjacent placement, remove all standing water in areas to receive fresh concrete prior to placement. Occasionally spray a fine mist of water over the wet curing areas. Do not puddle water on the surface of the fresh concrete. When the fresh concrete is finished and covered with burlap or cotton mats, reassemble the continuous fog spraying system or soaker hoses and continue wet curing immediately.

   c. Areas in which the concrete will be exposed to traffic shall be wet cured for as long as possible. Wet curing may stop only when there is just enough time to apply a liquid membrane forming curing compound over the entire area prior to reopening it to traffic. In this case, apply the liquid membrane forming curing compound when the surface has no standing water or puddles on the surface, but is in a damp condition.

5. Wet cure for 7 days, or until 75% of the design compressive strength is obtained, whichever is longer, when determined by strength tests performed on sample cylinders cast in the field and cured in the same manner as the concrete.

6. Immediately after wet curing procedures are completed, apply a liquid membrane forming curing compound in accordance with 2.02 R and 3.04 C.1.a.

7. Contain water within the area of work.

8. For latex modified concrete, wet cure for a maximum of 48 hours, unless otherwise directed by the Engineer.

C. *Liquid Membrane Forming Curing Compounds and Sheet Materials for Curing*

1. Immediately after placing or finishing, commence the curing process of concrete not covered by forms from loss of moisture. Use one of the curing materials listed in 2.02 R, which may be supplemented by initially using an evaporation retardant listed in 2.02 S, as long as wet curing is not required, subject to the following:

   a. Apply white pigmented liquid membrane forming curing compound as soon as surface moisture has evaporated by approved pressure spraying or distributing equipment in two uniform full applications perpendicular to each other as recommended by the manufacturer. Allow the first coat to become tacky before applying the second coat. Each application shall be the full quantity recommended by the manufacturer. The entire surface shall be white after the second application.

      (1) Recoat areas subjected to heavy rainfall within 3 hours after rain.

      (2) Follow manufacturer's recommendations for agitation during application and warming where necessary during cold weather. Do not use liquid membrane forming curing compound where the surface being cured is to receive a finish that will be bonded to the concrete surface or where a floor hardener is to be applied, unless a certification of compatibility and a minimum five-year performance record is submitted in advance to the Engineer for approval.

      (3) The Engineer will check for uniformity through random sampling and testing. Testing may include determination of membrane infrared spectrum, pH, specific gravity and solids content.

2. Removal of Forms

   Removal of forms shall be subject to the following:

   a. Remove forms in accordance with the requirements of Specification Section 03100 entitled "Concrete Formwork" or Section 02513 entitled "Placement of Portland Cement Concrete Paving (FAA)".

   b. After removal of forms, patch areas of concrete which in the opinion of the Engineer show excessive honeycomb by cutting out defective areas, keying and refilling them with a mortar of cement and sand in the same proportions as those in the approved concrete mix design and sufficient water to provide a workable mix.

   c. After forms are removed, cure sides of slabs greater than 12 inches in thickness in accordance with 3.04 C.

d. Immediately after removal of forms, holes and voids in the surfaces of concrete, resulting from bolts and ties, shall be wetted and filled with a mortar containing cement and fine aggregate in the same proportions as in the approved concrete mix design, and utilizing cement which shall produce mortar of the same color as the concrete. Exposed mortar surfaces shall then be finished smooth and even with a wood float, except that those surfaces exposed to view in the finished structure shall be finished with a steel trowel to match adjacent surfaces. All fins and other surface irregularities shall be removed promptly by chipping, grinding or other methods approved by the Engineer to give a uniform finish. Where no specific surface finish for formed concrete surfaces is indicated on the Contract Drawings, no further finishing will be required.

e. Drop in concrete surface temperature over the first 24 hours shall be controlled in accordance with ACI 306.

3.05 QUALITY ASSURANCE TESTING, SAMPLING AND INSPECTIONS

A. The Engineer will perform Quality Assurance testing during mixing and placing of concrete on samples taken from the end of the pump line or at the point of discharge in accordance with ASTM C 172. The Engineer will take samples of concrete from each Lot during a single Work period based on random sampling procedures contained in ASTM D 3665. A Lot of concrete is defined as the production of a single Work period. For each Sublot, the Engineer will cast cylinders in accordance with ASTM C 31 when testing for compressive strength, as well as 4" x 8" cylinders when permeability is being tested and beams when flexural strength is being tested. The cylinders and beams will be tested in accordance with ASTM C 39 and ASTM C 78, respectively, for each Sublot to determine the compressive strength and flexural strength at the time requirements specified.

TABLE 1
LOTS AND SUBLOTS

Daily Placement Quantity (Cubic Yards)	Number of Lots	Number of Sublots
Less than 50	Note 1	Notes 1 and 3
50 – 100	1	3 equally divided
101 – 450	1	4 equally divided
Greater than 450	1	Note 2

Table 1 Notes:

1. If one Work period's placement of a given Class of concrete is less than 50 cubic yards, it will not constitute a Lot. It will be added either to the previous or the next Work period's Lot, whichever is closer in time, or until a minimum of 3 Sublots are completed constituting a Lot.

2. For concrete placements of 450 cubic yards or greater, a Sublot will be deemed to be one fourth of a Lot of concrete, or 150 cubic yards of concrete, whichever is less. For larger pours the Engineer may increase the number of cubic yards that constitute a Sublot.

3. If the total concrete quantity under the Contract for any type of mix is less than 50 cubic yards, it will constitute one Lot and will be divided into a minimum of 3 Sublots, regardless of the placement schedule.

B. Quality Assurance Testing Standards and Frequency of Testing: Some or all of the following procedures will be used by the Engineer to approve the concrete mix proportions and evaluate the in-place concrete for Adjustments to Contract Compensation:

1. Compressive Strength: In accordance with ASTM C 31 and ACI 318 Part 3, Chapter 5, Item 5.6, entitled "Evaluation and Acceptance of Concrete", except that the Engineer will take samples on a random basis and 4" x 8" cylinders will be used when the nominal maximum size of the coarse aggregate allows. Latex Modified Concrete samples will be wet cured by the Engineer for 1 day and dry cured for 27 days. The cylinders will be tested in accordance with ASTM C 39. The Engineer will calculate the average of two test specimens at the compressive strength time requirement. The average of the two test specimen result values for each Sublot will be considered the Sublot compressive strength value.

2. Flexural Strength: From each Sublot sample, cast beams in accordance with ASTM C 31. The Engineer will test the beams in accordance with ASTM C 78 and will calculate the average of two test specimens at the flexural strength time requirement. The average of the two test specimen result values for each Sublot will be considered the Sublot flexural strength value.

3. Slump Test: Performed by the Engineer at the point of delivery during the time of placement in accordance with ASTM C 143 or ASTM C 1611 when self-consolidating concrete is used. For Latex Modified Concrete, the Engineer will perform slump tests 5 minutes after sampling from the mixer. For pile concrete applications, the slump shall be no less than 4 inches and no greater than 6 inches.

4. Air Content Test: Performed during the placement in accordance with ASTM C 138, ASTM C 173 or ASTM C 231. The Engineer will perform one test for each Sublot, which will be considered the Sublot air content test value.

   a. When results for either two consecutive tests or three tests in one lot or one day's production indicate that the air content is outside the Quality Limits specified in 2.04 A.6 by +1.0 or –0.50% do not place the next load until it has first been tested and satisfactory test results have been obtained. If the air content for the next load is outside the Quality Limits specified in 2.04 A.6, it will be rejected. The Engineer will test subsequent loads until the air content is found to be within the specified limits of 2.04 A.6.

5. Unit Weight: The Engineer will determine the plastic unit weight of concrete (taken at the same frequency as specified in 3.05 B.4 according to ASTM C 138). For lightweight concrete, the plastic unit weight, as determined in accordance with ASTM C 567, shall not exceed 125 pounds per cubic foot, unless otherwise specified.

6. Water Content Test: The Engineer will test for water content during the placement using a Microwave Drying Oven, in accordance with AASHTO T 318. He may adjust drying times depending on the mix constituents to achieve a constant dry weight. Once the water content has been determined, it will be divided by the cementitious content in the mix design to determine the water to cement ratio. When the maximum aggregate size exceeds 1-1/2 inches, the Engineer will obtain a sample of approximately 5000 grams. This sample will be split and the Engineer will perform two separate analyses. The weighted average of the two separate analyses will be considered the Sublot water content value. Likewise, the Engineer will compute the sublot water cement ratio as given above.

a. When results for either two consecutive tests or three tests in one lot or one day's production indicate that the water content exceeds the limits given in 2.03 A.4 by 0.10, do not place the next load until it has first been tested and satisfactory test results have been obtained. If the water content for this load is greater than the Upper Limit given in 2.04 A.5, it will be rejected. The Engineer will test subsequent loads until the water content is found to be within the limit given in 2.04 A.5.

7. Coulomb Test: To evaluate the permeability of the concrete the Upper Quality Limit, UQL, shall be 1700 Coulombs for mixes without a corrosion inhibitor and 2200 Coulombs for mixes containing a corrosion inhibitor, as tested by the Engineer in accordance with AASHTO T 277 after a 28-day wet cure. For mixes containing only fly ash or slag (no silica fume or metakaolin) permeability will be evaluated at 90 days, using the same performance requirements stated above (1700 Coulombs for mixes without a corrosion inhibitor and 2200 Coulombs for mixes with a corrosion inhibitor). For Latex Modified Concrete applications, samples will be wet cured for 7 days and dry cured for 21 days. For each Sublot, the Engineer will cast two (2) 4" x 8" cylinder specimens for each Sublot. The Engineer will cut 2-inch thick samples from the center of each cylinder for testing. The average of the two test specimen result values for each Sublot will be considered the Sublot Coulomb test value.

8. Bond Strength: The bond strength between overlay concrete and parent concrete will be evaluated in accordance with ASTM C 1583. For each Sublot, the Engineer will perform three tests. Three 4-inch diameter cores will be cut 1/2 inch into the parent concrete to isolate the overlay concrete. The average of the three test result values for the Sublot will be considered the Sublot bond strength test value. The locations for each test will be randomly determined by the Engineer.

9. Chloride Ion Concentration by Weight of Cement: The Engineer may perform testing for both the acid soluble and water soluble chloride ion concentrations by weight of cementitious material, which will be evaluated as follows. Powder samples from 28-day concrete cylinders, cast from the concrete mix delivered to the construction site, will be tested to assess both the acid soluble and water soluble chloride ion concentrations by weight of cementitious material. Samples will be obtained using a rotary hammer drill from the mid-height of a minimum of two Sublot specimens from each Lot. The sample will be obtained from the inner three inches of the cylinder specimen, and must be a minimum of 40 grams in weight. The acid soluble and water soluble chloride ion concentrations by weight of cementitious material will be determined by the Materials Engineering Unit in accordance with preparatory standards ASTM C 1152 and ASTM C 1218, respectively, followed by ASTM C 114 (silver nitrate titration) for both the acid soluble and water soluble chloride ion analysis.

10. Pavement Thickness: The Engineer will perform acoustical testing using Impact Echo instrumentation to determine the pavement thickness. Areas indicating pavement thickness below the requirements shown on the Contract Drawings will be cored for verification. The cores will be measured in accordance with ASTM C 174. The average of three test result values for the Sublot will be considered the Sublot test value.

11. Where specified the Engineer will place Remote Temperature Sensing Devices in the in situ concrete to record maximum core temperature and maximum drop of temperature for 24 hours after protection has been removed.

12. Test Cores for Tremie Concrete

a. The Engineer will drill test cores for every 100 cubic yards of concrete placed in mass pours, such as tremie seal, or one core for every 1000 square feet of surface of thin pours, such as bulkheads or wall facings. Cores will be obtained in accordance with ASTM C 42 and will be drilled full depth (or thickness) through the pour horizontally or vertically as applicable.

b. Recovery of less than 95 percent will be considered to indicate defective concrete requiring corrective action by the Contractor.

c. If the cores reveal voids, honeycombing, seams or other defects, the concrete will be subject to rejection for non-uniformity. Additional cores may be obtained by the Engineer for further investigation. The number and location of cores will be determined by the Engineer. All additional cores will be taken at the sole expense of the Contractor.

d. Fill all test core holes by pressure grouting from the bottom upward, or from the inside out, as the case may be.

e. Clean out and fill all voids, honeycombing, seams and other defects by pressure grouting with cement or sand-cement to the Engineer's satisfaction. At the Engineer's request and at the sole expense of the Contractor, drill additional cores to verify grouting.

C. In accordance with the Section of Division 1 entitled "Inspections and Rejections", provide labor and means for obtaining all samples required for trial batches and field testing performed by the Engineer. At no additional cost to the Authority, furnish and deliver the following when requested by the Engineer:

1. Provide a representative sample, in the quantity requested by the Engineer, of all cement, fly ash, slag, silica fume, fine and coarse aggregate, admixtures, corrosion inhibitor, latex, fibers, pigment, evaporation retardant and liquid membrane forming curing compound during any day of production the Engineer requests a sample. Take such samples in the presence of the Engineer at the point of storage used for the Work of this Contract. For cement, fly ash, slag and silica fume samples, only use a sampling port on the silo, or drop material in a loader bucket between loads, or take samples from the boot using a "Sample Thief" during loading. Notify the Engineer of aggregates being loaded at their source of supply at least 48 hours in advance of each loading.

2. Provide the cement, fly ash, slag, silica fume or metakaolin manufacturer's Mill Test Certificate and Bill of Lading, if such documents are requested by the Engineer.

3. Allow the Engineer to sample any mix proportion constituents at any time.

D. The Engineer may direct an inspection of the Contractor's concrete plant or precast concrete fabricator to observe operations and review the Quality Control procedures being implemented. Notify the Engineer, in writing, a minimum of 15 days prior to the commencement of production and submit a schedule and Quality Control Plan for all production for the Work of the Contract.

E. Precast Concrete: Obtain from the fabricator and submit to the Engineer a set of approved shop drawings for the Work of the Contract. Fabrication without shop drawings will not be permitted. Clearly mark all precast units with identification numbers for each unit. The Engineer will provide a manifest ticket to be attached to the driver's shipping ticket listing the approved unit identification numbers. Any units shipped to the construction site that are not approved or are not listed on the manifest will not be permitted to be unloaded at the construction site. Shipments not accompanied by a manifest upon delivery will not be permitted to be unloaded at the construction site.

F. For concrete where riding surface tolerances are required, other than pavements, as indicated on the Contract Drawings, the following requirements must be met:

1. The Engineer will test the entire surface of the hardened concrete with a rolling straight edge for conformance to the smoothness requirements. Surface smoothness deviations must not exceed 1/4 inch in 16 feet. Tests will be made in both the longitudinal and transverse direction of the slab and shall span joints. Correct any deficiencies as specified in 4.01 G.1.H and at no cost to the Authority.

2. The Engineer will survey the slab surface for vertical deviation from grade. Vertical deviation from the grade shown on the Contract Drawings must not exceed plus or minus 0.04 foot at any point.

3. The Engineer will determine finished grade by running levels at intervals of 25 feet longitudinally and transversely. Correct all deficiencies as specified in 4.01 G.1.H and at no cost to the Authority.

G. Specified concrete finishes, as shown on the Contract Drawings, must conform to the requirements set forth in 3.03 H.2. Correct all deficiencies as specified in 4.01 G.1.I and at no cost to the Authority.

PART 4. ADJUSTMENTS TO CONTRACT COMPENSATION

4.01 GENERAL

A. Unless otherwise shown on the Contract Drawings, acceptance of material will be based on the method of estimating Percentage of Lot Within Specification Limits (PWL), where the PWL will be determined in accordance with this Section. All Sublot test result values for a Lot, as defined in 3.05 A, Table 1, will be analyzed statistically to determine the total estimated Percent of the Lot that is Within specification Limits, as shown in 4.01 B. The PWL is computed using the Lot sample Average value, $\overline{X}$, as defined in 4.01 D.3 and the Lot sample standard deviation, S_N, as defined in 4.01 D.4, for the specified number of Sublots, n, and for the specification Quality Acceptance Limits, as defined in 2.04 A, where LQL represents the Lower Quality Limit, and UQL represents the Upper Quality Limit, as they apply to each particular acceptance parameter. From these values, the respective Quality Index(ices), Q_L for Lower Quality Index and/or Q_U for Upper Quality Index, is computed in accordance with 4.01 D.5 and 4.01 D.6. Then the PWL for the Lot for the specified number of Sublots, n, is determined from Table 4, "Percent of Lot Within Limits (PWL) (Standard Deviation Method)". The Adjustment to Contract Compensation for each Lot is then calculated using the formulas specified in 4.01 F.

B. Depending on the application, concrete will be tested for the properties shown below. The PWL of each Lot for each parameter will be determined as specified in 4.01 D. Payments will be based on the concrete application for a Lot and the criteria defined below.

Performance Parameters	Minimum PWL
Flexural Strength	95
Compressive Strength	95
Permeability	90
Bond Strength	80
Water to Cement Ratio	80
Air Content	70*
Pavement Thickness	90
Chloride Content	100**

*denotes that in addition to the minimum PWL, the air content will also be evaluated for the average of test results for a given Lot of concrete as per 3.05 B.4 and 4.01 J.

**denotes that the chloride content (acid soluble and water soluble) will be analyzed only for the average of test results for any given Lot of concrete, as per 3.05 B.9 and 4.01 G.1.b.

Table 2 defines the Quality Acceptance performance criteria to be evaluated for Adjustments to Contract Compensation for a given concrete application. In addition, all concrete shall conform to the requirements of 4.01 G. Any deficiencies found to exist as specified in 4.01 G will govern and the Contractor shall either:

1. Remove and replace the concrete in that particular Lot at no cost to the Authority, or

2. Accept a deduction of 50% of the Base Price per cubic yard, as indicated on the Contract Drawings, for that particular Lot of concrete.

TABLE 2
PERFORMANCE CRITERIA PARAMETERS

Category/ Application	Water/Cement Ratio (W/C)	% Air	Permeability	Bond Strength	Compressive Strength	Flexural Strength	Pavement Thickness
Category I - Full Depth Pavements & Unbonded Overlays							
	I	I	---	---	---	P	
LQL:	---	*	---	---	---	700 psi	97%
UQL:	0.45	*	---	---	---	---	---
Category II - Bonded Pavement Overlays							
	I	I	---	P	I	---	---
LQL:	---	*	---	150 psi	***	---	---
UQL:	0.45	*	---	---	---	---	---
Category III - Elevated Structural Overlays							
	I	I	I	P	I	---	---
LQL:	---	*	---	150 psi	***	---	---
UQL:	0.45	*	**	---	---	---	---
Category IV - Structural (exposed to freeze-thaw and/or sulfates, in addition to chlorides or a marine environment)							
	I	I	P	---	I	---	---
LQL:	---	*	---	---	***	---	---
UQL:	0.45	*	**	---	---	---	---
Category V - Structural (exposed to freeze/thaw and/or sulfates only; no exposure to chlorides or a marine environment)							
	I	I	---	---	P	---	---
LQL:	---	*	---	---	***	---	---
SQL:	0.45	*	---	---	---	---	---
Category VI - Standard Structural (not exposed to freeze-thaw cycles) and Miscellaneous Applications (at-grade sidewalks, at-grade curbs, kerfs, foundations, footings, drainage structures, manholes, pipe pile fill and all concrete applications below grade)							
	---	---	---	---	P	---	---
LQL:	---	---	---	---	***	---	---
UQL:	---	---	---	---	---	---	---

* - Refer to 2.04 A.6.

** - 1700 Coulomb counts for mixes without a corrosion inhibitor and 2200 Coulomb counts for mixes with a corrosion inhibitor.

*** - The proportion compressive strength at 28 days or as specified on the Contract Drawings.

P - Used to Calculate Pay Factor per cubic yard. It denotes the concrete property that will be used to calculate payment for a given concrete application. No incentive payments will be made if the performance criteria parameters labeled 'I' for a given application have a PWL less than specified in 4.01 B.

I - Used to Calculate Incentive only when the Pay Factor for the parameter labeled 'P' is greater than 0.00.

C. Full Depth Pavement and Unbonded Overlay (Category I) Final Pay Factor: The Pay Factor for Pavement Thickness will govern only when the Pay Factor for Pavement Thickness is less than the Pay Factor for Flexural Strength, with the exception of when the Pay Factor for Pavement Thickness is 0.00.

D. Method of Estimating Percentage of Material Within Limits (PWL)

1. Locate sampling positions on the Lot by use of random sampling procedures specified in 3.05 A.

2. Take a test sample and make the test specimens on the test sample in accordance with 3.05 A.

3. Determine the Lot sample Average value, $\overline{X}$, by calculating the average of all Sublot test values.

4. Find the Lot sample standard deviation, S_N, by using the following formula:

$$S_N = \sqrt{\frac{d_1^2+d_2^2+d_3^2+ +d_n^2}{n-1}}$$

Where:

S_N = standard deviation of the Sublot test values

$d_1, d_2....$ = deviation from the individual Sublot test values

$X_1, X_2, ...$ from the Average value, $\overline{X}$, that is,

$d_1 = (X_1 - \overline{X}), d_2 = (X_2 - \overline{X}), ..., d_n = (X_n - \overline{X})$

n = number of Sublots

5. Find the Lower Quality Index, Q_L, by subtracting the Lower Quality Limit, LQL, from the Average value, $\overline{X}$, and dividing the result by S_N.

$$Q_L = \frac{\overline{X} - LQL}{S_N}$$

6. Find the Upper Quality Index, Q_U, by subtracting the Average value, $\overline{X}$, from the Upper Quality Limit, UQL, and dividing the result by S_N.

$$Q_U = \frac{UQL - \overline{X}}{S_N}$$

7. The percentage of material above lower tolerance limit, P_L, and the percentage of material below upper tolerance limit, P_U, will be found by referring to Table 4, "Percent of Lot Within Tolerance Limit (PWL) (Standard Deviation Method)". Locate Q_L and/or Q_U in the column appropriate to the total number of Sublots, n, and reading the number under the column heading "PWL".

8. For concrete properties with only an Upper Quality Limit (ratio of water to cementitious material, permeability), PWL equals P_U. For concrete properties with a Lower Quality Limit (bond strength, compressive strength, flexural strength, pavement thickness), PWL equals P_L. For concrete properties with both Upper and Lower Quality Limits (air content), first calculate of the Upper Quality Index, Q_U, and the Lower Quality Index, Q_L, by using the Upper Quality Limit, UQL, and the Lower Quality Limit, LQL, respectively, as stipulated in 2.03 A.6. Then determine PWL using the following formula:

$$PWL = (P_U + P_L) - 100$$

E. Pay Factors for each Lot will be computed in accordance with the formulas contained in 4.01 F, Table 3 entitled, "Adjustments to Contract Compensation", by entering the PWL value and performing the calculation indicated for the appropriate PWL range to determine the Pay Factor.

F. Adjustments to Contract Compensation shall be calculated as follows:

TABLE 3

ADJUSTMENTS TO CONTRACT COMPENSATION PER CUBIC YARD

Percent Within Limits (PWL)	Compressive Strength Pay Factor
98 - 100	0.02 (PWL-100) +0.06
95 - 97	0.0
55 - 94	(PWL-95)/100
0 - 54	-0.50

Percent Within Limits (PWL)	Permeability & Bond Strength Pay Factor
91 - 100	0.006 (PWL - 90)
80 - 90	0.0
55 - 79	$0.00017PWL^2 - 0.0105PWL - 0.30$
0 - 54	-0.50

Percent Within Limits (PWL)	Flexural Strength Pay Factor
95 - 100	(PWL-95/100)+.01
55 - 94	(PWL-95)/100
0 - 54	-0.50

Percent Within Limits (PWL)	Pavement Thickness Pay Factor
90 - 100	0.00
55 - 89	(PWL-90)/100
0 - 54	-0.50

Pay Factors are multiplied by the Base Price per cubic yard established in the table below, unless otherwise indicated on the Contract Drawings. The result is the amount to be added or deducted from the compensation for that particular Lot of concrete.

Category	Base Prices for Adjustments to Contract Compensation Per Cubic Yd
I	$100
II	$90
III	$130
IV	$130
IV	$110 when silica fume or metakaolin are not included
V	$90
VI	$80

G. Correction or Cost Adjustments for Deficiencies

1. Remove and Replace Concrete: Remove and replace concrete in a manner approved by the Engineer and at no additional cost to the Authority if any of the following deficiencies exist, unless the Engineer elects to accept the concrete, at which time the Contractor will be compensated at 50% of the Base Price per cubic yard, regardless of the Pay Factors calculated in 4.01 F, Table 3:

a. Percent Within Limits (PWL) for compressive strength, flexural strength, permeability, bond strength or pavement thickness is below 55.

b. The average acid soluble chloride ions by weight of cementitious material test results for any given Lot of concrete exceed the limit of 0.10% (reinforced concrete) or 0.08% (prestressed concrete) weight of chloride ions by weight of cementitious material, in accordance with ASTM C 1152 and ASTM C 114, and the average water soluble chloride ions by weight of cementitious material test results for any given Lot of concrete exceed the limit of 0.08% (reinforced concrete) or 0.06% (prestressed concrete) weight of chloride ions by weight of cementitious material, in accordance with ASTM C 1218 and ASTM C 114. The Soxhlet test referenced in ACI 222R will not be considered for chloride evaluations.

c. For all concrete applications, the cylinder compressive strength shall conform to the following:

(1) The calculated average of any three consecutive compressive strength tests shall be equal to or shall exceed the specified compressive strength.

(2) No individual compressive strength test result shall be below the specified compressive strength by more than 500 psi. When the required strength is 5000 psi or less, or by more than 0.10 of the specified strength when greater than 5000 psi is required.

(3) If either or both of the requirements specified in 4.01 G.1.c.1 and 4.01 G.1.c.2 are not met, investigate the in-place compressive strength in accordance with ACI 318-02, Section 5.6.5, at no additional cost to the Authority. If the compressive strength test results of the in-place concrete fail to meet either or both of the requirements specified in 4.01 G.1.c.1 and 4.01 G.1.c.2, the concrete will be considered deficient, and 4.01 G.1 will apply.

d. Concrete slabs or structures that exhibit any cracks prior to opening to vehicular/aircraft operations or loading will be subject to the actions specified in 4.01 G.1. If the concrete is accepted by the Engineer, seal cracks in accordance with Specification Section 03734 entitled "Concrete Crack Repair" in a manner approved by the Engineer, and at no cost to the Authority.

e. Delamination Testing: The Engineer will check all concrete overlays using the chain drag method in accordance with ASTM D 4580. If more than 5.00% of the total surface area of the Lot is found to be delaminated, remove these areas and replace them at no cost to the Authority. The determination by the Engineer as to the existence of delaminations shall be final and binding.

f. Slabs showing high or low spots exceeding 1/2 inch when tested in accordance with 3.05 F.2.

H. Diamond Grinding and Partial Depth Removal

1. Cured riding surfaces, except pavements, that do not meet the smoothness or finished grade requirements set forth in 2.04 B shall be corrected, to obtain the specified smoothness deviation, as follows:

a. High spots between 1/4 inch and 1/2 inch and surfaces that exceed the finished grade requirements shall be identified and ground with diamond grinding equipment.

b. Low spots between 1/4 inch and 1/2inch and surfaces that are below the finished grade requirements shall be corrected by partial depth removal of the entire slab to 1 inch below rebars by hydrodemolition, or by hydromilling and constructing an overlay in conformance with this Specification.

2. The diamond grinding equipment shall be as approved by the Engineer and shall have a grinding head at least 36-inches wide.

3. Where grinding is required, grind the entire width of the riding surface by the length of defective area. In the sole opinion of the Engineer, if the deficiencies are closely spaced and grinding individual areas will adversely affect ride, grind the entire surface.

4. Dispose of slurry produced from grinding operations off Authority property.

5. Perform diamond grinding, partial depth removal and construction of an overlay, if required to correct deficiencies, at no additional cost to the Authority.

I. If concrete finishes do not meet the requirements set forth for the specified finishes, refinish the hardened concrete as directed by the Engineer, at no additional cost to the Authority.

J. If the average air content for a Lot exceeds either the LQL or the UQL by more than 1% (with the exception of concrete not exposed to freeze/thaw cycles) 10% of the Base Price per cubic yard will be deducted from the compensation for that particular Lot of concrete.

K. If the core temperature of the in situ concrete exceeds 160 deg F, the Engineer will evaluate concrete quality using cores taken from the concrete in question. The cores will be tested in accordance with ASTM C 42 and their compressive strength results will be used to calculate the PWL for payment adjustments.

TABLE 4

PERCENT OF LOT WITHIN TOLERANCE LIMIT (PWL)

(STANDARD DEVIATION METHOD)

Positive Values of Quality Index (QI)

(n = Number of Sublots in the Lot)

PWL	n=3	n=4	n=5	n=6	n=7	n=8
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4716
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630
87	1.0597	1.1100	1.1173	1.1191	1.1199	1.1204
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015
83	.9939	.9900	.9785	.9715	.9672	.9643
82	.9749	.9600	.9452	.9367	.9325	.9281
81	.9550	.9300	.9123	.9025	.8966	.8928
80	.9342	.9000	.8799	.8690	.8625	.8583
79	.9124	.8700	.8478	.8360	.8291	.8245
78	.8897	.8400	.8160	.8036	.7962	.7915
77	.8662	.8100	.7846	.7716	.7640	.7590
76	.8417	.7800	.7535	.7401	.7322	.7271
75	.8165	.7500	.7226	.7089	.7009	.6958
74	.7904	.7200	.6921	.6781	.6701	.6649
73	.7636	.6900	.6617	.6477	.6396	.6344
72	.7360	.6600	.6316	.6176	.6095	.6044
71	.7077	.6300	.6016	.5878	.5798	.5747
70	.6787	.6000	.5719	.5583	.5504	.5454
69	.6490	.5700	.5423	.5290	.5213	.5164
68	.6187	.5400	.5129	.4999	.4924	.4877
67	.5878	.5100	.4836	.4710	.4638	.4592
66	.5563	.4800	.4545	.4424	.4354	.4310
65	.5242	.4500	.4255	.4139	.4073	.4031
64	.4916	.4200	.3967	.3856	.3793	.3753
63	.4586	.3900	.3679	.3575	.3515	.3477
62	.4251	.3600	.3392	.3295	.3239	.3203
61	.3911	.3300	.3107	.3016	.2964	.2931
60	.3568	.3000	.2822	.2738	.2691	.2660
59	.3222	.2700	.2537	.2461	.2418	.2391
58	.2872	.2400	.2254	.2186	.2147	.2122
57	.2519	.2100	.1971	.1911	.1877	.1855
56	.2164	.1800	.1688	.1636	.1613	.1592
55	.1806	.1500	.1408	.1363	.1338	.1322
54	.1447	.1200	.1125	.1090	.1070	.1057

END OF SECTION

SECTION 03301

PORTLAND CEMENT CONCRETE, LONG FORM

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

03301A01 Shop Drawings of forms and test pour details at least 15 calendar days before the test.

Catalog Cuts

03301B02 At least 35 calendar days prior to concrete placement, the following:
Brand name and chemical composition of form oil or release agents, evaporation retardant and liquid membrane curing compounds. For Architectural Concrete, also include this information for forms, form liners, and pigments.

Samples

03301C02 List of materials for Work of this Section.

Certificates

03301E01 At least 35 calendar days prior to concrete placement, the following:
Material certifications, source, brand name and test results (where required) of cement, fine and coarse aggregate, fly ash, slag, silica fume, metakaolin and concrete admixtures following guidelines of Appendix "B". In addition, an independent testing laboratory to verify that the Very High Early Strength Cement meets the compressive strength, absolute drying shrinkage, and setting time requirements, as per 2.02.B at the testing frequency specified therein.

END OF APPENDIX "A"

SECTION 03301

PORTLAND CEMENT CONCRETE, LONG FORM

APPENDIX "B"

CONCRETE MATERIALS AND MIX PROPORTION DATA

A. Materials:

1. Cement: Type.....Source/Brand.....

2. Sand: Fineness Modulus.....Source.....

3. Stone: Size.....Class.....Source.....

4. Fly Ash: Type.....Source.....

5. Slag: Grade.....Source.....

6. Microsilica (Silica Fume): Source/Brand.....

7. Metakaolin: Source/Brand.....

8. Admixtures (Source/Brand):

Air Entraining Agent.....

Non-Chloride Accelerator.....

Retarder.....

Water Reducer.....

Water Reducer - Retarder.....

High Range Water Reducer.....

High Range Water Reducer - Retarder.....

Polycarboxylate High Range Water Reducer

Anti-Washout Admixture.....

Corrosion Inhibitor.....

Latex.....

Pigment.....

B. Mix Proportions

1. Proposed method of placement:.....Tremie/Mobile

.....Mixer/Transit Mixer/Portable Mixer/

Pumping/Tube Diameter:.....

2. Proportion of Ingredients:

Cement.....lbs./cu. yd.

Fly Ash.....lbs./cu. yd.

Slag.....lbs./cu. yd.

Silica Fume.....lbs./cu. yd.

Metakaolin.....lbs./cu. yd.

Pigment.....lbs./cu. yd.

Stone.....lbs./cu. yd.

Sand.....lbs./cu. yd.

Water.....lbs./cu. yd.....gallons

Air Entraining Agent:.....ounces/cu. yd.

Admixtures (specify type and amount):

.....at.....ounces/cu. yd.

.....at.....ounces/cu. yd.

.....at.....ounces/cu. yd.

.....at.....ounces/cu. yd.

3. Mix Properties:

Compressive Strength: f'c =.....psi at.....days/hours

Flexural Strength:.....psi at.....days/hours

Permeability at 28 days:.....Coulombs

Slump:.....inches

Water to Cementitious Ratio:.....

Air Entrainment:.....%

Sand/Stone Ratio:

Combined aggregate gradation chart (% retained on each sieve)

Unit Weight:.....lbs./cu. ft.

C. Conformance with ACI 318

Attach a report on mix proportion and test/statistical data documenting conformance with ACI 318, Chapter 5, or ACI 304R, Chapter 8, as they apply to the Work of the Contract.

D. Concrete Supplier/Batch Plant

1. Name:.....
2. Address:.....
3. Contact Name:.....
4. Telephone number/Fax number/E-mail address:.....
5. Quality Control technician(s):.....

   Name(s):.....

   Telephone number(s):.....

END OF APPENDIX "B"

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

1.03 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

1.04 JOB CONDITIONS

1.05 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.

1.06 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.

1.07 SUBMITTALS

1.08 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

3.02 Areas to be grouted as shown on the Contract Drawings shall be cleaned of all foreign materials, to the satisfaction of the Engineer.

3.03 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.

3.04 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

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Samples

03602C01 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.

Construction and Installation Procedures

03602G01 Submit manufacturer's instructions and methods for handling, storage, mixing and placing of the grout, for approval.

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:

Shop Drawings

05506A01 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.

Product Data

05506D01 Product Data
Manufacturer's technical information, specifications, anchor details and installation instructions for miscellaneous steel products used, including grout and paint products.

Qualifications

05506K01 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 9

SECTION 09910

PAINTING

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for shop and construction site application of paint as shown on the Contract Drawings.

B. Work of this Section includes surface preparation and painting of the following items and surfaces:

1. Exterior and interior painting in accordance with Appendix "B" to this Section.
2. Exposed bare and covered pipes, ducts and conduits, including color coding (if any), and hangers and supports.
3. Galvanized steel, iron work and miscellaneous metal items, and surfaces of architectural, mechanical and electrical items, if any.
4. Architectural woodwork and casework, if any.
   a. Surface preparation and shop staining or painting of architectural woodwork and casework is specified in other Sections of the Specifications.

C. These and similar items shall not be painted:

1. Items with factory-applied top coat.
2. Finished metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished metals.
3. Concealed pipes, ducts and conduits.
4. Concealed or inaccessible surfaces.
5. Code required labels such as Underwriters Laboratories and Factory Mutual.
6. Identification, performance rating, name or nomenclature plates of mechanical, electrical and fire equipment.
7. Operating and moving parts of operating units and mechanical and electrical equipment such as: valves, damper operators, linkages, sinkages, sensing devices, motors, shafts and sheaves.
8. Surfaces shown or scheduled on the Contract Drawings to receive spray-applied fire resistive material.

D. Definitions: "QC" refers to quality control or a quality control program. This is a methodology employed by the Contractor to ensure compliance with Contract requirements.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

ASTM A 780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
ASTM D 521	Standard Test Methods for Chemical Analysis of Zinc Dust (Metallic Zinc Powder).
ASTM D 523	Test Method for Specular Gloss.
ASTM D 562	Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer.
ASTM D 1475	Standard Test Method for Density of Liquid Coatings, Inks, and Related Products.
ASTM D 2369	Standard Test Method for Volatile Content of Coatings.
ASTM D 2371	Standard Test Method for Pigment Content of Solvent-Reducible Paints.
ASTM D 2697	Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings.
ASTM D 3359	Standard Test Method for Measuring Adhesion by Tape Test.
ASTM D 4263	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
ASTM D 4285	Standard Test Method for Indicating Oil or Water in Compressed Air.
ASTM D 4414	Standard Practice for Measurement of Wet Film Thickness by Notch Gages.
ASTM D 4417	Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.
ASTM D 4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
ASTM D 6386	Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
ASTM F 1869	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride.

Northeast Protective Coating Committee (NEPCOAT)

NEPCOAT QPL	Qualified Products List

The Society for Protective Coatings (SSPC)

SSPC-PA 1	Shop, Field and Maintenance Painting of Steel
SSPC-PA 2	Measurement of Dry Coating Thickness with Magnetic Gages.
SSPC-SP 1	Solvent Cleaning.
SSPC-SP 2	Hand Tool Cleaning.

SSPC-SP 3	Power Tool Cleaning.
SSPC-SP 5	White Metal Blast Cleaning.
SSPC-SP 6	Commercial Blast Cleaning.
SSPC-SP 7	Brush-Off Blast Cleaning.
SSPC-SP 10	Near-White Blast Cleaning.
SSPC-SP 11	Power Tool Cleaning to Bare Metal.
SSPC-VIS 1	Visual Standard for Abrasive Blast Cleaned Steel.

1.03 AMBIENT TEMPERATURE AND HUMIDITY REQUIREMENTS

A. Comply with the manufacturer's technical data sheets subject to approval by the Engineer as to environmental conditions under which paint and finishes may be applied, and with the following:

1. Do not apply paints in rain, snow, fog or mist, or when relative humidity exceeds 85 percent. Painting may be performed during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by the manufacturer(s) during application and drying periods.

2. Apply solvent based paint only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F and 95 degrees F.

3. Apply water-based paint only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F and 90 degrees F.

4. Apply paint to surfaces only when the surface temperature is at least 5 degrees F above the dew point.

5. Apply primer to non-metal surfaces only when the moisture content of surfaces meets the following criteria:

   a. Gypsum Wallboard: 0.5 percent maximum, when measured with an electronic moisture meter.

   b. Wood: 15 percent maximum, when measured with an electronic moisture meter.

   c. Concrete, Masonry and Plaster Walls: No visible moisture when measured in accordance with ASTM D 4263.

6. Do not apply primer to concrete floors unless the moisture vapor emission rate is less than 3 pounds/1,000 square feet/24 hours when tested in accordance with ASTM F 1869.

B. When painting and/or abrasive blasting operations are performed out of doors, no Work shall be performed when the U.S. Weather Bureau forecasts precipitation to commence prior to or within two hours after completion of such procedures and application of paint.

1.04 QUALITY ASSURANCE

A. Paint System Compatibility

The paint system, including all primers and undercoats, shall be produced by the manufacturer of the topcoat. Where this is not possible (as in cases of specialized primers used in the coating of miscellaneous components) review other Sections of the Specifications to determine the primer, surface preparation and treatment for the substrates and items to be field painted or finished as Work of this Section.

1. Notify the Engineer in writing of compatibility problems associated with the Work of this Section and substrates primed under other Sections of these Specifications.

B. Where shown on the Contract Drawings, provide not less than a 100 square foot full-coat finish sample(s) on actual surface(s) of coating material to be applied as Work of this Section, at a location selected by the Engineer. Such sample(s), when approved by the Engineer, may be incorporated into the Work and shall establish standards for color, texture and workmanship for the remainder of the Work of this Section.

C. Painting of Structural Steel - Requirements

All painting of structural steel must be done by firms that are approved by the Engineer. The firm shall have as a minimum the following:

1. Technical Capabilities

   a. Shops shall have areas available for specific operations, such as: receiving and lay down for steel to be coated; pre-cleaning of items to be coated; surface preparation; coating application; drying and curing of coated items; storage of coating materials.

   b. Blasters and painters must be trained. This training shall consist of at least 4 hours of instruction by a qualified instructor and shall cover various types of surface preparation equipment, paints and application equipment. Maintain instructor qualifications and training records and produce them when requested.

   c. There shall be procedures or processes in place to record specifications and revisions and to clarify ambiguous or incomplete specifications.

   d. There shall be a procedure for informing quality control and production personnel of job/shop procedures to meet requirements of this Specification.

2. Quality Control (QC)

   The entity performing painting of steel and galvanized steel shall have a written quality control program. The program shall contain, but not be limited to, the following:

   a. The qualifications of QC staff, including training records and experience.

   b. The authority of QC staff and reporting lines in the firm organization chart.

   c. Standards and specifications used by QC staff for inspection purposes.

   d. Inspection reports and other records documenting compliance with Authority requirements.

e. Inspection equipment and calibration standards used by QC staff and calibration procedures.

f. Procedure for QC staff to advise the shop foreman, in writing, of non-conforming Work.

3. Contractor's Responsibility

a. The Contractor is responsible for Quality Control, which entails the daily inspection of all painting. The Quality Control Program shall ensure that coating systems are applied according to the coating manufacturer's technical data sheets subject to approval by the Engineer for surface preparation, ambient conditions, application parameters, curing and film thickness.

b. The Engineer will perform Quality Assurance inspections to verify that the Contractor's Quality Control program is being followed.

4. Technical Advisor

Obtain the services of a technical advisor employed by the coating manufacturer to assist the Engineer and the Contractor during this Work. The technical advisor shall be a qualified representative, approved by the Engineer and shall be at the shop or work site prior to the opening of the coating containers. Consult with the technical advisor for instruction in the proper mixing of components and application of the materials. Arrange for the technical advisor to remain at the site until the Engineer is satisfied that the Contractor's personnel have mastered the proper handling, mixing and application of the materials.

5. Schedule and Engineer Approval

a. Submit a schedule for surface preparation and painting at least 30 days prior to beginning Work.

b. At least 10 days prior to painting, notify the Engineer.

c. Do not paint steel until approval to proceed is given by the Engineer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in the manufacturer's original unopened packages and containers bearing manufacturer's name, label and the following information:

1. Manufacturer's name.
2. Name or title of material.
3. Manufacturer's stock number and date of manufacture.
4. Shelf life.
5. Contract or order number under which the material has been ordered.
6. Lot and batch numbers.

B. Store materials not in actual use in tightly covered containers at a minimum ambient temperature of 45 degrees F and a maximum temperature of 90 degrees F in a well-ventilated area. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all necessary precautionary measures to ensure that workmen and Work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of materials.

C. Provide paint ready mixed to approved colors. Construction site tinting is prohibited.

D. Extra Material

Where requirements for extra materials are shown on the Contract Drawings, deliver to the Engineer prior to issuance of the Certificate of Final Completion not less than one gallon of each color of each coating applied as Work of this Section. Deliver extra material in the manufacturer's original, unopened containers, clearly labeled with product identification and Contract number.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

A. Provide paint systems and products of manufacturers in accordance with Appendix "B" to this Section, or approved equal.

B. When materials or products proposed to be used are products of manufacturers other than manufacturers specified in Appendix "B" to this Section, submit product information in accordance with the requirements of Division 1 - GENERAL PROVISIONS clause entitled "Substitution".

2.02 MATERIALS

A. Provide colors as shown on the Contract Drawings, or if not shown as required by the Engineer.

2.03 MIXES

A. Verify that the paint to be mixed has not exceeded its shelf life.

B. Mix and prepare painting materials in accordance with the manufacturer's technical data sheets subject to approval by the Engineer and 1.05 C.

C. Stir materials before application, and as required during application to produce a mixture of uniform density. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

D. Mix only complete kits of multi-component materials.

E. Colors

Each undercoat shall be a contrasting color to facilitate identification of each coat where multiple coats are to be applied as shown on the Contract Drawings.

2.04 ABRASIVES

A. Provide expendable or recyclable abrasives that are dry and free of oil, grease and corrosion-producing or other deleterious contaminants.

B. For the preparation of steel that is specified to be blasted, provide abrasives that are sized to produce a sharp, angular, uniform anchor pattern with a profile height of 2-3 mils, unless the requirements of the coating manufacturer are more restrictive. In this case, comply with profile requirements specified by coating manufacturer.

2.05 EQUIPMENT

A. Surface Preparation Equipment

1. Provide brushes, discs, wheels, scrapers, water jetting, blast cleaning and other surface preparation equipment sized properly to conduct the Work as specified in this Section and shown on the Contract Drawings.

2. Provide specialized equipment for the surface preparation of difficult-to-clean areas. Specialized equipment may include, but is not limited to:

a. Angled nozzles or short nozzles for abrasive blast cleaning.

b. Spin blast equipment.

B. Paint Application Equipment

1. Provide paint brushes, rollers and spray equipment to conduct the Work as specified in this Section.

2. Provide specialized equipment as required for the painting of difficult-to-paint areas. Specialized equipment may include, but is not limited to:

a. Angled brushes for backs of nuts and bolts and other hard to reach areas.

b. Mitts, daubers or other methods to supplement brush application.

PART 3. EXECUTION

3.01 PREPARATION

A. General

Perform preparation and cleaning procedures in accordance with the paint manufacturer's technical data sheets subject to approval by the Engineer and as specified in this Section, for each particular substrate condition.

1. Ensure paint system compatibility in accordance with 1.04 A.

2. Do not conduct final surface preparation which exposes the substrate to damp environmental conditions, or when the surface temperature is less than 5 degrees F above the dew point.

3. Remove hardware, hardware accessories, machined surfaces, lighting fixtures and similar items in place and not to be painted, or provide surface-applied protection prior to surface preparation and painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.

4. When previously painted surfaces requiring field top coating are glossy (greater than 50 units at 60 degrees), first dull them using a 120 grit or greater (finer) grade sandpaper.

5. Thoroughly clean and remove all dust, oil, grease and other contaminants from surfaces to be painted. Schedule cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

B. Surface Preparation

1. Steel

Remove slag, flux deposits, weld splatter and surface irregularities such as slivers, tears, fins and hackles; follow AWS Guidelines. Grind any resulting burrs smooth, including burrs around holes, if any. Do not remove any welding material that will weaken weld strength.

Prior to preparation, break sharp edges such as those created by flame cutting and shearing. Do not break rolled edges of angles, channels and wide flange beams without Engineer's approval.

Clean surfaces to remove oil, grease, soil and other soluble contaminants in accordance with SSPC-SP1 Solvent Cleaning. Where shown on the Contract Drawings, prepare surface in accordance with one or more of the following: SSPC-SP 2, SSPC-SP 3, SSPC-SP 5, SSPC-SP 6, SSPC-SP 7, SSPC-SP 10 and SSPC-SP 11. For welds, edges and holes, prepare surfaces to the same cleanliness level and profile as the surrounding steel.

a. Steel – Blast Cleaned

Unless otherwise shown on the Contract Drawings, perform abrasive blasting in accordance with SSPC-SP 10 Near White Blast Cleaning using a production line shot and grit blast machine or by air blast. Maintain the abrasive work mix such that the final surface profile is within the required range. Use SSPC-VIS 1 to evaluate the degree of cleaning.

b. Provide expendable or recyclable abrasives that are dry and free of oil, grease, and corrosion producing, or other deleterious contaminants. Daily (or more frequently if required) check the abrasive for oil, grease or dirt contamination with the vial test. The test consists of adding a sample of abrasive from the inside of the blast machine to a sealable vial filled with deionized water. The vial is shaken for one minute and allowed to settle for five minutes. If any oil or grease is floating on top of the water, then the abrasive is contaminated. If the water becomes cloudy, then it contains dirt. Do not use contaminated or dirty abrasives to blast steel surfaces.

c. Compressed Air Cleanliness

(1) Provide compressed air that is free from moisture and oil contamination.

(2) Use the white blotter test in accordance with ASTM D 4285 to verify the cleanliness of the compressed air. Conduct the test at least once per day for each compressor system. Sufficient freedom from oil and moisture is confirmed if soiling or discoloration are not visible on the paper.

(3) If air contamination is observed, change filters, clean traps, add moisture separators or filters or make adjustments as necessary to achieve clean, dry air. Reinspect surfaces prepared or coated since the last satisfactory test and repair, at no cost to the Authority, defective Work caused by contaminated air.

d. Surface Profile

The steel surface profile shall be 2-3 mils. Measure the surface profile of each girder, beam or diaphragm at three locations, paying special attention to areas that may have been shielded during blasting. Measure the surface profile using Testex Replica Tape in accordance with ASTM D 4417. File the impressed tapes with the Quality Control inspection records.

2. Galvanized Steel Surfaces

a. Hot-dip galvanizing shall be by the "dry kettle" process. Do not quench galvanized items following galvanizing nor shall galvanized surfaces be treated with waxes, oils or chromates.

b. Chemical Treatment

Prepare the surface for painting in accordance with ASTM D 6386 Zinc Phosphate Treatment. Follow the manufacturer's instructions for use of the materials. Prior to chemical treatment, remove white rust and other contaminants.

3. Aluminum Surfaces

Clean surfaces of oil, grease, dirt, and other foreign substances. Do not damage the aluminum. Use solvent cleaning in accordance with SSPC-SP 1.

4. Cementitious Materials

Prepare cementitious surfaces (concrete, concrete block and cement plaster) by removing efflorescence, chalk, dust, dirt, grease and oils. Remove oil and grease by detergent water cleaning and steam cleaning. Do not use solvents. For concrete surfaces, after removing oil and grease, prepare the surface for painting by abrasive blasting.

a. For concrete and other cementitious materials, perform appropriate tests as described in 1.03 A.5 to ensure that the moisture content is at or below the limit for painting and use only materials that are capable of being applied to alkaline surfaces. Do not paint over surfaces where moisture content exceeds that permitted in 1.03 A.5.

5. Wood

Wipe off dust and grit from miscellaneous wood items and millwork prior to priming, using a solution of tri-sodium phosphate and water. Rinse off surfaces with clean water. Spot coat knots, pitch streaks and sappy sections with sealer. Fill nail holes and cracks after primer has dried and sand with a fine grade sand paper between coats. Back prime interior and exterior woodwork.

a. Where clear finishes are shown on the Contract Drawings, ensure that fillers match wood tint. Work fillers into grain. Wipe excess from the surface.

3.02 APPLICATION

A. General

1. Apply paint in accordance with SSPC-PA 1 and the manufacturer's technical data sheets subject to approval by the Engineer. Use applicators and techniques best suited for substrate and type of material being applied. Follow the manufacturer's technical data sheets, subject to approval by the Engineer, for cure times, temperature and humidity conditions and recoat times as the individual coats of the specified system are applied.

   a. For blast cleaned steel, apply the prime coat on the same day (within 12 hours) that the substrate was cleaned. If the base substrate is allowed to remain uncoated for more than 12 hours, or rerusting is observed, reblast the steel prior to painting.

2. Do not apply paint in areas where dust is being generated.

3. Apply each coat at proper consistency. After each coat has dried, visually examine for pinholes, fish eyes, blisters, runs, sags and missed areas. Repair defects and repaint.

4. Apply additional coats when undercoats, stains or other conditions show through top coat of paint, until paint film is of uniform finish, color and appearance. Apply stripe coats of the prime and finish coat to all edges, corners, crevices, welds and other surface irregularities.

5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.

6. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

7. Paint backsides of access panels, and removable or hinged covers to match exposed surfaces.

8. Finish exterior doors on tops, bottoms and side edges the same as exterior faces.

9. Sand lightly between each succeeding enamel or varnish coat.

10. Omit first coat (primer) on metal surfaces which have been shop-primed.

11. Paint primed surfaces to color shown on the Contract Drawings.

12. Where shown on the Contract Drawings, prime and paint the following to match adjacent surface: exposed bare pipes, ducts, conduits, boxes, hangers, brackets and supports, except where items are covered with a prefinished coating.

13. Color code equipment, piping conduit and exposed ductwork as shown on the Contract Drawings.

B. Scheduling Painting

Apply paint to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Allow sufficient time between successive coats to permit proper drying. Abide by the coating manufacturer's minimum and maximum recoat times subject to approval by the Engineer. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Coating Thickness

Apply materials at the manufacturer's recommended spreading rate, to establish a total dry film thickness as shown on the Contract Drawings or, if not shown, as recommended by coating manufacturer and as approved by the Engineer. Monitor paint application rate by use of wet film thickness gage in accordance with ASTM D 4414. For metal surfaces, measure dry film thickness in accordance with SSPC-PA 2. Use a non-ferrous guage to measure coating thickness on galvanized surfaces or aluminum.

1. Give special attention to ensure that surfaces such as edges, corners, crevices, welds and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

2. Apply additional coating to areas of insufficient thickness. Use care during application to assure that all repairs blend in with the surrounding surfaces.

3. Unless directed otherwise by the Engineer, remove excessive coating thickness and reapply the affected coat(s).

D. Coating Adhesion

1. Apply all coats in such a manner to assure that they are well-adhered to each other and to the substrate. If the application of any coat causes lifting of an underlying coat, or if there is poor adhesion between coats or to the substrate, remove the coating in the affected area to adjacent sound, adherent coating and reapply the material.

2. If adhesion is suspect, conduct adhesion tests in accordance with ASTM D 3359 or ASTM D 4541 as directed by the Engineer and repair all test areas. The acceptance criteria for the testing will be established by the Engineer. Replace all defective coating that is revealed by the testing.

E. Completed Work

Match approved samples for color, texture and coverage. Remove, refinish or repair Work not in compliance with the requirements specified in this Section.

F. Field Painting – Fasteners

1. After erection or installation, all rust, scale, dirt, grease and other foreign material on bolts, nuts and washers shall be completely removed by solvent cleaning in accordance with SSPC-SP 1 followed by hand tool cleaning SSPC-SP 2, or power tool cleaning SSPC-SP 3.

2. Apply brush applications of primer and intermediate to bolts, nuts and washers after tensioning. Apply topcoat by spray application. Give careful attention to bolted connections to ensure that all bolts, nuts and washers are fully coated.

G. Repair of Damaged and Unacceptable Coatings

1. Surface Preparation of Localized Areas

   a. Repair localized damage, corrosion and unacceptable coatings.

   b. Prepare the surface by cleaning in accordance with SSPC-SP 1 Solvent Cleaning followed by SSPC-SP 2 Hand Tool Cleaning or SSPC-SP 3 Power Tool Cleaning. Use a solvent that is acceptable to the paint manufacturer.

   c. For previously blast-cleaned steel, if the damage exposes the substrate, remove all loose material and prepare the steel in accordance with SSPC-SP 11.

   d. For galvanized steel, repair damaged galvanizing in accordance with ASTM A 780. Use a zinc-rich coating containing a minimum of 92 percent zinc in the dry film.

2. Surface Preparation of Extensive Areas

   a. Repair extensive areas of damage or unacceptable coating by methods acceptable to the Engineer, based on the nature of the defect.

   b. For previously blast-cleaned steel, blast surfaces back to original requirements. Use extreme care to avoid overblast damage to the surrounding coating.

3. Feathering of Repair Areas

   a. Feather the existing coatings surrounding each repair location. Feather for a distance of 1 to 2 inches to provide a smooth, tapered transition into the coating.

   b. Verify that the edges of coating around the periphery of the repair areas are tight and intact by probing with a putty knife in accordance with the requirements of SSPC-SP 3 Power Tool Cleaning. Roughen the existing coating in the feathered area to assure proper adhesion of the repair coats.

H. Coating Application in Repair Areas

1. When the bare substrate is exposed in the repair area, apply all coats of the system to the specified thicknesses.

2. When the damage does not extend to the bare substrate, apply only the affected coats.

3. Maintain the thickness of the system in overlap areas within the specified total thickness tolerances.

I. Clean-up

During progress of Work, remove discarded paint materials, rubbish, cans and rags daily. Upon completion of painting Work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.03 PAINT TESTING

A. The Authority reserves the right to conduct tests of the materials at any time, and any number of times during shop or field painting.

1. The Engineer may sample the paint(s) being used. A representative pint or quart sample of each component of paint(s) at the construction site will be transferred to metal containers, identified, sealed and certified in the presence of the Contractor.

2. Tests on paint samples may be conducted by the Engineer to confirm manufacturer's submittals made under Appendix "A". Any or all of the following tests may be conducted:

   a. Viscosity (Stormer @ 25 degrees C) KU, ASTM D 562.

   b. Percent Total Solids by Weight, ASTM D 2369.

   c. Volatile Organic Compounds (VOC), ASTM D 2369.

   d. Weight per Gallon, ASTM D 1475.

   e. Volume Nonvolatile Matter, ASTM D 2697.

   f. Pigment Content, ASTM D 2371.

   g. Percent Metallic Zinc in Primer, ASTM D 521.

   h. Specular Gloss of Finish Coat, ASTM D 523.

   i. Infrared Identification - of individual components and of the mixed coatings for 2 component materials. Obtain each spectrum by sandwiching a small quantity (i.e., 1-2 drops) of material between 2 potassium bromide plates and obtaining a transmission infrared spectrum. For the mixed and cured material, use a solid sampling technique.

3. If the Engineer determines upon review of laboratory tests that the material being used does not comply with the requirements specified in this Section, he may direct the Contractor to stop painting Work and remove non-complying paint, to repaint surfaces coated with rejected paint or to remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are incompatible.

3.04 PROTECTION

Protect other adjacent Work against damage by painting and finishing Work. Correct damage by cleaning, repairing or replacing, and repainting, as approved by the Engineer.

A. Provide "Wet Paint" signs to protect newly painted finishes. After completion of painting operations, remove temporary protective wrappings for protection of adjacent and existing conditions.

B. At completion of Work of other trades, touch-up and restore damaged or defaced painted surfaces.

C. Ensure that coated items are not shipped until cured. Protect all fully coated and cured items from handling and shipping damages using padded slings, dunnage, separators and tie-downs.

END OF SECTION

SECTION 09910

PAINTING

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Product Data

09910D01 Manufacturer's technical data sheets including the following information for each coating:

- DFT maximum
- Zinc content (zinc primers only)
- Slip coefficient (zinc primers only)
- Substrates
- Surface preparation
- Profile
- Storage temperature
- Primers
- Topcoats
- Application equipment, including touchup
- Sweat-in-time
- Pot life
- Application schedule -
  - Minimum surface/air temperatures and humidity
  - Maximum surface/air temperatures and humidity
- Drying schedule -
  - Dry to handle
  - Dry to topcoat
  - Maximum recoat
  - Cure

END OF APPENDIX "A"

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:

Catalog Cuts

16000B01 Conduit, and fittings.

16000B02 Wire and cable.

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"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

16110A01 Raceway systems - only when shop drawings are required by the Contract Drawings.

Catalog Cuts

16110B01 Conduit and Tubing.

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:

Shop Drawings

16115A01 Handholes.

16115A03 Frames and covers.

16115A04 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.

Catalog Cuts

16115B01 Conduit.

16115B02 Racking assemblies.

16115B03 Grounding assemblies.

16115B04 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

WIRES, CABLES, SPLICES, TERMINATIONS (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:

Catalog Cuts

16120B01 Catalog Cuts
a. Wires and cables for each type and size
b. Splice kit materials and installation procedures

Manufacturer Test Reports

16120F01 Submit certified shop test reports for wires and cables.

Record Documents

16120M01 Submit field test results for wires and cables, including "Megger" readings with the test method used.

END OF APPENDIX "A"

DIVISION 16

SECTION 16125

TRAFFIC SIGNAL CABLES

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for traffic signal cables.

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	Standard Specification for Soft or Annealed Copper Wire.
ASTM B 8	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
ASTM B 33	Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.
	Electrical Testing Laboratories, Inc. (ETL)
	International Municipal Signal Association (IMSA)
IMSA	Official Wire And Cable Specifications (Series 19/20-600 Volts).
	National Electrical Manufacturers Association (NEMA)
NEMA TS 2	Traffic Controller Assemblies with NTCIP requirements.
	National Fire Protection Association (NFPA)
NFPA 70	National Electrical Code (NEC).
	Underwriters Laboratories, Inc. (UL)

1.03 QUALITY ASSURANCE

Wires and cables that have been manufactured more than two years prior to installation shall not be used in the Work of this Section.

1.04 DELIVERY, STORAGE, AND HANDLING

Store material in a clean, dry space and protect from weather.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Traffic signal cable wires shall be soft annealed copper wire in accordance with ASTM B 33 for tinned coated conductors or ASTM B 3 for bare copper conductors and shall be stranded copper conductors with concentric stranding conforming to ASTM B 8.

B. Color-Coding for Conductors

1. Insulation or covering of wires and cables shall be factory color-coded by the use of colored compounds or coatings. Consistently follow the color-code throughout the performance of the Work.
2. Color-code for conductors shall meet the IMSA standards.

C. All wires, cables, splice and terminations for which there are established UL standards shall bear the UL label.

D. Traffic Signal Cable

1. Shall meet the requirements specified herein, shall be Underwriters Laboratories (UL) and Electrical Testing Laboratories (ETL) approved and shall bear such approval labels.
2. Conductors shall be stranded copper of the gauge and number shown on the Contract Drawings. Standard conductor size for traffic signal cable applications shall be #14 AWG. Where voltage drop exceeds 5 percent, the conductor size for the traffic signal cable shall be #12 AWG.
3. Each conductor shall be factory tested for insulation resistance and for continuity of conductors.
4. Cables shall have a 600-volt rating, shall be factory tested for each conductor insulation resistance and for continuity of conductors and shall conform to the following International Municipal Signal Association (IMSA) Specifications:
   a. Cable in conduit and raceways: IMSA Specification 19-1 for polyethylene insulated polyvinyl chloride jacketed signal cable, with individual color-coded conductors and black outer jacket.
   b. Aerial Cable: IMSA Specification 19-3 for polyethylene insulated polyvinyl chloride jacketed signal cable with integral messenger, with individual color-coded conductors and black outer jacket.

2.02 CONSTRUCTION FEATURES

A. Cable Tags

1. Dry and Wet Locations
   a. Polyethylene tags, 0.025-inches thick and 1-1/2-inches wide, with letters and numbers 7/8-inch wide, with 2-14 AWG nylon, weather-resistant cable ties.
   b. PVC tags, 0.025-inches thick and 9/16-inch wide, with letters and numbers 5/16-inch wide, with 2-14 AWG nylon, weather-resistant cable ties.

B. Splicing and Terminating

1. All splicing and terminating 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.

3. All cable terminations shall meet the requirements of NEMA TS 2.

PART 3. EXECUTION

3.01 PREPARATION

A. Prior to pulling wires and cables, clean raceway systems of 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. Locations, types, sizes and numbers of wires and cables are shown on the Contract Drawings. Where not indicated, provide traffic signal cable selection to comply with this Section and NFPA 70 standards.

B. Keep wires and cables dry at all times.

C. 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.

D. Pull wires and cables through conduits in such a manner as not to overstress or stretch any wire. Do not score out, twist or damage the protective covering or insulation. In the pulling of wire or cable into conduits, where the strain on the wire or cable may prove excessive, use wire lubricant. Without exception, provide all cables and wires in junction or pull boxes with an adequate amount of slack formed around the interior of the box.

E. After cables have been installed and pending permanent splicing, make a thorough inspection to determine that water has not entered the wires and cables and that the wires and cables have not been damaged. Carefully seal the end of each section of cable in hand holes and service panels or cabinets, using rubber tape, and paint with a sealing type of waterproof compound. All cables in hand holes shall be placed on cable racks while waiting to be permanently spliced.

F. Cables and wires installed in a conduit system shall be properly trained through the hand holes to permit racking and connection to traffic signal poles and controller cabinets.

G. For wiring trained through existing hand holes, if any, which are not equipped with cable racks, furnish and install a cable rack assembly. Provide ground bushing and bonding wire on all metallic conduit ends within such hand holes. Cable rack assemblies for installation in existing hand holes, if any, shall consist of four cable racks, including inserts and fasteners.

H. Install cable terminations and terminate cables with insulated spade terminals conforming to NEMA TS 2.

I. Provide one coil of slack wire, three feet minimum, in all pole bases and six feet minimum in rectangular hand holes to allow for proper connection of all wiring. The allowable slack specified shall be the minimum amount of slack required. At certain locations or under certain conditions additional slack may be necessary, as shown on the Contract Drawings.

J. Secure conductors to the cable racks using nylon cable ties. In circular hand holes, provide one coil of slack wire, eight feet minimum, secured in a loop with nylon cable ties and placed in the bottom.

K. Cable/Wiring Joints and Splices

1. Cable shall be run between units of equipment without splices except in pole bases or unless otherwise shown on the Contract Drawings.

2. Where joints or splices are specified:

a. Make them with compression solderless connector and secured mechanically and electrically. Thoroughly clean conductors with a minimum of insulation removed.

b. Insulate joints and splices with insulating tape and provide one and one half times the insulation equivalent to that of the original conductor. Insulate the taped joints and splices with resin splicing kits.

L. Identification of Wires and Cables

1. Identify each wire and cable by its signal number in all cabinets, boxes, manholes, hand holes, wire ways and other enclosures and access locations, and at all terminal points.

2. The signal number designations shall be as shown on the Contract Drawings. Attach tags to wires and cables in such a manner as to be readily visible.

3. Wrap tag ties around all conductors comprising the signal number to be identified.

3.03 FIELD TESTS

A. Test all wires and cables up to equipment installed under the Contract with a 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 codes that would apply if the Authority were a private corporation, *promptly replace the materials involved, at the Contractor's expense, and retest.*

B. When each wiring system is completed and before any connection is made to operating equipment, perform the following tests on each circuit in the presence of the Engineer to determine whether the installations are in acceptable working order:

1. Tests for continuity.

2. Tests for ground.

3. Tests for insulation resistance performed between circuit wires and from circuit wires to ground. Upon completion of the electrical system with fuses removed, or devices removed from the circuit, and before energizing, the insulation resistance shall not be less than 150 megohms between conductors or between conductor and ground on those circuits with a total single conductor length of 1,500 feet and over, and no less than 175 megohms for those circuits with a single conductor length of less than 1,500 feet.

C. Perform tests on the system as a whole. Circuits shall be complete, including all splicing from the control cabinet to all the devices it services.

END OF SECTION

SECTION 16125

TRAFFIC SIGNAL CABLES

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Samples

16125C01 Wires and cables for each types and size.

Manufacturer Test Reports

16125F01 Furnish four copies of wire and wiring test results identifying the observed readings with their respective circuits. Identify test results with the Contract title, the date of the test and the atmospheric conditions. The Contractor is responsible for recording data and preparing the report with test results.

16125F02 Submit certified shop test reports for wires and cables.

16125F03 Submit field test results for wires and cables, including "Megger" readings with the test method used.

Construction and Installation Procedures

16125G01 Termination and splice kit materials and installation procedures.

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"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Catalog Cuts

16127B01 Catalog cuts for control/signal transmission media.

Samples

16127C01 One (1) foot sample of each type of control/signal transmission media for approval.

16127C02 Sample splice kit materials and installation procedures.

Certificates

16127E01 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".

Manufacturer Test Reports

16127F01 Certified shop test reports for control/signal transmission media.

Manuals, Warrantees/Guarantees

16127I01 Maintenance requirements for cables.

Qualifications

16127K01 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.

Record Documents

16127M01 Field test reports indicating and interpreting test results.

END OF APPENDIX "A"

DIVISION 16

SECTION 16128

ARCPROOFING

PART 1. GENERAL

1.01 SUMMARY

This Section specifies arcproofing of low and medium voltage cables for new installations as well as existing installations from which asbestos fireproofing has been removed.

1.02 REFERENCES

American Society for Testing and Materials (ASTM)

ASTM D 1000	Test method for Pressure Sensitive Adhesive Coated Tapes used for Electrical and Electronic Applications
ASTM D 1518	Test methods for Thermal Transmittance of Textile Material
ASTM D 2843	Test method for the Density of Smoke from the Burning or Decomposition of Plastics
ASTM D 2863	Test method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastic (Oxygen Index)
OSHA	Occupation Safety and Health Administration

Underwriters Laboratories (UL)

UL 94V 0	Tests for Flammability of Plastic Materials for Part in Devices and Appliances

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

Acrproofing shall be furnished, and installed, and reinstalled if required in accordance with this Section and as specified on the Contract Documents.

1.04 QUALITY ASSURANCE

All work shall be performed and completed in a thorough, workmanlike manner and shall follow the best modern practice. All work shall be performed by mechanics skilled in their respective trades.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, protective packaging.

B. Store material in original packaging in a manner to prevent soiling and physical damage prior to installation.

C. Handle in a manner to prevent physical damage.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 ARCPROOFING MATERIALS

A. Fire Resistant Tape shall be Scotch (3M) No. 77 or approved equal.

B. Glass Cloth Tape shall be Scotch (3M) No. 69 or approved equal.

C. Cable Tags

Stainless steel metal tags, No. 28 gauge and 3/4 inch wide, embossed with letters and numbers 5/16 inch high, fastened to the cable at both ends of tags with nominal 1/16 inch diameter monel metal wire or stainless steel cable ties.

PART 3. EXECUTION

3.01 EXAMINATION

A. Inspect tape prior to installation. Defective tape shall be discarded.

3.02 INSTALLATION

A. Arcproofing shall be installed as follows:

1. Arcproof all wire and cables operating at greater than 600 volts (line to line).
2. Wires and cables shall be grouped by circuit and arcproofing applied over the group of cables comprising one circuit. Splices shall be arcproofed individually and the taping shall join with and be overlapped by the group taping.
3. 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 wrapped with opposing-lays.
4. Arcproofing shall be extended into the conduit opening or end bell of the raceway entering a handhole, manhole or box.
5. Arcproofing tape shall be 1 1/2 inch wide where the diameter of the individual cable, or the circumscribed circle for the circuit group, is less than 1 3/4 inches. For larger diameters, the tape shall be 3 inches wide.

B. Identification of Wires and Cables

1. Each wire and cable shall be identified by its circuit in all cabinets, boxes, manholes, handholes, and other enclosures, 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 that are arcproofed shall be identified outside of the applied arcproofing.

3.03 ADJUSTMENTS

A. Prior to final inspection, arcproofing that has been disturbed, for any reason, shall be reinstalled as soon as possible.

END OF SECTION

SECTION 16128

ARCPROOFING

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Catalog Cuts

16128B01 Submit catalog cuts for Fire Resistant Tape, Glass Cloth Tape and Cable Tags.

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/CABINETS, AND TERMINAL BOXES

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

16133A01 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.

Catalog Cuts

16133B01 Catalog cuts
a. Enclosures
b. Cabinets
c. Terminal blocks
d. All factory or field mounted devices and equipment shown on the control panel or Enclosure/Cabinet drawings.

Schedules

16133J01 Schedules
a. Nameplate nomenclature
b. Terminal block designations

Record Documents

16133M01 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"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

16135A01 Shop drawings
a. Special boxes
b. Boxes lager than 12 inches
c. Ancillary equipment if shown on Contract Drawings

Catalog Cuts

16135B01 All boxes and fittings

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"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

16140A01 Shop drawings
a. Installation details for surface mounted receptacles and switches
b. Installation details for "poke-through" assemblies
c. Installation details for floor service receptacles

Catalog Cuts

16140B01 Catalog cuts
a. Receptacles
b. Switches
c. Wallplates
d. Ground fault circuit interrupter receptacles
e. 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"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

16190A01 Submit layout drawings for dimensioned locations of inserts, sleeves and anchors when required by the Contract Drawings.

Catalog Cuts

16190B01 Catalog cuts
a. Hangers and supports
b. Sleeves
c. Fasteners

Calculations

16190H01 Submit calculations for the following:
a. Supporting steel sections and channels, properly reflecting installed and future loading, including:
1. Safety factors of not less than 4 to 1.
2. Deflection ratio of not greater than 1/240.
b. Special hangers and supports shown on the Contract Drawings
c. Hangers, supports and fasteners when required by but not specifically shown on the Contract Drawings.

END OF APPENDIX "A"

DIVISION 16

SECTION 16320

DRY - TYPE TRANSFORMERS
GENERAL PURPOSE - 600 VOLTS OR LESS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for general purpose, dry-type transformers 600 volts or less.

1.02 REFERENCES

Not Used.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

The transformers shall be designed, manufactured and tested in accordance with the applicable provisions of the codes, standards and recommendations of the following entities:

American Welding Society (AWS)
American National Standards Institute (ANSI)
Institute of Electrical and Electric Engineers (IEEE)
National Electric Manufacturers Association (NEMA)
National Fire Protection Association (NFPA)
Underwriter Laboratories Inc. (UL)

In addition, specific provisions cited herein and as shown on the Contract Drawings shall govern for the associated specific application.

1.04 QUALITY ASSURANCE

A. The manufacturer of transformers shall have manufactured equipment of the voltage and KVA rating(s) described herein and as shown on the Contract Drawings, and they shall have been satisfactorily used for the purposes similar to those intended herein for a minimum of three years. When directed by the Engineer, the Contractor shall have the manufacturer provide a list of installations and contracts for which he has produced such materials.

B. All Work of this Section shall be performed and completed in a thorough, workmanlike manner and shall follow the best modern practice in the manufacture of high-grade equipment. All Work of this Section shall be performed by mechanics skilled in their respective trades.

C. All parts shall be made accurately to standard gauge, where applicable, for ease of replacement and repairs.

D. All material selected for the manufacture of the transformer units shall be the best available for the purpose for which they are intended to be used, considering strength, ductility, durability and the best engineering practice.

E. All parts shall be readily accessible and like parts shall be interchangeable insofar as possible.

F. Surfaces to be welded shall be clean and free from dirt, rust or other foreign matter. The welding processes shall be in accordance with the requirements specified by AWS.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Transformers shall be delivered complete, in the manufacturer's original, unopened protective packaging. All accessories, including but not limited to meters, temperature gauges, lightning arrestors, fan controls and relays, shall be in place and wired. Packing materials shall be such as to prevent damage to components due to vibration, jarring or the like during transportation and handling.

B. Accessories or spare parts shipped loose shall be delivered in the manufacturer's original unopened protective packaging and shall be identified with a non-corrosive tag.

C. The transformers shall be handled 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 CONSTRUCTION FEATURES

A. General

Unless otherwise shown on the Contract Drawings, transformers shall conform to the following requirements:

1. Transformers shall be self-cooled, with properly designed steel enclosures. Openings for ventilation or similar use shall be so designed as to deflect foreign objects inserted through these openings away from contact with energized parts. Enclosures shall be suitable for floor or wall mounting, as required to fit within the constraints of each specific application. Transformers larger than 112.5 KVA shall be designed for floor mounting only. Outside dimensions of enclosures shall not exceed the dimensions shown on the Contract Drawings.

2. Transformers shall be provided with four 2 1/2 percent full capacity taps in the primary winding, two above and two below the nominal voltage rating. The taps shall be factory-wired to terminals accessible only by removal of external access plates or panels.

3. The maximum temperature at any spot on the exterior surface of the enclosure shall not exceed 50 degrees C rise above a 40 degrees C ambient.

4. Each transformer as a unit shall be capable of withstanding the stresses resulting from operating conditions, including external and internal short circuits, without distortion or other damage.

B. Core and Coil

1. Core and coil shall be completely isolated from the enclosure by rubber vibration isolating pads. The core shall be visibly grounded to the enclosure by a flexible grounding conductor, sized in accordance with applicable NEMA, IEEE and ANSI standards.

   a. Transformer neutral lead shall be ungrounded and brought-out to an isolated terminal.

   b. The enclosure shall include ground connection lugs for the incoming and outgoing conduits, and provisions for grounding the isolated neutral lead, all as shown on the Contract Drawings.

2. All cores shall be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities shall be kept well below saturation to allow for a minimum of 10 percent overvoltage excitation. Cores shall be clamped with structural angles and bolted to the enclosure to prevent damage during shipment or rough handling. All laminations shall be cut with the direction of the grain and be free of burrs, core plated and stacked without gaps.

3. Windings shall be copper-formed wire or sheet, continuous from start to finish. Splices in windings will not be permitted. Material incorporated must have at least a minimum of one year of proven field usage. Accelerated laboratory tests will not be acceptable.

4. Internal primary and secondary bus shall be rectangular copper. All buses shall be hot-dipped, silver-plated over the entire area where incoming or internal cable or bus are to be bolted.

5. Transformer impedance shall be within 7-1/2 percent of the impedance value shown on the Contract Drawings.

6. All joints and leads to the transformer terminals shall be braced or welded.

7. The basic impulse level (BIL) windings shall be a minimum of 10 KV.

C. Insulation Systems

Transformers shall be vacuum-impregnated with non-hygroscopic thermosetting varnish.

1. Transformer capacity shall be based upon a temperature rise of 80 degrees C for transformers 30 KVA and larger, and 115 degrees C for transformers less than 30 KVA above an ambient temperature of 40 degrees C.

   a. Transformer design for 115 degrees C rise shall be capable of delivering a 15 percent continuous overload, above nominal rating, without exceeding 150 degrees C rise above a 40 degrees C ambient temperature.

   b. Transformer design for 80 degrees C rise shall be capable of delivering a 30 percent continuous overload, above nominal rating, without exceeding 150 degrees C rise above a 40 degrees C ambient temperature.

2. Transformer insulation systems shall be 220 degrees C for transformers 30 KVA and larger, and 185 degrees C for transformers less than 30 KVA. All insulating materials shall conform to the requirements of NEMA ST 20, for 220 degrees C, UL recognized insulation systems.

D. Sound Levels

Transformers shall operate at sound levels at or below ANSI C 89.1, and as follows:

Transformer Size	Maximum Sound Level
0.1 to 9 KVA	40 db
10 to 50 KVA	45 db
51 to 150 KVA	50 db
151 to 300 KVA	55 db
301 to 500 KVA	60 db

E. Painting

The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed and finished with two coats of ANSI 61 light gray, baked enamel.

2.02 FACTORY INSPECTION AND TESTS

A. The Engineer reserves the right to inspect each transformer 112.5 KVA and larger at the factory and to witness each factory test. The Engineer shall be notified 15 working days in advance of each test. Failure to notify the Engineer of testing may necessitate retesting in the presence of the Engineer at no additional cost to the Authority.

B. The accuracy of the calibration of all instruments to be utilized during the tests shall be ascertained and recorded at the beginning of the tests.

C. Factory tests shall include, but not be limited to, the following:

Submit certified test data of new transformer designs, or of electrically duplicate transformer designs. The required test data shall be:

1. Efficiency at 25, 50, 75 and 100 percent load.

2. Percent regulation at 80 and 100 percent power factor.

3. No load and full loss in watts.

4. Impedance based on reference temperature.

5. Sound level in db of transformer in enclosure.

6. Average temperature rise based on 40 degrees C ambient temperature.

PART 3. EXECUTION

3.01 INSTALLATION

A. Install transformers in accordance with the Contract Drawings, the manufacturer's instructions and in compliance with the applicable requirements of ANSI, IEEE, NFPA and UL.

B. All conduit and bus connections to the transformer enclosures shall be made with flexible or other approved vibrationless connectors.

3.02 FIELD TESTS

A. General

1. Provide all labor and materials for functional tests required. Unless otherwise shown on the Contract Drawings, power for the tests will be furnished by the Authority.

2. Should the tests reveal any defects in transformers installed under this Section, promptly correct such defects and rerun the tests until the entire installation is satisfactory to the Engineer.

B. Perform the following field test in the presence of the Engineer to demonstrate the proper phasing of each transformer installation and submit a written field report to the Engineer for record:

1. Verify that the proper phase sequence is maintained.

2. Use a phase sequence meter or demonstrate the proper rotation of a small 3-phase motor whose direction of rotation was verified prior to the transformer installation.

3. Should the foregoing test reveal any incorrect phasing, promptly correct such defects and retest until the entire installation is satisfactory to the Engineer.

END OF SECTION

SECTION 16320

DRY TYPE TRANSFORMERS - GENERAL PURPOSE - 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:

Shop Drawings

16320A01 Shop Drawings
a. Physical dimensions of each transformer
b. Nameplate drawing for each transformer
c. Drawings showing location of all specified accessories
d. Technical specification for proposed transformer
e. Wiring diagram of fan cooling provisions
f. Details of current transformers

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"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Catalog Cuts

16450B01 Catalog Cuts for ground rods, connectors and connection materials, and grounding fittings.

Record Documents

16450M01 Ground Resistance Test Results

END OF APPENDIX "A"

DIVISION 16

SECTION 16452

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

BONDING

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

16452A01 Shop Drawings
a. Details of bonding of structural steel and reinforcing bars encased in concrete below grade
b. Steel and concrete shop drawings, including all required welds, bonding connections and recoating or patching of protective coatings
c. Layout drawings of test electrodes, cabling and test junction boxes

Certificates

16452E01 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.

Qualifications

16452K01 Submit qualifications of the Corrosion Specialist and a copy of NACE certificate.

Record Documents

16452M01 Submit 12 copies of all test data, and the final report.

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"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

16470A01 Shop Drawings for each enclosure/cabinet shall include:

a. Data sheet for each panelboard with the following information
   1. Job name
   2. Item number
   3. Panelboard nameplate(s) in accordance with the design drawings
   4. Quantity of this panelboard configuration
   5. Phase, wire and voltage
   6. Main and neutral Bus material, continuous current, current density, and momentary capacity.
   7. Short- circuit rating
   8. 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)
   9. Thru feed lugs, subfeed
   10. Ground bar with main lug on frame
   11. Branch connection information:
      (1) Circuit breakers rating, number of poles, type, manufacturer, and catalog number
      (2) Lugs and cables per phase, Cable size range
   12. Panelboard circuits breaker's arrangement for left and right side-top to bottom.
   13. Panelboard overall dimensions H x W x D
   14. Panelboard NEMA rating

b. Panelboard dimensional drawing. Indicate conduit entrance space at the top and bottom, knockout diagram and mounting details

c. Panelboard directory

Catalog Cuts

16470B01 Catalog Cuts

a. Panelboards and Cabinets

b. Circuit breakers

c. Family of time current characteristic curves for all types

Record Documents

16470M01 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:

Catalog Cuts

16475B04 Fuses

END OF APPENDIX "A"

DIVISION 16

SECTION 16550

ROADWAY LIGHTING

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for Roadway Lighting.

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 LTS-2	Structural Support for Highway Signs, Luminaires, and Traffic Signals

American Society for Testing and Materials (ASTM)

ASTM A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B 108	Aluminum - Alloy Permanent Mold Casting
ASTM B 117	Method of Salt Spray (Fog) Testing
ASTM B 136	Method for Measurement of Stain Resistance of Anodic Coatings on Aluminum
ASTM B 137	Method for Measurement of Weight of Coating on Anodically Coated Aluminum
ASTM B 221	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM B 244	Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basic Metals with Eddy-Current Instruments

Underwriters Laboratories (UL)

UL 57	Electric Lighting Fixtures
UL 1029	High-Intensity-Discharge Lamp Ballasts
UL 1572	High Intensity Discharge Lighting Fixtures

The Energy Policy Act of 1992

Lamp Efficiency Labeling and Standards

Illuminating Engineering Society of North America (IESNA)

ANSI/IES RP8-1983	American National Standard Practice for Roadway Lighting

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. The roadway lighting system shall provide safe and uniform illumination levels on roadway and parking lot pavements. The lighting levels shall be as specified or as produced by the lighting systems shown on the Contract Drawings. In no case the lighting levels shall be lower than recommended by the ANSI/IES RP8-1983 or it's latest editions.

B. The complete roadway lighting standard including shafts, luminaires, appurtenances and accessories shown on the Contract Drawings, including but not limited to: mast arms, traffic signals, pedestrian signals, fixed signs, arms, bases and anchor bolts shall be designed to support the weight of the equipment and withstand a maximum wind force of 90 mph (unless otherwise shown on the Contract Drawings) without sustaining permanent deformation, rupture or structural failure.

C. The roadway light standards and accessories shall be designed in accordance with AASHTO LTS-2. Maximum deflection shall be limited to 5 percent of shaft length under static load test.

D. Design calculations shall be certified by a Professional Engineer licensed in the State where the installation will take place.

E. Where a manufacturer's model number is shown on the Contract Drawings, it shall establish the standards of quality and performance, accessories, including the construction features, lighting and electrical performance, finish and other physical and technical properties of the equipment.

F. Roadway lighting fixtures shall be furnished with an optical assembly which complies with IESNA light distribution classification and as specified on the Contract Drawings.

G. Install and adjust roadway lighting as specified in this Section and on the Contract Drawings.

1.04 QUALITY ASSURANCE

Entities performing the Work of this Section shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, protective packaging.

B. Materials shall be wrapped for protection during delivery, storage, and handling. Wet or damp wrapping shall be removed, and disposed of, to prevent staining shaft finish.

C. Store materials in original packaging in a manner to prevent soiling and physical damage, prior to installation.

D. Handle in a manner to prevent damage to finished surfaces.

E. Where possible, maintain protective coverings until installation is complete and remove such coverings as part of final cleanup.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

Unless otherwise noted on the Contract Drawings, materials for roadway lighting standards and assemblies shall be as specified below, or approved equal:

A. Shafts, Mast Arms, Pole Caps - ASTM B 221, Aluminum alloy 6063 heat-treated to produce a T6 temper.

B. Anchor Bases (including Bolt Covers) and Transformer Bases - ASTM B 108, Aluminum alloy 356 heat-treated to produce a T6 temper.

C. Anchor Studs, Lockwashers, Flatwashers, Screws, Nuts, Bolts, and Hardware -Stainless Steel

D. Anchor Rods - Hot-rolled steel; galvanized in accordance with ASTM A 153 for thread exposure, plus 3 inches minimum toward "hook" end.

E. Anchor Couplings - Hot-rolled steel; galvanized in accordance with ASTM A 153.

F. Luminaire Housings - Low copper content (less than 0.4%) aluminum alloy 360.4 heat-treated to produce a T6 temper.

2.02 CONSTRUCTION FEATURES

A. General

1. Components and sizes (lengths and diameters) of roadway lighting standards and assemblies shall be as shown on the Contract Drawings.

2. Electrical equipment for which there is a nationally recognized standard shall be safety tested and bear the conformance labeling of the third party inspection authority, such as Underwriters Laboratories Inc. (UL), ETL, Factory Mutual, or approved equal, certifying that the lighting fixtures and electrical equipment are listed as suitable for the purpose specified and shown on the Contract Drawings.

B. Luminaires

1. General

a. Roadway luminaires described in this specifications are of three general types:

(1) Highway luminaires-pole mounted luminaires for open roadways.

(2) Underpass luminaires-ceiling or wall mounted luminaires for covered portions of roadways.

(3) Sign luminaires-sign mounted luminaires for traffic signs.

b. Supply and install roadway luminaires in accordance with Section 16510, this Section of specifications and lighting fixture descriptions and manufacturer's model number as shown on the Contract Drawings.

c. Unless otherwise noted on the Contract Drawings, roadway luminaires shall be constructed of a metal housing, optical assembly, and a lens door. All mounting hardware shall be constructed of corrosion resistant material.

d. Optical assembly shall consist of specular aluminum reflector and borosilicate glass refractor or flat lens. Polycarbonate, Acrylic or other plastic refractors and lenses are not permitted. Optical assembly shall be self-leveling and sealed with a breathing and filtering gasket to prevent entrance of airborne contaminates. Gasket shall be cemented full perimeter with no metallic clips or fasteners.

e. The hinge mounted lens door shall be fully gasketed and accessible for tool-less or single tool relamping.

f. Ballast shall be mounted on a removable tray and shall have quick disconnect electrical terminals for easy maintenance.

g. Unless otherwise noted on the Contract Drawings, roadway luminaires shall have an electrostatically deposited, thermally set, grey polyester powder coat finish.

h. There shall be optional factory prewired no-tool photoelectric control receptacle. Photocontrol receptacles shall be provided with a stop to prevent rotation beyond 350°.

i. The photometric light distribution of the roadway luminaires shall be classified by IESNA as a one of the following Types:

(1) Type I

(2) Type II (Type II four-way)

(3) Type III

(4) Type IV

(5) Type V

2. Highway luminaires:

a. Unless otherwise noted on the Contract Drawings, highway luminaires shall be a high-pressure Sodium (HPS) type with Type I, Type II or Type III photometric distribution.

b. Highway luminaires shall be furnished with cutoff, semi-cutoff or non-cutoff optics as specified on the Contract Drawings.

c. The highway luminaires shall be equipped with a latched and hinged power door for easy luminaire access.

d. The internal slipfitter shall be furnished with one-piece pipe clamp capable of adapting 1-1/4 through 2-inch pipe without rearrangement of clamp or bolts, and shall be adjustable at least $\pm$ 5° from horizontal.

3. Underpass luminaires:

   a. Underpass luminaires shall be supplied for direct ceiling mounting, direct wall mounting, or for use with surface conduits and boxes. Mounting boxes shall comply with the requirements specified in Section 16135 of this specification.

   b. Unless otherwise noted on the Contract Drawings ceiling mounted underpass luminaires shall be a HPS type with Type I or Type V photometric distribution.

4. Sign Lighting luminaires:

   a. Unless otherwise noted on the Contract Drawings ceiling sign luminaires shall be a Metal Halide (MH) type with wide photometric distribution.

   b. Sign luminaires shall be furnished with integral light shields to minimize back and side glare.

C. Lamps

1. A lamp shall be furnished for each lamp holder of each luminaire. Luminaires and lamps shall be of the type and wattage as shown on the Contract Drawings and as specified in this Section and in Section 16510 of these specifications.

2. Mercury Vapor lamps are not permitted for roadway lighting.

D. Ballasts

1. Unless otherwise noted on the Contract Documents ballasts shall be a Constant Wattage Auto transformer (CWA) type and shall comply with requirements of Section 16510 of these specifications.

2. HPS ballasts, which are not used in a 24-hour operation, shall be furnished with automatic protective starters. An automatic protective starter shall apply pulses for no more than 15 minutes and then deactivate if a lamp arc cannot be initiated.

E. Fuse Assemblies

Fuse assemblies shall be complete with 5 amperes, 600-volt fuses, with 18-inch long leads of No.10 Standard type XHHW or USE wire.

F. Shafts

1. Unless otherwise noted on the Contract Drawings, shaft shall be spun tapered, or octagonal tapered, seamless tubing. Shaft may be drilled to manufacturer's specification for mounting luminaires. Removable aluminum pole cap shall be provided for the top of each shaft.

2. Each shaft shall be furnished with a cable support hook mounted inside the top of the shaft.

3. Welding shall be performed on the shaft only at the anchor base. Field welding shall not be permitted.

4. Where design parameters will result in excessive vibration, shafts shall be provided with factory installed vibration dampeners. Vibration dampener size, location and mounting shall be in accordance with the manufacturer's recommendations, and as approved by the Engineer.

G. Mast Arms

The types and sizes of mast arms shall be as shown on the Contract Drawings.

H. Anchor Bases

Anchor bases shall be free from cracks, pits, and blow holes, and shall be provided with a grounding lug. The base shall be supplied with bolt covers and mounting hardware and shall have provision for anchoring to the transformer base.

I. Transformer Bases

1. Transformer bases shall be frangible type and shall be free from cracks, pits and blow holes. Transformer bases shall be breakaway approved and fatigue tested.
2. Each transformer base shall be sized in accordance with the manufacturer's specifications and by pole height, total weight and bolt circle.
3. All transformer bases shall be provided with internal lugs for mounting on anchorage and a tapped hole inside the base for mounting a ground stud.
4. The base shall be furnished with a suitably sized, lockable, hinged door.

J. Pole Foundations

Pole foundation details and concrete for the pole foundations shall be as shown on the Contract Drawings.

K. Finish

Unless otherwise shown on the Contract Drawings, shafts, mast arms and transformer bases shall be satin finished clear anodized. Anodic coatings shall comply with ASTM B 117, 0 136, 0 137, and 0 244.

L. Accessories

Hardware accessories: slip fitters, mounting plates, screws, nuts, washers, bolts and other hardware necessary for assembling the roadway lighting standards shall be provided. The exposed portion of studs, washers, hex nuts and other hardware shall be well greased.

M. Anchor Bolts

Anchor bolts, including anchor rods, anchor couplings, anchor studs, nuts, installation template and flatwashers and lockwashers, shall he furnished for each lighting standard.

PART 3. EXECUTION

3.01 INSTALLATION

A. Install concrete foundations, including conduits and anchor bolts, as shown on the Contract Drawings and in accordance with the manufacturer's anchor bolt template.

B. *Install underground conduits as shown on the Contract Drawings and as specified in* Section 16115 of this specification.

C. Install conduit bodies and mounting boxes for underpass luminaires as shown on the Contract Drawings and as specified in Section 16135 of this specifications.

D. Install roadway lighting standards, fixtures and appurtenances in accordance with the Contract Drawings, manufacturers' installation procedures and as specified herein.

E. Connect all equipment as required for proper operation and as shown on the Contract Drawings.

F. Set lighting standards plumb with variation off-true-vertical not to exceed 1/8-inch in ten feet. Vertical alignment shall be achieved by shimming, grouting or other approved means. Grout all bases after final alignment has been completed.

G. Set underpass and sign luminaires plumb with variations off-true-horizontal between two adjacent fixtures not to exceed 1/8-inch. Fixture mounting variations from a straight line between the first and the last fixture in a row shall not exceed 1/8-inch.

H. Requirements for mounting heights shall be as shown on the Contract Drawings.

3.02 FINISH REPAIR

All abraded or damaged anodized surfaces of roadway lighting standards, fixtures and appurtenances shall be repaired in a manner satisfactory to the Engineer.

END OF SECTION

SECTION 16550

ROADWAY LIGHTING

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

16550A01 Shop Drawings
a. Manufacturer's established installation procedure manuals for each type of specified roadway lighting standard and fixture.
b. For each roadway lighting standard and fixture type: Clearly illustrate assembly methods, detailed dimensions, anchor bolt templates, mounting details, materials, finishes, electrical components, and light sources.
c. For each ballast type: Submit manufacturer's data with ballast description, catalog number, lamp type, input voltage, input wattage, ballast factor, power factor, minimum starting temperature, operating temperature and wiring diagram.
d. Photoelectric Control Devices: Submit manufacturer's data for ambient light sensors and contactors.

Manufacturer Test Reports

16550F01 For each lighting fixture type: Submit independent testing laboratory photometric report, and performance data in IESNA format
a. Luminaire, ballast and lamp and optical assembly description and manufacturer's complete catalog number
b. Luminaire schematic drawing with basic dimensions
c. Isolux (isofootcandle) Curves for street and house sides
d. Lumen Utilization Curves for street and house sides
e. Zonal Lumen Summary Table
f. Input Watts
g. Luminaire Efficiency

Calculations

16550H01 For each roadway lighting standard type specified on the Contract Documents submit calculations verifying that total weight and Effective Projected Area (EPA) of the selected lighting standard with accessories and appurtenances do not exceed manufacturers Maximum Recommended Total Load.

END OF APPENDIX "A"

DIVISION 16

SECTION 16571

VEHICULAR TRAFFIC SIGNAL HEADS AND MOUNTING HARDWARE

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for vehicular traffic signal heads, including flashing signals, optically programmable units and light emitting diode (LED) signals.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American Society for Testing and Materials (ASTM)
ASTM B 85	Specification for Aluminum-Alloy Die Castings.
	Federal Communications Commission (FCC)
Title 47	Telecommunication.
	Federal Highway Administration (FHWA)
MUTCD	Manual on Uniform Traffic Control Devices.
	Institute of Transportation Engineers (ITE)
ITE ST-017B	Equipment and Material Standards of the Institute of Transportation Engineers.
---	Vehicle Traffic Control Signal Heads –Part 3: Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Modules.
ITE ST-052	Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Circular Signal Supplement.
---	National Electrical Manufacturers Association (NEMA)
NEMA TS 2	Traffic Controller Assemblies with NTCIP Requirements.
NEMA 250	Enclosures for Electrical Equipment (1,000 Volts Maximum).
	The Port Authority of New York and New Jersey (PA)
	Traffic Signal Design and Drawing Preparation Guidelines.
	Underwriters Laboratories, Inc. (UL)
UL 94VO	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
	US Department of Defense Military Standards
MIL-STD-883	Test Method Standard Microcircuits.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Vehicular traffic signal heads shall conform to requirements specified in this Section. Where specific requirements are not listed herein, the vehicular traffic signal heads shall, as a minimum, conform to the requirements of the standards and publications listed in 1.02.

B. The units furnished as Work of this Section shall be of the size, number of indicators, colors and faces shown on the Contract Drawings, constructed to standard similar dimension sections or combination head arrangements with lenses, aluminum alloy housings, mounting brackets and hardware, aluminum reflectors, lamps, visors, strobes, safety chains and, where shown on the Contract Drawings, with backplates.

C. Polycarbonate housings and visors in the quantities shown shall be furnished only if specified on the Contract Drawings.

D. Vehicular traffic signal heads shall consist of readily available and proven equipment, fully consistent with their intended design and operation as specified herein. Special or custom-built components may be used only upon written approval from the Engineer.

E. Use modular type construction with assemblies, sub-assemblies and modules that are available from a second source of supply wherever possible.

F. All assemblies, sub-assemblies and modules shall be readily accessible for removal, testing or replacement without removal of other modules, assemblies or components. Components shall be located so that there is visibility and access for the use of hand tools and standard test probes where maintenance is required. Test points shall be provided to facilitate troubleshooting.

1.04 ENVIRONMENTAL REQUIREMENTS

A. The vehicular traffic signal head equipment shall operate over an ambient temperature range from minus 40 degrees F to plus 165 degrees F (minus 40 degrees C to 74 degrees C). Operation of the vehicular traffic signal head equipment shall not be degraded by rain, snow, fog or normally encountered ambient humidity conditions.

B. The equipment shall be protected against the intrusion of dust and moisture to protect all internal components.

C. The equipment shall operate without degradation or damage under ambient shock (thermal and mechanical), vibration, lightning and electromagnetic/electrical interference at the construction site.

1.05 QUALITY ASSURANCE

A. Verify that all LED vehicular traffic signal heads have undergone Design Qualification (DQ) testing prior to shipment as specified herein and ITE ST-017B. Failure of any LED signal to meet requirements of the DQ tests shall be cause for rejection. If any equipment has been damaged or if, for any reason, the equipment does not comply with the requirements or test standards specified, the Contractor shall repair or replace the equipment at his own expense. Provide DQ process and test results documentation to the Engineer.

B. Ensure that all LED vehicular traffic signal heads undergo the following production Quality Assurance (QA) testing prior to shipment in accordance with ITE ST-017B. Failure of any LED signal to meet requirements of the QA tests shall be cause for rejection. If any equipment has been damaged or if, for any reason, the equipment does not comply with the requirements or test standards specified, the Contractor shall repair or replace the equipment at his own expense. Provide QA process and test results documentation to the Engineer.

1. Signal Burn-in.
2. Maintained Minimum Luminous Intensity.
3. Power Factor.
4. Current.
5. Visual Inspection.

C. After delivery of equipment, the Engineer may perform a construction site inspection of the equipment. If any equipment has been damaged or if, for any reason, the equipment does not comply with the requirements or testing hereof, the Contractor shall repair or replace the equipment at his own expense, even though the equipment had been inspected for shipment. After such satisfactory replacement and/or repair and the Engineer's subsequent written approval, the equipment may be installed.

D. After installation, test the equipment in the presence of the Engineer to show compliance with the requirements of this Section and with the Contract Drawings. Continue testing until the results are satisfactory to the Engineer. If any equipment has been damaged or if, for any reason, the equipment does not comply with this Section, the Contractor shall repair or replace the equipment at his own expense. Provide installation process and test results documentation to the Engineer. Perform any repairs, construction and modifications required to comply with the Specifications and the Contract Drawings.

1.06 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to the construction site in original unopened containers or bundles with labels, which 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 and other causes.

1.07 SPARE EQUIPMENT

For items with no second source of supply, provide replacement assemblies in quantities as shown on the Contract Drawings.

1.08 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Head Housing and Door: Virgin metal die cast aluminum alloy conforming to ASTM B 85 of one of the following alloys:

1. S12A (A14130).

2. S12B (A04130).
3. SC84A (A13800).
4. SC84B (A03800).
5. SG100B (A03600).

B. Backplates: 1/8-inch thick minimum, black Acrylonitrile Butadiene Styrene (ABS), ultraviolet (UV) stabilized plastic sheet with hair cell finish on the front side, smooth finish on the back side and 3-inch corner radii. Vacuum formed backplates shall have a 5/8-inch flange on all sides providing rigidity and structural integrity. Backplates shall be designed to precisely fit manufacturer's signal head and supplied with necessary mounting hardware.

C. Polycarbonate housings and visors shall be molded, ultraviolet and heat stabilized, flame retardant, unaffected by the heat of the lamp used and permanently colored.

D. All bolts, nuts, washers and lock washers supplied shall be stainless steel.

2.02 CONSTRUCTION FEATURES

A. General

1. Design signal head equipment for operation from line voltage at 120 plus or minus 3 VAC RMS nominal and over a voltage range from 80 VAC RMS to 135 VAC RMS, 60 Hz plus or minus 3 Hz, AC line power. Variations in operating line voltage shall have no visible effect on luminous intensity and shall not vary by more than 10 percent over the entire operating voltage range.
2. Signal heads, bracket arms and mounting attachments shall receive three coats of paint, each of which shall be baked after application. The first or primer coat shall be a non-lead or chromium containing paint for aluminum surfaces. The second and third coats shall be Federal Yellow matching Color No. 13538 conforming to Federal Standard No. 595B, except for the underside of visor, which shall be flat black enamel. Each coat shall be baked on separately. All metal surfaces to be painted shall be suitably cleaned of all foreign deposits, oil and grease, and then neutralized for priming. Paint separate parts before assembly. Do not paint stainless steel housing latching assembly.
3. Unless specified otherwise, equipment shall be fabricated in accordance with ITE ST-017B.
4. Identify all wire terminations and terminal block connections. At mast arm installations, bring separate continuous #14 AWG, 19 strand wires from the terminal block of the signal head to the traffic signal controller cabinet without splicing. At overhead span installations, secure separate continuous traffic signal cables to the span wire and terminate on the traffic signal head terminal block. Terminate cables with insulated spade terminals conforming to NEMA TS 2.

B. Vehicular Traffic Signal Heads

1. Shall be of the size, number of indicators, color and faces as shown on the Contract Drawings.
2. The Vehicular Traffic Signal Heads shall be of the type Optically Programmable or LED as specified herein and as shown on the Contract Drawings.

3. The housing for each signal face shall be of unitized sectional construction and shall consist of as many sections as necessary to provide the signal indications shown on the Contract Drawings. Rigidly and securely fasten sections together into a weather tight signal face. Adjustable traffic signal heads shall consist of two or more signal faces fastened to and supported by a pipe assembly and suitable entrance fittings. No special tools shall be required to fasten the signal heads together.

   a. Arrange each housing with openings in the top and bottom so that it may be rotated about a vertical axis between waterproof supporting brackets or trunnions and shall be capable of being securely fastened at increments of not more than five degrees of rotation, designed to accommodate standard 1-1/2-inch pipe brackets.

   b. The top and bottom of each housing shall have integral cast locking rings or other provisions to provide positive interlocking and indexing. The top and bottom housing coupler shall be free of sharp edges and protrusions that might damage conductor cable insulation and shall provide sufficient space for the entrance of the required signal cable. Provide tees or crosses equipped with pipe plug knobs or caps at the top and bottom of the housings that can be removed to assist in wiring. As an alternative, flat arms or spiders will be acceptable for use on the bottom of adjustable signals. One-section beacons may be supplied without bottom bracket arms.

   c. Each signal face shall be locked by engagement of serrations in the end signal sections engaging with similar serrations in the mounting bracket assembly. The serrations shall be recessed and integral with the signal section. All signal brackets shall be designed for use with a tabbed lock ring to lock the signal face in position.

   d. Housing construction shall permit the assembly of 12-inch signal sections with 8-inch signal sections of the same manufacturer. The assembly shall permit the joining of 8-inch sections to 12-inch sections, either above or below for vertical mounted signals and either to the right or left for horizontally mounted signals.

4. Provide neoprene gaskets between the body of the housing and the doors. The door shall be hinged and forced tightly against the gasket and the housing by a simple stainless steel locking mechanism.

   a. Cast hinge lugs integral with the door. All other exterior hardware such as hinge pins, lens or clips shall be stainless steel. The locking device shall operate without the use of tools.

   b. Arrange hinges to allow convenient re-lamping. On the outside of the door, there shall be a rim encircling the lens opening to prevent any light leakage between optical systems.

   c. Each door shall contain four Number 10-24 tapped holes equally spaced and straddling the vertical centerline through bosses on the door to accommodate visor clip connections on the outside and lens clip connections on the inside of the door.

5. Provide each completed vehicular traffic signal head with a barrier type terminal block, equipped with connectors for the lamp receptacle leads and screw terminals for the field wires, located within the bottom section of the signal unit. The terminal board for standard three-section units shall be a four-position, eight-terminal, barrier-type strip. Attach the white, red; orange and green color-coded section leads to one side of each terminal strip leaving the opposite terminals for field wires. All wires shall be stranded 18 AWG minimum with an insulation rating of 221 degrees F (105 degrees C). Greater than three-section head clusters shall be designed accordingly.

6. The visors shall be separate and removable from the doors, held in place by stainless steel fastenings attached to the door in such a manner as to prevent the possibility of any light leakage between the door and the visor hood, which might be discernible from the side. Fabricate visors of sheet aluminum, not less than 0.050 inches thick, and equip with bayonet slots or other provisions to permit snap-on attachment and rotation of the visor.

   a. Visors shall be either the standard open type or the type shown on the Contract Drawings. *Paint the inside of the visors flat black to minimize light reflection to* the sides of the signal.

   b. Visors shall tilt down from the horizontal a minimum of 3-1/2 degrees and shall be 10 inches nominally in length for 12-inch diameter lenses and 8 inches nominally in length for 8-inch diameter lenses.

7. Directional Louvers

   a. Furnish and install directional louvers in signal visors where shown on the Contract Drawings.

   b. Directional louvers shall be so constructed as to have a snug fit in the signal visors. The outside cylinder shall be constructed of 0.030-inch nominal thickness, or thicker, sheet steel and the vanes shall be constructed of 0.016-inch nominal thickness, or thicker, sheet steel or the cylinder and vanes shall be constructed of 5052-H32 aluminum alloy of equivalent thickness. Dimensions of louvers and arrangements of vanes shall be as shown on the Contract Drawings.

   c. The entire surface of louvers used in front of signal lenses shall be painted a flat black to minimize light reflection to the sides of the signals.

8. Provide removable black ABS, UV-stabilized plastic backplates at locations and of configuration shown on the Contract Drawings, 1/8-inch minimum thickness. Backplates shall attach to the signal head in such a manner so as not to obstruct the signal housing door opening. The backplates shall be designed to precisely fit manufacturer's signal head and shall be supplied with necessary hardware.

9. The housing assembly shall accommodate the installation and/or replacement of either Optically Programmable or LED vehicular traffic signal head as specified herein.

10. Polycarbonate housings and visors in the quantities shown shall be furnished only if specified on the Contract Drawings.

a. The polycarbonate housing shall be one piece molded or shall be fabricated from two or more pieces joined into a single piece. The housing thickness shall be a minimum of 0.090 inches thick. All sections shall be identical and interchangeable with each other and shall be so designed that they interlock with each other forming a weatherproof assembly. Hinges or lugs shall be located inside each section for attaching the reflector assembly. Each signal section shall be dust-tight.

b. The polycarbonate-housing door of each section shall be a one-piece unit with an opening of sufficient diameter to accommodate the lens. On one side of the door, at top and bottom, there shall be a hinge so as to ensure perfect alignment of the door. On the opposite side of the door, there shall be a wingnut assembly-locking device to ensure even gasket pressure. Twelve-inch signal sections shall be secured with two wingnut assemblies. Hinge pins and locking device shall be stainless steel.

c. Each polycarbonate signal face shall be provided with polycarbonate or metal visor. Polycarbonate visors shall be a minimum of 0.100-inch thick, formed from sheet polycarbonate or assembled from one or more injection, rotational or blow molded polycarbonate sections of black homogeneous colored material with a lusterless finish. Sections shall be joined using thermal, chemical or ultrasonic bonding.

d. Polycarbonate signal faces that require backplates shall be provided with ABS backplates, a minimum of 1/8-inch thick.

C. Optically Programmable Vehicular Signal Heads

1. Optically programmable vehicular signal heads, if any, shall be located as shown on the Contract Drawings. Such units shall permit the visibility zone of the indication to be determined optically without hoods or louvers. The projected indication may be selectively visible or veiled anywhere within 15 degrees of the optical axis. No indication shall result from external illumination nor shall one light unit illuminate a second.

2. The optical system shall be comprised of the lamp, a lamp collar, an optical limiter/diffuser and the objective lens.

a. Lamp shall be a nominal 150 watts, 120 VAC, three prong, sealed beam having an integral reflector with stippled cover and an average rated life of at least 7,000 hours, coupled to the diffusing element with a collar including a specular inner surface. The diffusing element may be discrete or integral with the convex surface of the optical limiter/diffuser.

b. The optical limiter/diffuser shall provide an accessible imaging surface at focus on the optical axis for objects 900 to 1,200-feet distance, and shall permit an effective veiling mask to be variously applied as determined by the desired visibility zone. Provide the optical limiter/diffuser with positive indexing means, composed of heat resistant glass or polycarbonate.

c. The objective lens shall be a high resolution, planar incremental lens hermetically sealed within a flat laminate of weather resistant acrylic, or approved equal. The lens shall be symmetrical in outline and able to be rotated to any 90-degree orientation about the optical axis without displacing the primary image.

d. The optical system shall accommodate projection of diverse, selected signal displays to separate portions of the roadway such that only one display will be apparent to any viewer.

3. Mount the signals to standard 1-1/2 inch pipe fittings as a single section, as a multiple section face, or in combination with other signals, as shown on the Contract Drawings. Provide the signal sections with an adjustable connection that permits incremental tilting from 0 to 10 degrees above or below the horizontal while maintaining a common vertical axis through couplers and mounting. Terminal connection shall permit external adjustment about the mounting axis in 5-degree increments. Construct the signal such that it can be installed with ordinary tools and serviced with no tools.

a. Visor, backplate and adapter attachments shall conform and readily fasten to mounting surfaces without affecting the water and light integrity of the signal.

b. Arrange the programmed signal heads for rigid mounting to maintain optical orientation with the roadway. Where span wires are used, securely tether to the lower span wire.

4. The lamp fixture shall be comprised of a separately accessible housing and integral lamp support, an indexed ceramic socket and a self-aligning, quick-release lamp retainer. Provide electrical connection between the case and lamp housing with an interlock assembly that disconnects the lamp housing when opened. Each signal head shall include a covered terminal block for screw attachment of field wires.

5. Provide each signal section with integral means for regulating its intensity between limits as a function of individual background illumination. Lamp intensity shall not be less than 97 percent of uncontrolled intensity at 1,000 ft-c. and shall reduce to 15 plus or minus 2 percent of maximum at less than one ft-c. over the applied voltage and ambient temperature range. Response shall be proportional and essentially instantaneous to any detectable increase in illumination from darkness to 1,000 ft-c. and damped for any decrease from 1,000 ft-c.

a. The intensity controller shall be comprised of an integrated, directional light sensing and regulating device interposed between the lamp and field wires; responsive over an applied voltage of 105 VAC RMS to 135 VAC RMS, 60 Hz plus or minus 3 Hz, AC line power, and may provide phase-controlled output voltage but shall also have a nominal open circuit terminal impedance of 1,500 ohms.

b. The light intensity mechanism shall not produce electrical noise or interference sufficient to adversely affect the operation of solid-state electronic equipment used in the traffic signal controllers and associated auxiliary equipment and shall not cause false tripping of the conflict monitors.

D. LED Vehicular Traffic Signal

1. General

a. LED vehicular traffic signal shall not require special tools for installation when used as a retrofit replacement for existing traffic signal lamps.

b. LED vehicular traffic signal shall fit into new or existing traffic housings built in accordance with ITE ST-017B without any modification to the housing.

c. LED vehicular traffic signal shall be weather tight, shall fit securely in the housing and shall connect directly to existing electrical wiring.

d. Installation of a retrofit replacement LED vehicular traffic signal into the existing signal housing shall require only the removal of the existing optical unit components, i.e., lens, lamps, gaskets and reflector.

e. Each retrofit kit shall include all necessary components to complete conversion, including a one-piece gasket.

2. LED Signal Lens

a. The LED signal lens may be a replaceable part, without the need to replace the complete LED signal.

b. The LED signal lens may be tinted with the appropriate color to enhance on/off contrast. The material used to tint the lens shall not affect the luminous intensity or chromaticity and shall be uniform across the face of the lens.

c. The LED signal lens shall be polycarbonate and shall withstand ultraviolet light (direct sunlight) exposure for a minimum time period of five years without exhibiting evidence of deterioration.

3. LED Signal Construction

a. The LED signal shall be a single, self-contained device, not requiring on-site assembly, for installation into the existing traffic signal housing.

b. All LEDs shall be rated for 100,000 hours or more at 77 degrees F (25 degrees C) and 20 milliamps.

c. All internal LED and electronic components shall be adequately supported to withstand mechanical shock and vibration from high winds and other sources.

d. The signal enclosure shall be made of UL 94VO flame-retardant materials. The lens is excluded from this requirement.

e. The LED signal shall have a prominent and permanent vertical indexing indicator for correct indexing and orientation inside the signal housing.

f. Each individual LED signal shall be identified for warranty purposes with the manufacturer's name, serial number and operating characteristics, such as rated voltage and power consumption.

g. The LED arrow signal pattern shall conform to ITE ST-017B Vehicle Traffic Control Signal Heads – Part 3: Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Modules for color, size and shape. The LED arrow signal shall not require a specific orientation or have a variance in light output, pattern or visibility for any orientation.

h. The LED ball signal shall conform to ITE ST-017B and Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Circular Signal Supplement for color, size and shape.

i. The beam color, beam intensity and radiation pattern shall conform to the requirements for maintained minimum luminous intensity for LED signal and chromaticity as specified in ITE ST-017B Vehicle Traffic Control Signal Heads – Part 3: Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Modules and ITE ST-052 Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Circular Signal Supplement.

j. Red LEDs shall be AlInGaP(Aluminum Indium Gallium Phosphorus) and shall be ultra bright type. ALGaAs LEDs are not permitted.

k. Green LEDs shall be GaN (Gallium Nitride) and shall be ultra bright type.

l. Yellow LEDs shall be AlInGaP (Aluminum Indium Gallium Phosphorus) and shall be ultra bright type. ALGaAs LEDs are not permitted.

4. Environmental Requirements

a. LED signal shall satisfy all the environmental requirements specified in 1.04.

b. LED signal, when properly installed with gasket, shall be protected against dust and moisture intrusion per requirements of NEMA 250 Type 4 enclosures to protect all internal LED, electronic and electrical components.

5. Luminous Intensity

a. The Maintained Minimum Luminous Intensity shall be in accordance with ITE ST-017B Vehicle Traffic Control Signal Heads – Part 3: Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Modules and ITE ST-052 Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Circular Signal Supplement.

6. Chromaticity

a. The measured chromaticity coordinates of the LED signal shall conform to the chromaticity requirement of ITE ST-017B Vehicle Traffic Control Signal Heads – Part 3: Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Modules and ITE ST-052 Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Circular Signal Supplement.

7. Electrical

a. The LED signal shall operate from a 60 plus or minus 3 Hz AC line over a voltage range of 80 VAC RMS to 135 VAC RMS. The current drawn shall be sufficient to ensure compatibility and proper triggering and operation of load switches and conflict monitors in the signal controller units.

b. Nominal operating voltage for all measurements shall be 120 plus or minus 3 VAC RMS.

c. The 8-inch nominal and 12-inch nominal LED ball shall consume no more than 20 watts and 30 watts respectively. The 8-inch nominal and 12-inch nominal LED arrow shall not consume more than 15 watts and 20 watts respectively.

d. The forward current, as measured through each LED, shall not exceed 60 percent of the LED manufacturer's maximum current rating when operating at 77 degrees F (25 degrees C).

e. The LEDs shall emit no visible light when subjected to a 120 VAC, 4-milliamp leakages current from a NEMA-rated solid-state load switch (load switch in the off state).

f. The LEDs shall be wired in series parallel strings. The failure of any one LED, and its associated string of LEDs, shall not cause the loss of more than 20 percent of the light output of the complete LED signal.

g. The LED circuitry shall prevent flicker at less than 100 Hz over the voltage range specified above.

h. The LED circuitry shall include voltage surge protection against high-repetition noise transients and low-repetition noise transients as stated in NEMA TS 2.

i. The LED signal, including its circuitry, shall meet FCC Title 47, Subpart B, Section 15 regulations concerning the emission of noise.

j. The LED signal shall provide a power factor of 0.90 or greater over the operating voltage range and temperature range specified above.

8. Total harmonic distortion (current and voltage) induced in an AC power line by an LED signal shall not exceed 20 percent over the operating voltage range and *temperature range specified above.*

9. Design Qualification Testing

Complete and document the Design Qualification testing described below. Carry out all Design Qualification testing after a burn-in (module energized for a minimum of 24 hours at 100 percent duty cycle and at an ambient temperature of 140 degrees F (60 degrees C)). Signals submitted for test shall be representative of typical production units.

a. The LED signal shall be measured for chromaticity per the requirements of this Section and ITE ST-017B using a spectroradiometer at an ambient temperature of 77 degrees F (25 degrees C).

b. The LED signal shall be measured for power factor per the requirements of this Section by an independent testing laboratory.

c. The LED signal shall be measured for total harmonic distortion per the requirements of this Section by an independent testing laboratory.

d. The LED signal shall be tested for electronic noise per the requirements of this Section with reference to Class A emission limits referenced in FCC Title 47, Subpart B, Section 15 by an independent testing laboratory.

e. The LED signal shall be tested for compatibility with controller unit, conflict monitor and load switches. These tests are to be conducted in accordance with ITE ST-017B.

f. The LED signal shall be tested for transient immunity (e.g., early electronic component mortality failures, component reliability problems) using NEMA TS 2 by an independent testing laboratory.

g. Mechanical vibration testing shall be performed on the LED signal, by an independent testing laboratory, in accordance with MIL-STD-883, Test Method 2007, using three 4-minute cycles along each x, y, and z axis, at a force of 2.5 Gs, with a frequency sweep from 2 Hz to 120 Hz. The loosening of the lens or of any internal components or any other physical damage shall be cause for rejection.

h. The maintained minimum luminous intensity testing shall be in accordance with ITE ST-017B.

E. Electrical Connections

Wire the traffic signal heads to implement the signal operations shown on the Contract Drawings. At mast arm installations, separate continuous #14 AWG, 19 strand wires shall be brought from the terminal block of the signal head to the base of pole and spliced to the traffic signal cable. At overhead span installations, separate continuous traffic signal cables shall be secured to the span wire and terminated on the traffic signal head terminal block.

F. Mechanical Connections

Furnish safety chain and bolted connections securing the signal heads to the mast arm on all installations. The safety chain shall be a minimum of 1/4 inch hot-dip galvanized coil proof straight link chain with 5/16 inch stainless steel bolts, nuts, flat and lock washers.

PART 3. EXECUTION

3.01 PREPARATION

A. Before manufacture or procurement of equipment, submit Catalog Cuts and Shop Drawings outlining the construction and operation details of all equipment for prior Engineer approval as specified in 1.08. No equipment shall be procured until the Engineer has given written approval.

B. Related equipment to be removed and not required for relocation under the Contract, if any, as shown on the Contract Drawings, shall remain the property of the Authority and shall be delivered to a location in the Port District as designated by the Engineer. Removed equipment, if any, shall not be used in a new installation unless specifically called for on the Contract Drawings.

3.02 INSTALLATION

A. Install signal head equipment in accordance with the guidelines specified in the FHWA Manual on Uniform Traffic Control Devices and as shown on the Contract Drawings.

B. Arrange signal heads for mounting on span wire, mast arms, post tops or vertical pole bracket mounts as shown on the Contract Drawings.

1. For span wire mounting, furnish the signal heads with a span wire clamp and wire outlet fitting, with span wire clamp comprised of a shoe, lock bar, and two "U" bolts, equipped with a balance adjuster. Assemble the heads so that they hang plumb and include means for adjusting the signal heads to the proper vertical alignment, including circuit disconnect hangers, extension pipes and swivel balancer assemblies. In addition to the upper suspension fitting, provide signal heads with similar mounting attachments for securing the signal to an upper or lower span or tether wire as called for on the Contract Drawings.
2. Furnish signal heads for Vertical, Horizontal and Mid-mast arm mounting with a mount consisting of upper and lower horizontal arms attaching to the top and bottom of the signal head housing. The horizontal arm shall attach to a vertical member that in turn clamps to the mast arm. The mast arm mount shall have provision for adjusting the vertical, angular and rotational positioning of the head in relation to the mast arm so that it is plumb, in line with other signal heads and properly oriented in relation to traffic, including the use of extension pipes, plumbizers, and swivel balancers. Safety chains securing the signal heads to the mast arm are required. Conceal wiring within the mounting assembly.
3. Furnish post top mounted signal heads with a post top type slip fitter mount that is designed for use with a tabbed serrated lock ring to lock the signal face in position.
4. Furnish vertical pole bracket mount signal heads with upper and lower horizontal brackets equipped with pole plates for attachment to the pole with stainless steel straps.

C. Until the installed signal heads are placed into operation, they shall be bagged with an opaque or other approved material. The material shall be adequately secured to the signal heads in an orderly and neat manner.

D. After installation of equipment, the Engineer may perform a site inspection of the equipment. If any equipment has been damaged or if, for any reason, the equipment does not comply with the requirements or testing hereof, the Contractor shall repair or replace the equipment at his own expense, even though the equipment had been inspected previously. After such satisfactory replacement and/or repair and Engineer's subsequent written approval, the equipment may be tested as per 1.05 D.

3.03 FIELD TESTS

Perform initial installation test in accordance with 1.05 D.

END OF SECTION

SECTION 16571

VEHICULAR TRAFFIC SIGNAL HEADS AND MOUNTING HARDWARE

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

16571A01 Submit the following to the Engineer within forty-five (45) days after acceptance of Proposal: A complete set of reproducible mylar shop drawings for the signal head equipment, from which clear prints can be made.

16571A02 Submit the following to the Engineer within forty-five (45) days after acceptance of Proposal: Detailed drawing(s) for signal head equipment, backplates, visors, lens, mounting brackets and hardware including recommended mounting instructions. The submittal shall include the environmental tolerance provisions of the proposed equipment, including the material that the housing, backplates, visors, lens, mounting brackets and hardware were fabricated from. Include within this documentation electrical schematic wiring diagrams for the equipment, defining terminal identification number assignment.

Product Data

16571D01 Submit the following to the Engineer within forty-five (45) days after acceptance of Proposal: A list of manufacturers of equipment to be furnished for the Work of this Section.

Manufacturer Test Reports

16571F01 Submit the following to the Engineer within forty-five (45) days after acceptance of Proposal: Five complete sets and one reproducible master set of all test process and results. This shall include but not limited to the Quality Assurance (QA) process and test results documentation, Design Qualification (DQ) process and test results documentation and installation process and test results documentation.

Manuals, Warrantees/Guarantees

16571I01 Submit the following to the Engineer within forty-five (45) days after acceptance of Proposal: Five complete sets and one reproducible master set of operations and maintenance instructions including preventive and corrective maintenance.

END OF APPENDIX "A"

DIVISION 16

SECTION 16572

TRAFFIC SIGNAL POLES, MAST ARMS, SPAN WIRE AND POLE FOUNDATIONS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for traffic signal poles, mast arms, span wire and pole foundations.

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	Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

American Society for Testing and Materials (ASTM)

ASTM A.36	Specification for Carbon Structural Steel.
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 325	Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
ASTM A 370	Test Methods and Definitions for Mechanical Testing of Steel Products.
ASTM A 475	Specification for Zinc-Coated Steel Wire Strand.
ASTM A 572	Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
ASTM A 576	Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
ASTM A 595	Specification for Steel Tubes, Low-Carbon or High-Strength Low-Alloy, Tapered for Structural Use.
ASTM A 615	Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
ASTM B 108	Specification for Aluminum-Alloy Permanent Mold Castings.
ASTM B 221	Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
ASTM B 228	Specification for Concentric-Lay-Stranded Copper-Clad Steel Conductors.
ASTM F 1554	Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

Federal Highway Administration (FHWA)

MUTCD Manual on Uniform Traffic Control Devices.

National Fire Protection Association (NFPA)

NFPA 70 National Electrical Code (NEC).

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Traffic signal poles, mast arms, span wire and pole foundations shall conform to requirements specified herein; and where specific requirements are not listed herein, the traffic signal poles shall, as a minimum, conform to the requirements of the standards and publications listed in 1.02.

B. Traffic signal poles, mast arms, span wire and pole foundations furnished as Work of this Section shall be as shown on the Contract Drawings, constructed to standard similar dimension sections.

C. Traffic signal poles, mast arms, span wire and pole foundations shall consist of readily available and proven equipment, fully consistent with their intended design and operation as specified herein. Special or custom-built components may be used only upon written approval from the Engineer.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Equipment shall operate without degradation or damage under ambient shock (thermal and mechanical), vibration, lightning and electromagnetic/electrical interference at the construction site.

1.05 QUALITY ASSURANCE

A. Provide independent test certification of foundations, poles, bases, span wires, guy wire and mast arms to show compliance with the load requirements.

B. Submit design calculations signed and sealed by a professional engineer licensed in the state in which the traffic signals are to be installed to the Engineer for approval for all non-standard foundations, bases, poles, span wires, guy wire and mast arms.

1. Wind load pressure shall be at least 90 miles per hour in accordance with AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

C. After installation, inspect the equipment in the presence of the Engineer to show compliance with the requirements of this Section. Continue inspection until the results are satisfactory to the Engineer. Perform any repairs, construction and modifications as required to comply with the Specifications without 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 MATERIALS

A. Furnish poles and mast arms of material shown on the Contract Drawings as follows:

1. Aluminum Poles and Mast Arms: ASTM B 221, Alloy 6063-T6.

   a. Rotary ground, paper protection wrapped.

   b. Anodized aluminum poles and arms in the quantities shown, shall be furnished only if specified on the Contract Drawings.

2. Aluminum Struts and Plates: ASTM B 221, Alloy 6063-T6.

3. Steel Poles and Mast Arms: ASTM A 595, Grade A, or ASTM A 572, Grades 50 with the following minimum yield strength after fabrication guaranteed by the manufacturer and documented by the submission of certified copies of physical tests performed on material lots from which items were fabricated; and galvanized in accordance with ASTM A 123:

   a. Pole of base diameter of 13 inches or less: ASTM A 595; 55,000 psi.

   b. Pole of base diameter greater than 13 inches: ASTM A 572; 65,000 psi.

B. Shoe Bases

1. Aluminum: ASTM B 108, Alloy 356-T6.

   a. ASTM B 221, Alloy 6005-T5 at hand hole reinforcement.

2. Steel: In accordance with 2.01 A.3.

C. Transformer Bases

1. Aluminum: ASTM B 108, Alloy 356-T6.

2. Furnish powder-coated transformer bases and bolt covers in the quantities shown in the color specified only if specified on the Contract Drawings.

D. Clamps

1. Cast Aluminum Pole Clamps: ASTM B 108, Alloy 356-T6.

2. Steel: In accordance with 2.01 A.3.

E. Connection Devices

1. Aluminum: ASTM B 221, Alloy 6061-T6.

2. Steel: ASTM A 36.

F. Anchor Bolts, Nuts and Washers

1. Bolts for pole base diameter of 16 inches or less.

2. ASTM A 576 modified to minimum yield strength of 50,000 psi, minimum tensile strength of 65,000 psi and minimum elongation of 18 percent in 2 inches, tested in accordance with ASTM A 370.

3. Bolts for pole base diameter exceeding 16 inches: ASTM A 615, Grade 75.

4. Bolts for steel traffic pole base shall be hot-dip galvanized steel ASTM F 1554, Grade 55 or ASTM A 36 modified to minimum yield strength of 55,000 psi.

5. Nuts and Washers: Type and grade of steel compatible and of comparable strength to anchor bolt steel.

6. Galvanize nuts, washers and a minimum of 6 inches of bolt-threaded end in accordance with ASTM A 153.

G. Span Wire Cable: ASTM A 475, with Class A weight zinc coating or ASTM B 228 with a suitable diameter to provide the minimum pound breaking strength as specified on the Contract Drawings.

1. Tether wire, where required, shall be 5/16-inch minimum diameter.

2. Fabricate wire dead ends with heat-treated aluminum alloy strand vice yoke and cartridge and case hardened plated steel alloy jaws. The breaking strength of the strand vice shall be not less than the minimum pound breaking strength as specified on the Contract Drawings.

3. Strand wire attachment shall be 3/4-inch diameter galvanized eye through bolts with double nut and curved stubbing washer.

H. Guy Wire Cable: ASTM A 475, with Class A weight zinc coating or ASTM B 228 with a suitable diameter to provide the minimum pound breaking strength as specified on the Contract Drawings.

1. Guy wire attachment shall be a guy strand vise with a 3/4-inch angle thumb eye bolt and 3/4-inch diameter galvanized through bolts with double nut and curved stubbing washer. Guy guard shall be a minimum of 8 ft. Helix anchor shall be as shown on the Contract Drawings.

I. Foundations

1. Concrete Category VI shall be monolithically poured, cast-in-place of the size and shape shown on the Contract Drawings.

J. Grounding

1. All poles shall be grounded, meeting or exceeding the NFPA 70 National Electrical Code (NEC) standards.

K. Safety Chain: Hot-dip galvanized 1/4-inch coil proof straight link chain shall be fabricated in accordance with ASTM A 36 and galvanized in accordance with ASTM A 123.

2.02 CONSTRUCTION FEATURES

A. General

1. Traffic signal poles shall be of the following types as shown on the Contract Drawings:

   a. Span Wire Poles: Poles for supporting a steel cable or cables to which are attached traffic signals and overhead signs.

   b. Mast Arm Poles: Vertical pole(s) and approximately horizontal arm(s) to which are attached traffic signals and overhead signs.

   c. Post-top Mount Poles: Vertical pole(s) used for mounting traffic or pedestrian signals directly on post top.

   d. Bracket Mount Poles: Vertical pole(s) used to support traffic or pedestrian signals, bracketed from side.

2. Pole shapes shall be round, near round or multisided (8 minimum), of length sufficient to provide roadway clearance for signals as shown on the Contract Drawings; and the length of span wire poles shall allow for a minimum of 5 percent wire sag after all signals and signs are installed while maintaining such roadway clearance for signals.

3. Design anchor bolts for the most critical orientation of the pole. Provide anchor bolts, nuts and washers for each pole supplied.

   a. Anchors for anchor bolts with a yield stress equal to or less than 55,000 psi may be "L" bend terminations.

   b. Anchors for anchor bolts with a yield stress greater than 55,000 psi shall be double nuts and plates or threaded plate terminations.

4. Shop paint shall be rust-inhibitive, non-lead or chromium-based oil/alkyd primer on non-galvanized steel fabrications, junction box frames and covers and exterior exposed metallic conduits and anchor bolts. Field paint all uncoated steel with rust-inhibitive, non-lead primer tinted to distinguish it from shop paint coating; and finish paint one coat of black graphite or foliage green paint.

B. Pole Construction: Fabricate pole of material shown on the Contract Drawings with a uniform wall thickness and a uniform taper, starting at the butt end, decreasing in diameter at a rate of not more than 0.14 inches, but not less than 0.07 inches per foot of length.

1. The maximum base diameter of span wire poles shall be 0.70 inches per foot of pole length.

2. Equip poles with removable end caps and a 1/2-13 threaded bolt, grounding terminal accessible through a hand hole.

3. Fabricate aluminum shafts free of longitudinal welds.

4. Fabricate steel shafts of one-piece construction with full-length high frequency resistance welds. Use submerged arc welds for poles of 13-inch or greater butt diameter.

C. Shoe Base Construction: Weld base to shaft so that connection develops full yield strength of shaft section.

1. Equip base with gussets and anchor bolt slots, sized to fit anchor bolts.

2. Equip shoe base with shoe base bolt covers.

D. Transformer Base Construction

1. Equip aluminum transformer and pedestal bases with a plastic hand hole door type ABS, modified for UV resistance, with stainless steel mounting hardware, steel gray color of the size and thickness shown on the Contract Drawings. A grounding clip shall be located on wall opposite door opening.

2. Attach removable type transformer base to pole shaft by bolting to a shoe base welded to shaft. Attach rotary transformer base into a reinforced collar arrangement that shall accept pole shaft. Arrange shaft disconnections so that no special tools are required for unbolting disconnection.

E. Mast Arm Construction: Fabricate to arm length and configuration and of material shown on the Contract Drawings. Provide a hole with smooth wiring cable guide in flange plates on shaft and on mast arms at signal location for complete internal wire routing.

1. Aluminum Mast Arms

a. Fabricate arms of one-piece horizontal plane ovalized aluminum tubing of minimum 0.125-inch wall thickness, with welded vertical struts.

b. For truss type mast arms, design for both free swinging and adjustable fixed vertical signal mounting. Join outboard ends of arms by welding a one-piece extrusion shaped to accept arm members back to back and maintain a 1/4-inch minimum separation between tubes. Extend upper arm to form a 2-inch slipfitter at outboard end and provide a welded signal strap to mount free-swinging signal.

c. Secure mast arm to pole shaft with aluminum plate clamp welded to inboard end of arm and a matching pole back clamp, with four stainless steel through bolts and locknuts for attachment.

2. Steel Mast Arms

a. Fabricate with longitudinal high frequency resistance welds and provide a uniform taper starting at the butt end, decreasing in diameter at a rate of not more than 0.14 inches, but not less than 0.07 inches, per foot of length.

b. Fabricate arms in one piece for lengths up to 43 feet, over 43 feet fabricate of two-piece construction with an overlap joint length of 1-1/2 times the maximum inside diameter of the outer shaft, and secure with a through bolt and locknut.

c. Provide a removable galvanized steel end cap secured with stainless steel screws.

d. Secure mast arm to pole shaft with a steel plate drilled to fit mast arms, circumferential welded inside and outside. Stiffen plate with horizontal gusset plates both top and bottom and at each side. Secure to the pole shaft with four ASTM A 325 through bolts with nuts, ASTM A 153 zinc-coated.

F. Hand Holes: Equip poles, except transformer base mounted poles, with hand holes. Center holes 12 to 18 inches above the base end of pole. The maximum hand hole size shall not exceed 4 by 8 inches.

1. Internally reinforce poles with metal of a cross section area at least equal to the cross section area of hole area removed.

2. Provide removable door flush with outside of shaft.

G. Ground Lug: Equip poles and transformer bases with ground lug.

H. Safety Chain: Furnish and install hot-dip galvanized 1/4-inch coil proof straight link chain with stainless steel bolts, nuts and washers at all mast arm signal head installations.

PART 3. EXECUTION

3.01 PREPARATION

A. Before manufacture or procurement of equipment, submit calculations, Catalog Cuts and Shop Drawings for prior Engineer approval as specified in 1.03 and 1.05. Do not procure equipment until the Engineer has given written approval.

B. Related equipment to be removed and not required for relocation under the Contract, if and where shown on the Contract Drawings, shall remain the property of the Authority and shall be delivered to a location in the Port District as designated by the Engineer. Removed equipment, if any, shall not be used in a new installation unless specifically shown on the Contract Drawings.

C. Verify that each pole foundation and anchor bolt pattern has been installed using the proper anchor bolt circle for the pole base.

3.02 INSTALLATION

A. Poles

1. Attach pole shaft by bolting shoe base to transformer base or to the foundation. Locate hand hole to face away from traffic.

2. Use shims to level pole to a maximum of 1/4 inch.

3. Traffic signal poles shall be bonded and grounded according to the NEC. Furnish and install a ground cable from the pole's ground lug to a ground rod at the nearest manhole.

4. Install mast arms and span wires so traffic signal heads and signs meet minimum elevation requirements as shown on the Contract Drawings, in accordance with AASHTO standards and MUTCD guidelines.

B. Span Wire

1. Fasten signal control cable to the span wire by non-corrosive metal lashing, messenger rings or weather resistant plastic cable bands, at no greater than 15-inch intervals. Hang signal heads and brackets from the span wire so that the bottoms of the signal heads on each approach are aligned horizontally. The signal cable shall follow the lowest path to the signal heads.

2. Determine the length of span wire required to span the distance between poles, allowing sufficient length for fastening and sag to produce a final assembly that is consistent with the Contract Drawings.

3. Determine all the loads for the span wire and arrange for the cable manufacturer to select the cable based on the determined loads and test for tensile strength subject to the Engineer's written approval.

4. In order to restrict excessive signal movement, install a second tether cable to stabilize signal heads, if and where shown on the Contract Drawings. Attach tether cable to the lower edge of the signal head.

5. Drill through pole at an approximate straight angle at each connection to receive the eye through bolts. In no case shall the span wire pull or strain on the eye bolt at an angle greater than 10 degrees plus or minus from straight.

6. Furnish and install galvanized thimble eyebolts to connect ground wires to round signal poles. Circumferential pole clamps, as an alternative to galvanized thimble eyebolts, may be used to connect span wires to the top of polygonal shaped signal poles.

C. Foundations

1. Concrete foundations shall be cast-in-place.

2. Foundations shall rest on firm ground and shall be poured monolithically. Conduit and anchor bolts shall be placed in proper position and shall be held in place by means of a template until the concrete sets. Forms shall not be removed until the concrete has hardened but not less than 24 hours after the concrete has been placed. Exposed portions of foundations shall be neatly finished with a wood float followed by brushing with a wet, soft-haired brush. Construct tops of foundations to a finished grade elevation of 1 inch above final grade sidewalk. Where sidewalks are not constructed or do not exist, finish foundations to an elevation of 2 inches above the final grade of the surrounding lawn or earth.

3. Conduit installed in foundations shall be set plumb. The conduit shall terminate with a coupling flush with the top of the foundations and shall be provided with a close nipple. Conduit shall be provided with pipe caps during the placement of the concrete. When the finishing of the foundation is complete, the pipe caps shall be removed and insulated grounding bushings shall be installed. If the wiring is not immediately installed, the bushings shall be installed with push-penny plugs.

4. Anchor bolts installed in the foundation shall be set plumb. Bolt transformer or shoe base to foundation using stainless steel washers, lock washers and bolts. Stainless steel shims may be used to a maximum of 1/4 inch to level the pole.

3.03 INSPECTION

Perform final installation inspection in accordance with 1.05 C.

END OF SECTION

SECTION 16572

TRAFFIC SIGNAL POLES, MAST ARMS, SPAN WIRE AND POLE FOUNDATIONS

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

16572A01 Shop Drawings
Details of all traffic signal poles including their bases, poles, cables, arms, mounting brackets, attachments and fittings, and anchor bolt details and layout.

Samples

16572C01 Samples

Certificates

16572E01 Catalog Cuts, Material Certifications, and Test Results
1. Certified test results for steel poles and mast arms in accordance with 2.01 A.3.
2. Certification for anchor bolt strength in accordance with 2.01 F.
3. Certification for span wire cable strength in accordance with 2.01 G.

Construction and Installation Procedures

16572G01 Construction Procedures and Quality Assurance Documents

Calculations

16572H01 Design Computations
Design computations for all traffic poles in accordance 1.05 B.

END OF APPENDIX "A"

DIVISION 16

SECTION 16574

TRAFFIC SIGNAL CONTROLLER ASSEMBLY

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for an 8-phase digital traffic signal controller assembly.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Welding Society (AWS)

AWS D1.2 Structural Welding Code – Aluminum

American Society for Testing and Materials International (ASTM)

ASTM B209 Aluminum and Aluminum - Alloy Sheet and Plate

Electrical Testing Laboratories, Inc. (ETL)

Federal Highway Administration (FHWA)

MUTCD Manual on Uniform Traffic Control Devices

Institute of Transportation Engineers (ITE)

ST-017B Equipment and Material Standards of the Institute of Transportation Engineers

National Electrical Manufacturers Association (NEMA)

NEMA TS 1 Traffic Controller Assemblies

NEMA TS 2 Traffic Controller Assemblies with NTCIP Requirements

NEMA 250 Enclosures for Electrical Equipment

NEMA WD6 Standards for Wiring Devices – Dimensional Requirements

National Transportation Communications for Intelligent Transportation Systems (ITS) Protocol (NTCIP):

NTCIP 1101 Simple Transportation Management Framework – Amendment 1

NTCIP 1201 Global Object Definitions – Amendment 1

NTCIP 1202 Object Definitions for Actuated Traffic Signal Controller Units

NTCIP 2001 Class B Profile – Amendment 1

National Fire Protection Association (NFPA)

NFPA 70 National Electrical Code (NEC)

Underwriters Laboratories, Inc. (UL)

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. The traffic signal controller assembly shall conform to requirements specified herein; and where specific requirements are not listed herein the controller assembly shall, as a minimum, conform to the requirements of the standards and publications listed in 1.02 herein.

B. The traffic signal controller assembly electrical and electronic hardware, interconnect cable, structural materials, equipment housings and software required for a fully operational, integrated, real-time system shall be capable of operating on a 24-hour-per-day, seven-day-per-week basis with high system reliability (99.5%) and shall conform to the physical and functional requirements of this Section and the requirements shown on the Contract Drawings.

C. The traffic signal controller assembly shall be composed of all items of firmware and software, 8-phase digital controller unit, signal conflict monitor, cabinet power supply, filters, relays, transformer with main breaker (as required), modem, communication panel, load switches, flashers, connecting harnesses, terminals and other miscellaneous equipment in a complete and fully wired aluminum weatherproof controller cabinet. Furnish and install with the controller assemblies an Uninterruptible Power Supply (UPS) with batteries at locations shown on the Contract Drawings.

D. The traffic signal controller unit shall be composed of all items of firmware and software, 8-phase digital controller unit, modem, connecting harnesses and shall be fully wired within the existing controller cabinet.

E. The traffic signal controller assembly and units shall conform to the requirements of NEMA TS 2 Type 2 for actuated controllers and as modified herein.

F. The traffic signal controller assembly shall be compatible with the Traffic Signal Management System in operation at the facility or with the Traffic Signal Management System as indicated on the Contract Drawings. Furnish the controller unit with National Transportation Communications for ITS Protocol.

G. In general, the controller assembly and/or unit and associated equipment shall consist of readily available and proven hardware and software elements, fully consistent with the system's intended design and operation. The controller assembly and/or unit shall integrate seamlessly with existing or new vehicular and pedestrian signals, r, detector loops, detector units, pedestrian pushbuttons, controller interconnect cable, associated conduit and traffic signal cable to provide an operational traffic signal installation for control of vehicular traffic signals, pedestrian traffic signals and roadway vehicle detectors shown on the Contract Drawings. Special or custom-built components may be used only upon written approval from the Engineer. Use modular type construction with assemblies, sub-assemblies and modules that are available from a second source of supply, wherever possible. For items with no second source of supply, provide replacement assemblies in quantities as shown on the Contract Drawings.

H. All assemblies, sub-assemblies and modules shall be readily accessible for removal, testing or replacement without removal of the other modules, assemblies or cabinet components. Locate components so that there is visibility and access for the use of hand tools and standard test probes where maintenance is required. Provide test points to facilitate troubleshooting.

1.04 ENVIRONMENTAL REQUIREMENTS

A. The traffic signal controller assembly shall operate over an ambient temperature range from -30°F to +165°F (-34°C to +74°C).

B. The controller assembly shall operate over the range of relative humidity from 0% to 95%, non-condensing.

C. All equipment shall operate without degradation or damage under ambient shock (thermal and mechanical), vibration, lightning and electromagnetic/electrical interference existing at the construction site.

1.05 QUALITY ASSURANCE

A. Controller assemblies and/or units furnished per the Specification shall be current production equipment and of recent manufacture, identical models of which are field operational. Untried or prototype units will be rejected.

B. The traffic signal controller assembly and/or traffic signal controller unit and all associated control equipment and electronics shall work together as a complete and integrated device mounted in a field cabinet for controlling the operation of a traffic control signal as indicated on the Contract Drawings.

C. Verify that the traffic signal controller manufacturer has been in the business of manufacturing traffic signal controller assemblies, traffic signal controller units and all associated control and communications equipment and electronics equivalent to that specified in this Section for a minimum of 5 years.

D. Verify that the traffic signal controller manufacturer has maintenance services and related technical assistance available in the New York City metropolitan area and an established maintenance facility within the Port District, as evidenced by existing contracts, to provide maintenance for traffic signal controller assemblies and/or units and all associated control equipment and electronics to be furnished and installed under the Contract. The traffic signal controller manufacturer's maintenance staff shall consist of a sufficient number of qualified journeymen, technicians and other technical personnel to perform complete maintenance of the traffic signal controller assembly and units and all associated control equipment and electronics.

E. After delivery of the traffic signal controller assembly and/or traffic signal controller unit, the Engineer may perform a site inspection of said equipment. If any equipment has been damaged or for any reason does not comply with the requirements hereof, the Contractor will be notified in writing, and he shall repair or replace the equipment at no cost to the Authority, even though the equipment had been approved for shipment. After such satisfactory replacement and/or repair and Engineer's subsequent written approval, the equipment may be installed.

F. After installation, test the traffic signal controller assembly and/or traffic signal controller unit in the presence of the Engineer to show compliance with the requirements of this Section and with the applicable sections of the Traffic Signal Turn-On Checklist. Continue testing until the results are satisfactory to the Engineer. Perform all repairs, construction and modifications required to comply with the Specification 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 instruction.

B. Properly store and handle all materials delivered to prevent deterioration or damage due to moisture, temperature change, contaminants and other causes.

1.07 SUBMITTALS

Refer to Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 CONSTRUCTION FEATURES

A. General

1. The traffic signal controller assembly and traffic signal controller unit shall conform to the requirements of NEMA TS 2 Type 2 for actuated controllers and as modified herein.

2. Controller assembly equipment shall conform to the requirements specified in NEMA TS 2, Type 2 and ITE ST-017B. Where a conflict occurs between the NEMA and ITE Standards and the Specifications, the requirements of the Specifications shall govern.

B. Controller Unit

1. The controller unit shall be devoted to the selection and timing of the signal displays and shall meet the requirements of NEMA TS 2, Type 2 for actuated controllers and as modified herein. The controller unit shall be available in two configurations, and National Transportation Communications for ITS Protocol (NTCIP) as shown on the Contract Drawings.

2. The controller unit shall be compatible with controller assembly equipment that includes, but may not be limited to, detector sensor units, conflict monitors, flashers, load switches, circuit protection, connection wiring harnesses, "D" connector with appropriate harness and assembly where required for control of equipment.

3. Electronics

a. Furnish required solid-state, fully actuated, microprocessor-based traffic signal controller units that utilize digital timing in their control logic and the power line frequency as a base. The controllers shall be of modular construction and shall provide the traffic signal control functions required at each signal location as specified on the Contract Drawings. When applicable, specific manufacturer model identification numbers will be shown on the Contract Drawings for acceptable controller types.

b. The controller unit shall be a microprocessor-based unit for the control of all traffic signal timing, operation monitoring and selection of signal displays at an intersection.

c. Use modular type construction with assemblies, sub-assemblies and modules. Circuit board shall fit into the manufacturer-supplied chassis. The circuit board materials shall meet NEMA TS 2 and all electrical mating surfaces shall be made of non-corrosive materials.

d. Group the functional operating circuits and their associated components in plug-in printed circuit board assemblies so they may be readily removed without unsoldering or handling individual connections. Each circuit board shall have a unique serial number.

e. Functional modules for controllers of the same manufacturer shall be interchangeable. Modules providing control or operational functions in one controller shall be interchangeable with the same module in all other controllers of the same manufacturer that provide the same traffic signal control operations.

f. Provide the controller mainframe with power supply including housing, mounting and internal interconnection for printed circuit assemblies. Equip the frame with sliding ways and sockets to receive the plug-in printed circuit assemblies and to allow removal and replacement of all controller circuitry.

g. Positively fasten assemblies to the frame by means of a captive nut and bolt arrangement or other suitable method with no special tools required to remove or replace individual printed circuit assemblies.

h. Design the units so that each component is identified by a circuit reference symbol. Affix this symbol to the printed circuit boards, to the cover of the unit or in an assembly drawing provided with the unit.

i. The controller unit's power supply and control circuitry shall be housed in a metal case suitable for shelf mounting with an appropriate protection finish. Each controller unit shall have a unique serial number. All external connectors shall be mounted on the front of the controller units.

j. Extender boards or ribbon cables shall be available for use with the controller units for testing. Provide one extension board and/or ribbon cable for every one to five controllers furnished.

4. Front Panel

a. Shall consist of a keyboard, operator display and connectors.

b. A display with a minimum of 8 lines by 40 characters per line shall provide operational and program status information. The display shall be backlit for ease of viewing and shall have multiple levels of contrast adjustment.

c. Provide identified indicator lamps or displays on the controller unit to check for normal controller operation providing both phase and ring status information with indicator lamps or displays easily readable at a distance of four feet during normal outside lighting conditions.

d. The operator keyboard shall contain environmentally sealed keys that are clearly labeled. The keypad shall include at a minimum a 10-digit numeric cluster, function keys and four arrow cursor control keys.

e. The front panel connectors shall meet at a minimum the NEMA TS 2, Type 2 as follows:

(1) Port 1 – shall be a 15-pin metal shell D sub-miniature type connector utilizing female contacts.

(2) Port 2 – shall be a 25-pin metal shell D sub-miniature type connector utilizing female contacts.

(3) Port 3 shall be a 9-pin metal shell D sub-miniature type connector utilizing male contacts.

(4) Connector A shall mate with a MS3116-22-55S

(5) Connector B shall mate with a MS3116-22-55P

(6) Connector C shall mate with a MS3116-24-61P

f. Furnish and install controller with a "D" connector on the front panel of the controller with the capability for hardwire coordination and preemption inputs and outputs as specified on the Contract Drawings.

(1) In conjunction with the hardwire coordination the controller unit shall be supplied with a six-foot "D" harness and coordination interface panel.

g. Connector pin assignment shall be as specified in NEMA TS 2, Type 2.

5. Provide an industry standard RS232C I/O port to upload/download all controller program data through a laptop computer. All controller programs stored within the laptop computer shall be editable without the need to be connected to a controller unit (stand-alone capability).

6. Communications Protocols

a. Furnish and install actuated controller units with Furnish and install actuated controller units with National Transportation Communications for ITS Protocol (NTCIP) in the quantities shown only if specified on the Contract Drawings.

7. NTCIP Requirements

a. The controller unit shall comply with the NTCIP standards The software shall comply with the versions of the relevant NTCIP Standards that are current at the date of the NEMA TS 2.

b. The controller unit shall comply with NTCIP 1101 Simple Transportation Management Framework and shall meet the requirements for Conformance Level 2. The software shall comply with NTCIP 2001 Class B profile and shall include both an EIA/TIA 232-E and an FSK modem interface for NTCIP-based communications.

c. The controller unit shall implement conformance groups as defined in NTCIP 1201 Global Object Definitions and NTCIP 1202 Object Definitions for Actuated Traffic Signal Controller Units in accordance with Actuated Type 2 NTCIP (A2N), Level 2 as outlined in NEMA TS 2.

d. Furnish and install conformance groups required for the advanced functions relative to Coordination, Time Base, Preemption, System Control, Overlaps or TS 2 Port 1 as supported by the Traffic Signal Management System in operation at the facility or with the Traffic Signal Management System as indicated on the Contract Drawings or as directed by the Engineer. Document conformance groups and submit to the Engineer for approval.

8. Actuated Control

a. The controller units shall provide phase, ring and unit inputs, outputs and programming controls as specified in NEMA TS 2, Type 2.

b. Units capable of accepting up to eight phases shall contain at least two timing rings. Dual ring controller units shall be programmable for both single- and dual-entry operations and shall contain the wiring and circuit necessary to produce four internally generated overlaps.

c. Provide separate input, output and programming controls into per-phase, per-ring and per-unit categories. The priority of the input function, the use of the outputs and the method of establishing the programmable controls, such as overlaps, shall be as specified in NEMA TS 2, Type 2.

d. The controllers shall be capable of operating in an isolated or free mode, under the supervision of a and under the supervision of a remote digital computer. Equip units for pre-timed, semi-actuated, fully actuated and volume-density operations, and both sequential and concurrent (non-conflicting) phase servicing. In addition, equip units to allow for concurrent pedestrian phase timing, alternate phase sequencing, phase omission and all-red rest; and include inhibit maximum phase green time termination, the selection of at least two alternate maximum green times per phase, interval advance, stop timing and manual control.

e. Provide the following functional time setting with associated timing ranges for all controller phases unless otherwise shown on the Contract Drawings:

Function	Range*	Maximum Increment*
Minimum Green	1 to 255 seconds	1 second
Passage Time	0 to 25.5 seconds	0.1 second
Maximum 1	1 to 255 seconds	1 second
Maximum 2	1 to 255 seconds	1 second
Yellow Change	3 to 25.5 seconds	0.1 second
All Red Clearance	0 to 25.5 seconds	0.1 second
Walk	0 to 255 seconds	1 second
Pedestrian Clearance	0 to 255 seconds	1 second
Added Initial per actuation	0 to 25.5 seconds	0.1 second
Time to Reduce	1 to 255 seconds	1 second
Time Before Reduction	1 to 255 seconds	1 second
Minimum Gap	0 to 25.5 seconds	0.1 second

*Zero can be satisfied by a time increment between zero and 100 milliseconds.

f. A guaranteed three-second minimum Yellow Change shall be provided.

g. Make selection of time intervals, phase sequencing and operational parameters, such as the placement of maximum phase recall, minimum phase recall, phase omission and pedestrian recall, from the front panel of the controller through keyboard entry. Provide suitable means to give a clear visual indication of the timing and parameter settings. Equip each controller with its own front panel so that no additional devices are required for programming the units.

h. All controller units shall have the capability of providing different sequences from the front panel. These sequences shall be stored on the EEPROM program chip as part of the controller software program. Provide four distinct sequences as follows:

(1) Single Ring Sequential

(2) Dual Ring Quad/Sequential

(3) Dual Ring Quad Left Turn

(4) Dual Ring Sequential/Quad

i. When power is first applied to the controller, an actuation shall be placed on all phases. Thereafter, right-of-way shall not be subsequently given to any phase without actuation thereon; however, provide recall facilities for each phase which when activated, will cause right-of-way to revert to the associated phase despite the absence of traffic thereon. All controllers shall have the capacity to automatically restart following a power failure.

j. The actuation of a detector or pushbutton for a phase not having the right-of-way shall, after display of the clearance intervals for the phase losing right-of-way, cause right-of-way to be transferred to the phase for which the action was received if the existing phase minimum has been satisfied.

(1) Overlapping, non-conflicting phases shall be immediately initiated, in response to an actuation, and shall be timed concurrently with the parallel phase.

(2) The phase next to be serviced shall be determined at the end of the GREEN interval of the terminating phase, except that if the decision cannot be made at the end of the GREEN interval, it shall not be made until after the end of all vehicle change and clearance intervals.

(3) When a controller is in an ALL RED interval, right-of-way shall be given directly to the phase for which an actuation(s) has been received.

(4) Provide for the storage of a call for vehicle service for each vehicle phase when that phase is not displaying a GREEN indication. This vehicle memory feature shall be capable of being disabled. Similar facilities shall be available for the storage of a call for pedestrian service on phases equipped with pedestrian time settings, when that phase is not displaying a WALK indication.

(5) When a phase is terminated with time remaining in the PASSAGE TIME, a call shall be left on that phase. Disabling the vehicle call memory shall defeat this feature. If a phase is terminated with no passage time remaining, no call shall be left on the phase.

k. Variable phase sequence operation shall not be required unless otherwise shown on the Contract Drawings. Where variable sequence phasing is required, provide a minimum of three alternate signal phase sequences in addition to the required single- and dual-ring phase sequences as defined in NEMA TS 2, Type 2. Such alternate sequences shall be selectable at the controller front panel or remotely by a traffic-responsive satellite master controller or manually through a central control digital computer.

l. The four unique signal interval sequences shall provide for leading, lagging, or dual left-turn movements and straight through (and right turn) movement configurations in various sequences.

m. The controller unit shall be provided with EPROM for retention of the software program. A battery or super capacitor shall be used for retention of real-time clock data only. The controller shall also contain a reserved database of intersection timing and function variables stored in EEPROM. It shall be possible for an operator to activate the reserve database by loading it into memory through a simple procedure involving front panel controls. These default values shall include all keyboard addressable functions and shall be subject to approval by the Engineer.

n. Each detector input shall be capable of being programmed for stretch and delay timing. Program shall also include inhibit of stretch and delay during selected phases and/or intervals.

o. An input and the circuitry required for accomplishing flashing operation per MUTCD guidelines shall be incorporated into the controller unit.

9. Time-Based Coordination

a. Each controller shall be furnished with software capable of time-based coordination and shall be capable of storing and implementing predefined signal timing patterns on a time-of-day/day-of-week (TOD/DOW) schedule basis. In addition, the controller shall be supplied with a "D" connector with the capability for hardwire coordination. Where applicable and in accordance with the Contract Drawings and Specifications, the controller shall be supplied with a six-foot "D" harness and coordination interface panel.

b. Furnish each intersection controller with time-based coordination functions as an integral part of the controller software. In a hardwire system, the time-based coordination functions shall be used as a backup system in the event of a loss of communication from the master controller or a local failure.

c. Furnish each controller with an internal fiber optic modem for external hardwire interconnect coordination. Furnish an internal electrical modem or external fiber optic or electrical modem in the quantities shown only if specified on the Contract Drawings. The modem shall be compatible with the interconnect as shown on the Contract Drawings.

d. The controller unit shall be capable of internal time-based coordination. The internal coordinators, when installed at a group of intersections, shall provide a coordinated system without the use of interconnecting cables. Each internal coordinator shall provide the synchronizing signals from an internally stored coordination plan, using a precise clock as reference.

e. The internal time-based coordination software shall have a real time clock with the ability to select cycle, splits, offsets and auxiliary function outputs on a preprogrammed TOD/DOW basis. The clock shall also provide daily a time-based reference point for the start of all cycles. The reference shall be programmable.

f. The time-based coordination software shall be provided with EPROM for retention of the software program and the specific program data for the time- based coordination unit. All controller units shall have these time-based coordination features stored on the controller EPROM as part of the basic controller software package. A battery or super capacitor shall be provided for retention of the real-time clock information. The battery shall be located in the unit in such a way as to be easily removed and replaced without the use of special tools. The battery or super capacitor shall be capable of powering EPROM for a minimum of 60 days without AC power applied. Locate an indicator on the front panel to identify when there is a battery failure.

g. With normal primary power applied, the real-time clock shall reference the 60 Hz power line frequency for its time basis. With primary power removed, the clock shall maintain time on standby and battery power for a period of at least 60 days. During standby battery operation, clock accuracy shall be better than 0.005%.

h. Accomplish operator-programmable data entry through a keyboard located on the front panel of the unit. For ease of programming, the front panel shall have, in addition to a standard numeric keyboard, a series of function keys that allows immediate access to specified function screens. The controller unit shall be programmable in a menu driven format. The controller unit shall be supplied with serial connectors to provide the following features:

(1) The units shall allow for the upload and download of all local control information at the individual installation site via a portable keyboard terminal with display screen.

(2) The units shall have the capability of outputting all operational data stored in the unit's memory to a portable printer.

i. Provide the front panel with indicators for the various functions as well as status. The basic phase functions shall be in the form of a liquid crystal display. The status indicators may be in the form of either liquid crystal or light emitting diodes or a combination of the two methods. Incandescent indicators will not be acceptable.

j. Each controller with internal time-based coordination shall have the ability to provide the following minimum features and functions:

(1) Selection of any of the four cycles, four split sets and three offsets on a time-of-day, day-of-week and week-of-year basis.

(2) Selection of flash operation and free operation on a time-of-day, day-of-week and week-of-year basis.

(3) Activation (on/off) of three auxiliary outputs on a time-of-day, day-of-week and week-of-year basis.

(4) Fifteen different day programs with a minimum of 15 total events. All events shall be programmable to configure each day program. The day programs shall be utilized to form a minimum of 5 different week programs. All events shall be programmable to a resolution of one minute.

(5) A minimum of 20 special event days or exception days to override any day program. Exception days shall be programmable on a day-of-week/week-of-year basis and on a date-specific basis and shall be programmable on a one-time or perennial basis.

(6) Automatic adjustment for daylight saving time.

C. Conflict Monitors

1. The conflict monitor shall be a stand-alone Type 12, where each of the 12 channels consists of four 120-volt AC inputs: Green, Yellow, Walk and Red. The conflict monitor shall conform to the requirements of current NEMA TS 1. The conflict monitor shall be capable of operation in a cabinet designated to TS 1 specifications with no loss of TS 1 functionality.

2. All pins of the connector plug shall be wired and terminated on a cabinet-mounted terminal block. Channel assignments shall be wired to their corresponding phase. For example, channel 1 to phase 1, channel 8 to phase 8; overlap A thru overlap D shall be channel 9 thru channel 12, respectively. Detection of a failure mode shall cause the monitor to trigger, de-energize its output relay contacts and place the intersection in flash. Once the monitor triggers, it shall assume one of two states:

a. Non-Correcting state - The monitor cannot return to normal operation without manual or input reset. Non-Correcting failures shall be stored in memory and shall be retained through an indefinite power interruption until power is once again restored and the unit is reset, maintaining the output relay de-energized until such time as the reset occurs.

b. Self-Correcting state - The monitor may return to normal operation if the condition causing the failure is corrected.

3. Provide indicator lights or liquid crystal displays for all channels in order to display the active channels.

4. The start delay relay shall be utilized to provide power to the controller mechanism. Upon monitor power-up and no failure condition detected or in memory, the start delay relay shall energize an adjustable period of 0 - 15 seconds after power-up. The minimum period shall be programmable by means accessible on the front panel of the monitor.

5. The monitor shall be supplied with a resident set of self-check diagnostic capabilities, which monitor for correct operation of the unit both at power-up and continuously during operation.

6. The monitor shall be able to detect presence of conflicting green, yellow or walk signal voltages on the AC field terminals (full or 1/2 wave) between any two or more non-compatible channels. Conflict shall always be considered a non-correcting failure.

7. The conflict monitor shall, as a dip switched option, be capable of monitoring for the absence of proper voltage on all inputs (including red) of a channel. Therefore, a Red Failure condition shall be detected and the monitor shall trigger if at least one input per channel is not at the proper voltage level. Red failure shall always be considered a non-correcting failure.

8. The monitor shall initiate flashing operation as a result of over-current protection operation, absence of AC voltage to the monitor or a failure of the monitor power supply. The monitor shall also provide an internal "watch dog" circuit for purposes of monitoring the central processor unit. If the processor fails to periodically cycle, the monitor shall initiate flashing operation.

9. The monitor shall provide a means of displaying the real time status of operating parameters such as time and date, compatibility card programming, functional inputs and the on/off status of dipswitches.

10. The monitor shall provide a settable internal 99-year clock. The clock shall automatically adjust for daylight savings time. This requirement shall be accomplished by a programmable function. As an alternate to this requirement, this function may be accomplished in ROM. However if legislation changes the effective dates for daylight savings time, a revised ROM implementing the change shall be supplied.

11. The monitor shall store in nonvolatile memory an event log that shall be retained through indefinite power interruption. A minimum of 140 events shall be logged by time and date of occurrence. As a minimum, the log shall contain the following events:

    a. Power on/off occurrences.
    b. Failures and failure type (Conflict, Red Fail, etc.).
    c. Display indications active at time of failure.
    d. Monitor resets and type (manual vs. input).
    e. Exit failure occurrences (i.e., self correction).
    f. Dipswitch changes.
    g. Last time/date set.
    h. Message overflow.
    i. Last printout to laptop computer.

12. The monitor shall provide a means of initiating a printout sequence to a laptop computer. The printing shall not disrupt the normal operation of the monitor. The report shall contain as a minimum the following:

a. Intersection Identification (7-digit number, route number and intersection cross street).

b. Current time and date.

c. Date and time of last printout.

d. Current status of dipswitches.

e. Current status of input modifiers.

f. Current status of compatibility card programming.

g. Event log as stipulated above.

13. The conflict monitor shall be furnished and wired to provide inputs to the to a laptop computer such that when operating in such a system, the monitor shall be capable of interfacing with the controller unit for purposes of data exchange. The data exchange shall provide the ability to, via the controller unit, remotely upload the monitor event log, dip switch settings, and compatibility card programming information to the closed loop and/or central computer.

14. The conflict monitor shall be furnished and wired to provide inputs to the laptop computer to indicate that the controller is in monitor flash. The input shall also distinguish type of failure, either a voltage or signal conflict.

D. Solid-State Flashers

1. Equip all signal controller assemblies with a jack-mounted, two-circuit, solid-state flash control mechanism to periodically interrupt an appropriate source of alternating-current line power for the purpose of providing alternating flash traffic signals. The flashers shall have no contact points or moving parts, and shall be compatible with the specified traffic signal controllers.

2. Provide each flasher with dual output circuits, each rated at 15 amp RMS per circuit. The flash rate shall be not less than 50 nor more than 60 flashes per minute. The duty cycle for each circuit shall be 50% on and 50% off, plus or minus 5%.

3. The rating of the output circuits shall be the minimum rating for tungsten-lamp or gas-tubing transformer load over a voltage range of 95 to 135 VAC RMS line power at 60 hertz.

4. Input to the flasher shall consist solely of the 60 hertz, alternating-current power source. This input shall supply the power for both the output circuits and the flasher logic. Switching shall occur at the zero crossover point of the AC voltage. The flasher shall turn on within 5 degrees of the zero voltage point of the alternating current line sinusoid and shall turn off within 5 degrees of the zero current point of the alternating-current line sinusoid.

5. The flasher output shall have a dv/dt rating of 100 volts per microsecond at 60°F (20°C) when tested with the procedures defined in NEMA TS 2. The output current from the flasher through the load when the flasher is in the off state shall not exceed a maximum of 15 milliamperes RMS.

6. Flash transfer relays shall be de-energized for flashing operation and installed in close proximity to load relays and flashers. Provide flasher output and connections for transfer relays terminated on terminal blocks for programming of Flash 1 and Flash 2 outputs. The load on both circuits of the flasher shall always be balanced.

7. The flasher shall be so designed that circuit #1 will be on when circuit # 2 is off and vice versa. The maximum off period when both circuit #1 and circuit #2 are off, or the maximum period when both circuit # 1 and circuit #2 are on, shall not exceed 17 milliseconds during the transition from off to on and on to off.

E. Solid-State Load Switches

1. Utilize plug-in mounted solid-state load switches for connection between the alternating current line power and the traffic signals. The switches shall have no moving parts. Electromechanical relay contacts are not acceptable. The load switches shall be external to the controller unit. Stacking of load switches shall not be permitted.
2. Provide switching capabilities for three independent circuits containing solid-state cubes in each load switch. The switching device shall utilize zero-point switching, with turn-on at the zero voltage point (plus or minus 5 degrees), and turn-off at the zero current point (plus or minus 5 degrees), of the power line sinusoid.
3. Isolate the switch inputs and direct current voltage input from the power line so that transients applied to the power line with a 25-watt lamp load shall not cause a destructive failure in the load switch. The load switches shall perform all of their defined functions when supplied from a 24 plus or minus 2 volt DC source.
4. Input to the load switches shall be negative true logic. A low-level input (0 to 6 volts) shall cause the output device to conduct. A high level input (greater than 16 volts) shall cause the output device not to conduct. The transition zone of the input circuitry from the conducting state to the non-conducting state (and vice versa) shall occur between 6 and 16 volts.
5. The load switches shall draw not more than 20 milliamperes from a plus 26 VDC supply unless more than one circuit is energized in which case it shall draw not more than 20 milliamperes times the number of circuits energized. Each input circuit of the load switches shall have reverse polarity protection.
6. The output current through the load switches when the load switch is in the off state shall not exceed 20 milliamperes peak at 135 VAC. Each load switch output shall have a peak standing voltage of 500 volts or greater and shall have a dv/dt rating of at least 100 volts per microsecond when measured by the procedures defined in NEMA TS 2.
7. Each switching unit shall have a minimum rating of 10 amperes RMS for either tungsten lamp loads or power factor corrected gas tubing transformer loads over a voltage range of 95 to 135 VAC RMS line power at 60 hertz. Each load switch shall be capable of switching currents as low as 100 milliamperes. The load switches shall be rated for 10 amperes total continuous load divided between the circuits in any proportion. Each circuit shall be capable of continuously conducting 10 amperes.
8. Design each load switch circuit to switch a 1,200-watt tungsten lamp load operating from a 120 VAC source for a minimum of 10 million operations. Each load switch circuit shall be capable of withstanding a one-second, surge current of 40 amperes RMS at 60 hertz.
9. Provide all load switches with an indicator light for each of the lamp circuit inputs. The lights shall be clearly visible for viewing the installed switching device. The load switches shall be constructed so that personnel inserting or removing the modules will not be exposed to live parts. Provide all load switches with hand pulls. No other equipment within the signal controller cabinet shall use a socket that will accept a load switch.

F. Controller Cabinets

1. House traffic signal controller assembly and associated electronics in weatherproof and corrosion resistant aluminum cabinets. The style, construction material, dimensions and field locations for the cabinets shall be as shown on the Contract Drawings. Size and design cabinets to allow for a system-type operation including storage accommodations for separate conduit access for two-way communications, Uninterruptible Power Supply (UPS) with battery backup

2. Construct sheet aluminum cabinets of ASTM B209, Alloy 5052-H3 or equivalent, with a minimum 0.125-inch thickness. Fabricate overlapping seams to comply with Type 3R enclosure according to NEMA 250.

3. All nuts and bolts used in cabinet assembly shall be stainless steel. Mount internal components so that there are no external protrusions.

4. Provide cabinets with a sufficient number of adequately sized metal shelves and brackets to support the required control equipment. Arrange adjustable shelves and equipment so that it is possible to remove any piece of equipment from the cabinet without removing any other piece of equipment. Weld vertical mounting channels to the interior cabinet wall to provide adjustable shelf and panel locations.

5. Provide cabinets with slide-out metal shelf of adequate size to accommodate laptop computers and located at a comfortable work height. Slide-out shelf shall not conflict with equipment shelves.

6. Provide full width door fitted and gasketed to assure complete weatherproofing. Equip each door with a three point cadmium plated latching mechanism similar and equal to Eberheard #5647 series, with door handle provisions for padlocking and Corbin #1548-1 or approved equal padlock fitted for a standard Corbin #2 key.

   a. Door openings shall have rolled-up lips at the top and flanged lips on the remaining three sides.

   b. Hinge each door with a heavy gauge stainless steel continuous hinge complete with a 0.25-inch diameter stainless steel hinge pin secured with 1/4-20 stainless steel carriage bolts and lock nuts.

   c. Provide louvered air vents on the door complete with filter retainer brackets and filters.

   d. Provide each cabinet door with a stop mechanism to limit the door opening to 120 degrees, plus or minus 10 degrees with a load of 15 lb/sq ft applied uniformly over the face of the door, with a catch which shall operate when the door reaches the extreme open position and shall hold the door securely in that position until it is released. The arm of the stop, when closed, shall be parallel to the closed cabinet door with a minimum of projection into the cabinet.

7. Mount a plastic weatherproof pouch suitable for storing the controller's maintenance and operations manuals to the inside of the main door for each cabinet. Attach a red label containing the Authority's Traffic Engineering emergency call telephone numbers to the inside of the main door. The pouch shall be furnished with, but not be limited to, the following:

   a. Cabinet wiring diagrams.

   b. Load switch table.

   c. Timing and detector table.

   d. Activity log.

   e. Operation manuals for all furnished equipment.

8. Locate a small "police door" within the larger main door of the controller cabinets to provide access to a control panel. Hinge shall be continuous 14-gauge stainless steel complete with a 0.120-inch diameter stainless steel hinge pin with a Corbin R357565 or approved equal lock with a keyhole cover

9. House the local control panel in box-like enclosure attached to the inward side of the main cabinet door. Provide access to the control panel via the cabinet "police door". No entry shall be required into the main cabinet to gain access to the control panel. Fit the panel with four, 1/2-inch diameter openings for the mounting of two-position toggle switches, and one, 3/4-inch diameter opening for a remote manual push-button control cord, consisting of a six-foot rubber insulated cable with a weatherproof, normally open momentary contact.

   a. Provide identified toggle switches to initiate remote manual control, local flash operations, signal shutdown and other special functions as specified on the Contract Drawings. Shield the signal shutdown switch to discourage its use in other than emergency situations.

   b. Toggle switches shall have poles as required for their intended usage and shall be rated at 200% of circuit current for circuits of 10 amperes or less and 125% of circuit current for circuits over 10 amperes. Circuit breakers used as toggle switches shall be adequate for the application and shall be UL or ETL listed for switching operation.

   c. The flash switch shall, when activated, extinguish all signal indications except the yellows on the major street and the reds on the minor street. The power supply to the controller unit shall not be affected and the controller shall continue to function in a normal manner. It shall be possible to disconnect and remove the controller without interfering with the flash operation. Activation of the flash switch shall extinguish the AC plus voltage used to feed power to the pedestrian signals, where applicable, and to turn them off.

   d. Activation of the manual control toggle switch shall discontinue the signal controller's automatic cycle operation by energizing the manual control enable input of the controller. Interval changes shall then be permitted only when the manual push-button is depressed, which, in turn, shall energize the interval advance input of the controller. The only exceptions shall be the phase change and pedestrian clearance intervals, which shall be timed and sequenced automatically by the signal controller. The controller cycle sequence shall be the same under manual control as under automatic operation. When energized, the controller's manual control input shall automatically enter vehicle and pedestrian calls for all available phases. Furnish and install manual push-button and cord as called for on the Contract Drawings.

   e. The signal shutdown switch shall, when activated, extinguish the signal lamp indications. The power supply to the controller unit shall not be affected and the controller shall continue to function in the normal manner.

10. Provide a set of 3-position toggle switches that enables the manual calling of any available controller phase. Attach switches to the inward side of the main cabinet door. One set of switches shall be available to simulate a vehicle call for the signal phases and shall be capable of issuing momentary and continuous calls. A similar set shall be available for pedestrian actuation simulation. Provide access to the switch panel via the main cabinet door.

11. Wiring between the cabinet door and cabinet body shall be firmly secured, protected and of sufficient length to prevent kinking and abrasion from the opening and closing of the cabinet door.

12. Cabinet Finish

    a. Continuously weld exterior seams. Seal the main door and the "police door" with adhesive black, close-cell neoprene gaskets.

    b. Furnish cabinets with a clear anodized aluminum finish only if specified on the Contract Drawings.

    c. Fabricate unpainted aluminum cabinets from mill finish material, cleaned using appropriate methods that will remove oil film, weld black and mill ink marks and render the surface clean, bright, smooth and non-sticky to touch.

13. Cabinet Mounting

    a. Ground mounted cabinets shall be suitable in design to allow for their installation on concrete foundations as shown on the Contract Drawings. Obtain a template from the cabinet manufacturer for locating the cabinet foundation anchor bolts to be supplied with the cabinets.

    b. Anchor bolts for base-mounted cabinets shall be 3/4-inch diameter, minimum 18 inches long, with a 90-degree bend with a 2-inch leg with hot-dipped galvanizing or zinc plate treatment. Thread the end opposite the leg for at least 1 inch with a 3/4 - 10 thread. Furnish each anchor bolt with a 3-inch galvanized coupler with continuous threads, one 3/4 - 10 stainless steel cap screw with lock and flat washers.

    c. Cabinet ground for base-mounted cabinets shall be a 3/4-inch diameter and 10-ft long ground rod composed of steel core with a copper covering of minimum thickness of 250 micrometers, thoroughly welded so that an interlocking crystalline union is secure between the two metals. Use brass ground coupler and No. 4 AWG, 17 stranded ground wire to connect the ground rod to the cabinet ground lug and earth ground bus.

    d. Keys: Provide two sets of cabinet and police door keys with each cabinet. The keys shall not be shipped with the cabinets, but packed separately and mailed to the Engineer.

G. Terminals and Facilities

1. Provide for terminals and facilities within the controller cabinet as specified in NEMA TS 2, Type 2 that allows all equipment to be readily accessible and that shall include but not be limited to:

    a. Terminals for controller unit inputs and outputs
    b. Load switch and flasher supports and terminals
    c. Detector loops and auxiliary function field terminals
    d. Power distribution components and terminals
    e. Back panels
    f. Cabinet light and thermostatically controlled fan
    g. Transformer and UPS

2. The basic control equipment shall be capable of expansion to the full number of signal phases and timing intervals shown on the Contract Drawings. The original controller back panel(s) and power supply shall be adequate in design to accommodate full expansion of the controllers specified. The controller cabinet back panels shall be provided with a 12-position load bay and a 12-channel conflict monitor. .

   a. Provide 8 load switches and 4 flash transfer relays as a minimum.

3. Equip cabinets with a thermostatically controlled forced air fan system with screen air exhaust openings under the roof overhang. The thermostat turn-on points shall be manually adjustable from 91°F to 113°F (33°C to 45°C) with a differential of not more than 11°F (6°C) between automatic turn-on and turn-off. Locate the thermostat on the inside of the top portion of the cabinet not lower than 6 inches from the top of the cabinet.

4. Equip the inside of the cabinet with a fluorescent lighting fixture mounted on the inside top of the cabinet near the front edge which is activated by a door contact when the door is open and turned off when the door is closed. Provide fixture with an F15T8 cool-white lamp operated from a normal power factor UL or ETL listed ballast.

5. Equip cabinets with a main circuit breaker rated at a minimum of 30 amps.

6. Equip cabinets with a maintenance outlet consisting of a duplex, three-prong, NEMA Type 5-15R grounding outlet in accordance with NEMA WD6, with ground-fault circuit interrupt (GFI) as defined by the National Electrical Code. Furnish separate breaker for GFI. No permanent cabinet equipment shall be plugged into this maintenance outlet.

7. Equip cabinets with equipment outlets consisting of two additional duplex, three-prong, NEMA Type 5-15R grounding outlets without GFI, each furnished on a separate breaker. Mount the outlets in readily accessible locations inside the cabinet. Provide a UL-rated 15 amp, 6-outlet power strip with surge protection and a lighted on/off switch with a protective cover. Secure the power strip to the cabinet and plug it into one of the outlets.

8. Radio Interference Suppressers

   a. Equip each controller cabinet with suitable feed-through radio interference suppressers designed to minimize any broadcast or aircraft frequency interference that may be generated by the controller or other mechanism in the cabinet. The interference suppressers shall provide a minimum attenuation of 50 decibels over the frequency range of 200 kilohertz to 75 megahertz when used in connection with a normal installation.

   b. Design the suppressers for 125 percent of the total connection load and in no event less than 25 amperes on 120 volts, 60 hertz, single-wire circuits, meeting UL and ETL standards with unit hermetically sealed in a metal case filled with a suitable insulating compound.

   c. Terminals shall be nickel-plated, 10-24 brass studs of sufficient external length to provide space for connecting two No. 8 AWG connectors, mounted so that the terminals cannot be turned in the case. Ungrounded terminals shall be properly insulated from each other, and shall maintain a surface leakage distance of not less than 1/4-inch between any exposed current conductor and any other metallic part, with an insulation factor of 100 to 200 megohms dependent on external circuit conditions.

9. Circuitry Protection

a. Install appropriate devices in the traffic signal controller cabinets to protect the system electronics from an overvoltage situation, such as lightning strikes and power surges over the power lines. Incoming power shall be protected using a device such as an EDCO SH1210 or approved equal. Surge arrestors shall reduce the effects of power line voltage transients and shall have the following rating:

(1) recurrent peak voltages - 184 volts;

(2) energy rating, maximum - 20 joules;

(3) power dissipation, average - 0.85 watts;

(4) *peak current for pulse less than 7 microseconds - 1,250 amperes.*

b. Install permanently identified, separate protection devices at each traffic signal controller cabinet location on the field side of loop detectors and pedestrian button and interconnect lines. The surge suppressers shall be as follows or approved equal:

(1) Loop Detectors - EDCO Model No. SRA 6LC Pedestrian Inputs - EDCO Model No. SPA 60B;

(2) Modem Interconnect - EDCO Model PC642 with Socket;

(3) AC Interconnect - EDCO Model SRA64.

(4) The components shall be plug-in or screw-in units, which require no system downtime to replace, mounted on isolated panels completely wired through their own terminal blocks.

c. The devices shall be self-restoring under all except catastrophic conditions, whereby they shall be fail-safe or permanently shot to ground.

10. Transformers

a. Where only 480-volt power is available at an installation, as shown on the Contract Drawings, furnish a 5-KVA 480/120-volt, single-phase 60-hertz transformer to provide power to the controller cabinets. Provide properly sized circuit breaker on primary side of transformer.

11. Uninterruptible Power Supply (UPS)

a. Furnish and install a stand-alone UPS with battery back up

b. The UPS and battery back-up shall be suitable for operation in an outdoor cabinet. The function, capacity and run time of the UPS shall be as shown on the Contract Drawings. The function shall identify those cabinet components to be backed-up by the UPS.

12. Electrical Requirements

a. All wiring shall be in accordance with the requirements of the NFPA 70 National Electrical Code (NEC) and as shown on the Contract Drawings or specified herein. No wiring shall be exposed. Provide electrical connection by barrier type terminal blocks as defined in NEMA TS 2. All terminal block connections shall be identified and readily accessible for maintenance.

b. Make all wire and cable terminations with insulated spade terminals as defined in NEMA TS 2. Soldering of terminal connections will not be permitted.

c. Cables shall be used for interfacing between all panels including police panel. Cable shall have a PVC jacket rated for 300 volts. The conductors shall be minimum No. 18 AWG stranded annealed copper wire with PVC insulation rated for 300 volts minimum and shall be rated for use at 221°F (105°C).

d. Identify the circuit number of all cables, wires and spare wires by cable tags attached to each of the cables or wires in all terminations. Secure the cable tags to the cable or wire with nylon cable ties. Neatly lace wires into cables with nylon lacing or approved equal. Secure all cables with nylon cable clamps. Neatly route wires to their connections.

e. Harnesses for "A", "B", "C" and "D" Connectors, and Monitor Harnesses, shall have nylon braided expandable self-fitting cable sleeving.

f. Where a cable or wire passes through a hole or runs along a surface at any point through or on a completed assembly, deburr such holes and/or surfaces void of any sharp edges that may damage the cable or wire passing through or along the surface. Equip all deburred holes with a rubber or plastic grommet.

g. Electrical materials and equipment for which there are established Underwriters Laboratories (UL) and Electrical Testing Laboratories (ETL) standards shall bear the UL and ETL labels.

h. Provide separate ground busses for Earth, AC Neutral, and Logic, all of which shall be connected together at a single ground point grounding in accordance with the requirements of the NFPA 70 National Electrical Code (NEC) as specified herein. The cabinet and all metal conduits entering the cabinet shall be grounded.

13. Mechanical Connections

a. Provide all bolted connections other than high strength friction bolted connections with lock washers, locking nuts or other suitable means to prevent the connection nuts from backing off. All shop connections shall be either bolted or welded. Field welding will not be permitted. All connections to supporting structures shall be bolted.

b. Isolate dissimilar materials by stainless steel plates or other stainless steel fittings. Use stainless steel bolts for connection at these locations. Coating or plating will not be considered adequate for isolation of dissimilar metals or other connections.

c. Welding of aluminum shall consist of inert gas shielded metal arc welding with consumable electrodes. Perform all welding of aluminum in the shop; no field welding of aluminum will be permitted. Verify that all welders are qualified in accordance with the qualification procedures of AWS D1.2.

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 1.05 herein. No equipment shall be procured until the Engineer has given written approval.

B. Traffic related equipment to be removed and not required for relocation under the Contract, if and where shown on the Contract Drawings, shall remain the property of the Authority and shall be delivered to a location, in the Port District, designated by the Engineer. Removed equipment shall not be used in a new installation unless specifically shown on the Contract Drawings.

3.02 INSTALLATION

A. Install equipment and components in accordance with the Contract Drawings and approved shop drawings.

1. For field terminals in cabinet assemblies, use double row, high-type barrier block-type rated for 50 amperes with a minimum barrier height of 5/8 inches. Mount field terminal blocks horizontally at a minimum of ten inches from the bottom of the cabinet secured to the cabinet.
2. Locate terminal blocks and strips within the cabinet to be accessible to the extent that it shall not be necessary to remove the controller from the cabinet to make an inspection or connection.
3. Cut wires to their proper length before assembly with no double back to make up slack.
4. Make electrical connections between the complete controller mechanism and the terminal panel by "MS" type cable sockets to enable the rapid exchange of the controller without disconnecting or connecting individual wires.
5. Maintain clearance between each terminal and the terminal and cabinet so as to prevent a leakage path or physical contact under stress. The lay of the interconnect cables between components shall be such that when the cabinet door is closed, it will not press against the cables or force the cables against various components inside the cabinet.
6. Carry the groundside of service throughout the cabinet without a break. Run equipment grounds directly and independently to the ground bus. Provide a grounding strip having a minimum of nine connections grounded to the cabinet by connection directly to the cabinet wall.

B. Set work accurately in location and alignment. Provide anchorage devices and fasteners where necessary for installation and connection to other construction.

C. Prior to energization, test all field-installed wiring for continuity and hook-up. Tag-identify all terminations.

3.03 FIELD TESTS

A. Perform initial installation test in accordance with 1.05 F and as specified herein.

B. After installation, test the traffic signal controller assembly and/or traffic signal controller unit in the presence of the Engineer to show compliance with the requirements of this Section and with the applicable sections of the Traffic Signal Turn-On Checklist. The Turn-On Checklist is attached in Appendix B 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.

C. After satisfactory completion of the Turn-On Checklist and prior to Authority acceptance, the controller assembly shall pass the Traffic Signal Final Inspection using the Traffic Signal Final Inspection Checklist. The Final Inspection Checklist is attached in Appendix B of this Section. In the event of a failure or non-compliance of any component, correct the malfunction to the satisfaction of the Engineer. Malfunctions shall include but not be limited to equipment failures or the failure of the traffic signal controllers or non-compliance with the Contract Drawings or failure to comply with the requirements of this Section.

D. After malfunctions are corrected, a 30-day operational test period shall commence. In the event of a failure of any component, the final period countdown shall come to a halt. After said malfunctions are corrected, restart the 30-day test.

E. After satisfactory completion of the 30-day operational test, provide documentation for the installation to the Engineer using the Traffic Signal Asset Commissioning Form that is attached in Appendix B of this Section. Said documentation shall be completed and returned to the Engineer without additional cost to the Authority.

3.04 TRAINING

A. Operations Training Course: Conduct Operations Training Course prior to rendition of the Certificate of Final Completion. The training shall include but not be limited to hands-on operation of all signal control functions and hardware elements of the system. Conduct the training course for up to ten students. Give a minimum of three hours of instruction for the operations training course, encompassing an actual start up and shut down of the operations controlled by the signals.

B. Maintenance Training Course: Conduct Maintenance Training Course prior to rendition of the Certificate of Final Completion. Conduct the course for up to ten students. Give a minimum of seven hours of instruction for the Maintenance Training Course. As a minimum, the maintenance training shall include the following:

1. An overview of equipment and functions;
2. Theory of operation of all hardware and software components;
3. A complete description and demonstration of all diagnostic routines;
4. Instructions on minor servicing procedures in the field or by means of appropriate display models;
5. Instruction in equipment "troubleshooting" and problem identification procedures; and,
6. Complete description of recommended preventive maintenance requirements.

3.05 WARRANTY

A. Notwithstanding the Specifications, any inspection or approval by the Authority of the equipment or its installation, or the existence of any patent or trade name, the Contractor nevertheless warrants and represents that all equipment and all other items including the software supplied to the Authority hereunder and all workmanship shall be in accordance with the Contract, shall be fully fit for performance and shall operate in accordance with the requirements of the Specifications.

B. The Contractor guarantees that all equipment and other items to be supplied meet original manufacturer's specifications. The Contractor guarantees all equipment and other items to be supplied and workmanship against defects or failures in workmanship and materials, except to the extent of defects or failures, which the Contractor demonstrates to the satisfaction of the Director have arisen by reason of accident, abuse or negligence or fault of the Authority, its agents, employees, Licensees or invitees, and not due to fault on the Contractor's part.

C. In the event of defects or failures in said equipment or other items or in workmanship or any part thereof, then upon receipt of notice thereof from the Director, the Contractor's warranty obligations for 8-phase digital controller unit, signal conflict monitor, filters, suppressors, relays, transformer, circuit breakers, modems, communication panels, load switches, flasher, connecting harnesses, terminals, UPS, video detector modules and any other equipment not listed above but required for proper operation in accordance with the Contract Drawings and Specifications, shall be to repair or replace such equipment. With the repaired unit the Contractor shall provide documentation, which shall include an explanation of the repairs made and identification of the parts replaced by part number and circuit number.

D. The obligations of the Contractor to remedy defects under this Warranty shall extend through a period of two years after the rendition of the Certificate of Final Completion.

END OF SECTION

SECTION 16574

TRAFFIC SIGNAL CONTROLLER ASSEMBLY

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS:

Shop Drawings

16574A04 D. Submit the following to the Engineer in accordance with Division 1 – GENERAL PROVI¬SIONS entitled "Shop Drawings, Catalog Cuts and Samples":

1. Catalog Cuts and Data Sheets: Detailed drawing(s) for all equipment and outdoor envi¬ronmental housings of the traffic signal controller, including recommended mounting instructions.
2. Shop Drawings: A complete set of electronic reproducible shop drawings for the traf-fic signal controller, controller cabinet and associated equipment, from which clear prints can be made; and 5 sets of prints thereof. Included within this documentation shall be a bill of materials with manufacturers' names and part numbers and cabinet wiring diagrams for each controller cabinet.

Manufacturer Test Reports

16574F06 F. Submit the following to the Engineer in accordance with the Traffic Signal Asset Commis-sioning Form contained in Appendix "B".

1. Three copies of the satisfactory test results for the controller.
2. Three copies of the satisfactory test results for the conflict monitor.
3. Three copies of the satisfactory test results for the internal cabinet wiring.
4. One set of operation manuals.
5. Three copies of the final cabinet wiring schematics.
6. Three copies of the warranty documentation for all equipment.

Manuals, Warrantees/Guarantees

16574I03 C. Prepare and furnish complete operation and maintenance manuals for the traffic signal con¬troller assembly for approval not less than thirty (30) days prior to the intended start date for the training courses. Provide information for products furnished under this Sec-tion and prepare in the form of an instruction manual that shall be used as the basis for in-struction during the operations and maintenance courses. Content shall include, but not be limited to:

1. Each manufacturer's product data annotated to clearly identify product or part.
2. As-installed color-coded interconnection wiring diagrams, both "factory" and "field".
3. Equipment wiring or circuit board schematic diagrams indicating "factory" and "field"

4. Complete nomenclature and commercial number of replacement parts, including cur-rent prices, listing of spare parts initially provided and a second source of supply where applicable, cross referenced as to component designation.
5. Each manufacturer's pr

16574I05 E. Submit to the Engineer:
1. Keys in accordance with 2.01 F.14.

Qualifications

16574K01 A. Submit the following to the Engineer within forty-five (45) days after receipt by the Con-tractor of the acceptance of his Proposal:
1. Names and locations of at least three users who have had a minimum of one-year experi¬ence with the software and equipment to be furnished for Work of this Section. These users may be contacted by the Engineer to verify equipment performance, replacement and spare parts availability, delivery and other items as deemed helpful by the Engineer.
2. For approval, a list of manufacturers of equipment and software to be furnished un¬der the Work of this Section.

Training

16574Q02 B. Submit to the Engineer for approval not less than thirty (30) days prior to the intended start date for the training courses an outline of the curriculum for each course.

END OF APPENDIX "A"

wiring.

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 solderless 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:

Shop Drawings

16680A01 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.

Catalog Cuts

16680B01 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"

Queens County General Construction

Asbestos Worker — 07/01/2012

JOB DESCRIPTION Asbestos Worker **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES
Per Hour:

	07/01/2012
Abestos Worker Removal & Abatement Only*	$40.95

NOTE: *On Mechanical Systems that are NOT to be SCRAPPED.

SUPPLEMENTAL BENEFITS
Per Hour:

Abestos Worker Removal & Abatement Only	$8.25

OVERTIME PAY
See (B, B2, *E, J) on OVERTIME PAGE
Hours worked on Saturdays are paid at time and one half only if forty hours have been worked during the week.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8) on HOLIDAY PAGE

REGISTERED APPRENTICES
Apprentice Removal & Abatement Only:
1000 hour terms at the following percentage of Journeyman's rates.

1st	2nd	3rd	4th
78%	80%	83%	89%

SUPPLEMENTAL BENEFIT

Per Hour:

Apprentice Removal & Abatement	$8.25

4-12a - Removal Only

Boilermaker — 07/01/2012

JOB DESCRIPTION Boilermaker **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES
Per Hour:

	07/01/2012
Boilermaker	$ 47.98
Repairs & Renovations	$ 47.98

SUPPLEMENTAL BENEFITS
Per Hour:

	07/01/2012
Boilermaker Repairs & Renovations	33% of hourly Wage Paid + $22.25

NOTE: "Hourly Wage Paid" shall include any and all premium(s) pay.

Repairs & Renovation Includes replacement of parts and repairs & renovation of existing unit.

OVERTIME PAY
OVERTIME PAY
See (D, O) on OVERTIME PAGE
HOLIDAY
Paid: See (8, 16, 23, 24) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 12, 15, 25) on HOLIDAY PAGE
NOTE: *Employee must work in pay week to receive Holiday Pay.
**Boilermarker gets 4 times the hourly wage rate for working on Labor Day.
***Repairs & Renovation see (B,E,Q) on HOLIDAY PAGE

HOLIDAY

REGISTERED APPRENTICES
*REGISTERED APPRENTICES

(1/2) Year Terms at the following pecentage of Boilermaker's Wage

1st	2nd	3rd	4th	5th	6th	7th	8th
65%	65%	70%	75%	80%	85%	90%	95%

Supplemental Benefits Per Hour:

Apprentice(s)	07/01/2012 33% of Hourly Wage Paid plus amount below

1st	2nd	3rd	4th	5th	6th	7th	8th
$17.41	$18.10	$18.79	$19.48	$20.17	$20.86	$21.55	$22.25

NOTE: "Hourly Wage Paid" shall includ any and all premium(s)

4-5

Carpenter 07/01/2012

JOB DESCRIPTION Carpenter **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES
Per hour: 07/01/2012

Piledriver	$ 46.74
Dockbuilder	$ 46.74

SUPPLEMENTAL BENEFITS
Per hour paid:

Journeyworker	$ 42.45

OVERTIME PAY
See (B, E2, O) on OVERTIME PAGE

HOLIDAY
Paid: See (18,19)on HOLIDAY PAGE.

Paid: for 1st & 2nd yr.
Apprentices See (5,6,11,13,16,18,19,25)

Overtime: See (5,6,11,13,16,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES
Wages per houris Pecentage of Journeyworkers Wage

(1)year terms:

1st.	2nd.	3rd.	4th.

	40%	50%	65%	80%

Supplemental benefits per hour:

Apprentices $ 27.77

9-1456

Carpenter **07/01/2012**

JOB DESCRIPTION Carpenter **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES
Per hour: 07/01/2012

Carpet/Resilient
Floor Coverer $ 45.34

INCLUDES HANDLING & INSTALLATION OF ARTIFICIAL TURF AND SIMILAR TURF INDOORS/OUTDOORS.

SUPPLEMENTAL BENEFITS
Per hour paid:

Floor Coverer $ 38.58

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (18, 19)on HOLIDAY PAGE.

Paid: for 1st & 2nd yr.
Apprentices See (5,6,11,13,16,18,19,25)

Overtime: See (5,6,11,13,16,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES
Wage per hour is Pecentage of Journeyworkers Wage

(1) year terms:

1st.	2nd.	3rd.	4th.
40%	50%	65%	80%

Supplemental benefits per hour:

Apprentices $ 25.83

9-2287

Carpenter **07/01/2012**

JOB DESCRIPTION Carpenter **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES
Per Hour: 07/01/2012

Marine Construction:

Marine Diver $ 58.95
M.D.Tender 42.10

SUPPLEMENTAL BENEFITS
Per Hour Paid:

Journeyman $ 42.37

OVERTIME PAY
See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (18, 19) on HOLIDAY PAGE
Overtime: See (5, 6, 10, 11, 13, 16, 18, 19) on HOLIDAY PAGE

9-1456MC

Carpenter **07/01/2012**

JOB DESCRIPTION Carpenter **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES
Per hour: 07/01/2012

Building
Millwright $ 47.86

SUPPLEMENTAL BENEFITS
Per hour paid:

Millwright $ 44.75

OVERTIME PAY
See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (18,19) on HOLIDAY PAGE.

Paid: for 1st & 2nd yr.
Apprentices See (5,6,11,13,16,18,19,25)

Overtime See (5,6,11,13,16,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES
Wages per hour is Pecentage of Journeyworkers wage

(1) year terms:

1st.	2nd.	3rd.	4th.
55%	65%	75%	95%

Supplemental benefits per hour:

(1) year terms:

1st.	2nd.	3rd.	4th.
$28.19	$31.29	$35.51	$40.62

9-740.1

Carpenter **07/01/2012**

JOB DESCRIPTION Carpenter **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES
Per Hour: 07/01/2012

Timberman $ 44.03

SUPPLEMENTAL BENEFITS
Per Hour: 07/01/2012

$ 40.62

OVERTIME PAY
See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (18,19) on HOLIDAY PAGE.

Paid: for 1st & 2nd yr.
Apprentices See (5,6,11,13,16,18,19,25)

Overtime: See (5,6,11,13,16,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES
Wages per hour is Pecentage of Journeymans Wage.

(1) year terms:

1st	2nd	3rd	4th
40%	50%	65%	80%

Supplemental benefits per hour:

Apprentices $ 25.14

9-1536

Carpenter **07/01/2012**

JOB DESCRIPTION Carpenter **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Westchester

PARTIAL COUNTIES
Orange: South of but including the following, Waterloo Mills, SlateHill, New Hampton, Goshen, Blooming Grove, Mountainville, east to the Hudson River.
Putnam: South of but including the following, Cold Spring, TompkinsCorner, Mahopac, Croton Falls, east to Connecticut border.
Suffolk: West of Port Jefferson and Patchoque Road to Route 112 tothe Atlantic Ocean.

WAGES
Per hour: 07/01/2012

Core Drilling:

Driller	$ 35.46
Assistant Driller	$ 28.89

Note: Hazardous Waste Pay Differential:
For Level C, an additional 10% above wage rate per hour
For Level B, an additional 10% above wage rate per hour
For Level A, an additional 10% above wage rate per hour
Note: When required to work on water: an additional $ 0.50 per hour.

* May be allocated between wages and benefits.

SUPPLEMENTAL BENEFITS
Per hour paid:

Driller	$ 17.52
Asst. driller	17.52

OVERTIME PAY
OVERTIME: See (B,E,K*,P,R**) on OVERTIME PAGE.

HOLIDAY
HOLIDAY:
Paid: See (5,6) on HOLIDAY PAGE.
Overtime: * See (5,6) on HOLIDAY PAGE.
** See (8,10,11,13) on HOLIDAY PAGE.

Assistant: One (1) year increments at the following percentage of Assistant wages. This is not an apprenticeship for Driller.

1st Year	2nd Year	3rd Year	4th Year
70%	80%	90%	100%

9-1536-CoreDriller

Carpenter **07/01/2012**

JOB DESCRIPTION Carpenter **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Putnam, Queens, Richmond

PARTIAL COUNTIES
Nassau: That portion of the county that lies west of Seaford Creekand south of the Southern State Parkway.

WAGES

Per hour:	07/01/2012
Show Exibit/ Carpenter	$ 46.15

SUPPLEMENTAL BENEFITS
Per hour paid:

Show Exibit/ Carpenter	$ 38.58

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY

Paid:	See (18,19) on HOLIDAY PAGE.
Paid:for 1st & 2nd yr. Apprentices	See (5,6,11,13,16,18,19,25)
Overtime:	See (5,6,11,13,16,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES
Wages per hour is Pecentage of Journeyworkers Wage

(1) year terms:

1st.	2nd.	3rd.	4th.
40%	50%	65%	80%

Supplemental benefits per hour:
Apprentices $ 25.83

9-EXHIB

Carpenter - Building / Heavy&Highway **07/01/2012**

JOB DESCRIPTION Carpenter - Building / Heavy&Highway **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

PARTIAL COUNTIES
Nassau: Work preformed south of the Southern State Parkway and west of the Seaford Creek.

WAGES

Per hour:	07/01/2012
Building:	
Carpenter	$46.15
Heavy&Highway:	
Carpenter	$54.12*

*Premium pay calculated on hourly wage of $46.74; the balance ($7.38) paid at straight time.

SUPPLEMENTAL BENEFITS
Per hour paid:

Building:	
Carpenter	$ 38.50
Heavy&Highway:	
Carpenter	$ 34.99

OVERTIME PAY
See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (18,19) on HOLIDAY PAGE.

Paid: for 1st & 2nd yr.
Apprentices See (5,6,11,13,16,18,19,25)

Overtime: See (5,6,11,13,16,18,19,25) on HOLIDAY PAGE.

REGISTERED APPRENTICES
Wage per hour:

(1) year terms:

	1st	2nd	3rd	4th
Building	40%	50%	65%	80%
Heavy&Highway*	40%	50%	65%	80%

*Wage calculations to be based off an hourly wage of $46.74
Supplemental benefits per hour for all Apprentices:

Building	$ 25.75
Heavy & Highway	27.69

9-NYC

Electrician **07/01/2012**

JOB DESCRIPTION Electrician **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond, Westchester

WAGES
Per hour Paid: 07/01/2012

Service Technician $ 28.89

Service and Maintenance on Alarm and Security Systems.

Maintenance, repair and /or replacement of defective (or damaged) equipment on, but not limited to, Burglar - Fire - Security - CCTV - Card Access - Life Safety Systems and associated devices. (Whether by service contract of T&M by customer request.)

SUPPLEMENTAL BENEFITS
Per hour:
Journeyworker: 38.72% of wage
+ $12.00 per day

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 11, 12, 16, 25, 26) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 12, 16, 25, 26) on HOLIDAY PAGE

9-3H

Electrician **07/01/2012**

JOB DESCRIPTION Electrician **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
Per hour: 07/01/2012

Electrician
H - Telephone $ 25.30

Maintenance and Jobbing-Electrical work of limited duration and scope, consisting of repairs and/or replacement of electrical and teledata equipment.

- Includes all work necessary to retrofit, service, maintain and repair all kinds of lighting fixtures and local lighting controls and washing and cleaning of foregoing fixtures.

SUPPLEMENTAL BENEFITS

Journeyworker $ 17.52

OVERTIME PAY
See (B, H) on OVERTIME PAGE

HOLIDAY
Paid: *See (5, 6, 10, 11, 12, 16) on HOLIDAY PAGE*
Overtime: See (5, 6, 10, 11, 12, 16) on HOLIDAY PAGE

9-3m

Electrician **07/01/2012**

JOB DESCRIPTION Electrician **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
Per hour: 07/01/2012

Tree Trimmer	$ 23.92
Ground Person	$ 15.80

Applies to line clearance, tree work, and right-of-way preparation on all new or existing overhead, electrical, telephone, and CATV lines.

SUPPLEMENTAL BENEFITS
Per hour paid:
35.3% of wages*(INCLUDING OVERTIME)

Note: *Plus paid vacation & 4 days sick leave. Vacation based on continous service as follows:

* 40 hours after 1 year
* 80 hours after 2 years
* 120 hours after 5 years
* 160 hours after 15 years

Note: Employee must work atleast 1800 hours in employee's anniversary year . An employee who workes 900 in the employee anniversary year but did not actually worked 1800 hours during that period shall be entitled to a pro rata share of vacation on the basis of 900 hours or more actually worded as a percentage based on 1800 hours.

OVERTIME PAY
See (B, *H, Q) on OVERTIME PAGE
*Worked performed on Sundays & Holidys outside of 7.00am - 4.00pm shall be paid at double time, in addition to the holiday pay if applicable.

HOLIDAY
HOLIDAY:
Paid: See (5,6,10,11,15,16,26) on HOLIDAY PAGE.

(An additional floating holiday after four years' service)

Overtime: See (5,6,10,11,15,16,26) on HOLIDAY PAGE.

9-3T

Electrician **07/01/2012**

JOB DESCRIPTION Electrician **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
Per Hour:

	07/01/2012
Electrician	$ 51.00
Audio/Sound	51.00

SUPPLEMENTAL BENEFITS
Per Hour:
Journey Worker $ 42.45*

*This hourly benefit rates applies for cumulative wages for the year up to $110,100 for the same employer; thereafter the benefit rate is $40.31 per hour.

OVERTIME PAY
See (A, H) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15, 16) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages Per Hour:
Apprentices registered
before 05/10/2007
One (1) year terms.

	07/01/2012
1st term	$ 14.25
2nd term	17.05
3rd term	19.15
4th term	21.10
MIJ (5th term)	25.30

Apprentices registered
after 05/10/2007
One (1) year terms

1st term	$ 11.50
2nd term	13.50
3rd term	15.50
4th term	17.50
MIJ (5th term)	21.50

Supplemental Benefits:
Per Hour for Apprentices
registered before 05/10/2007

1st term	$ 11.19
2nd term	12.54
3rd term	13.55
4th term	14.50
MIJ (5th term)	17.52

Suppemental Benefits:
Per hour for Apprentices
registered after 05/10/2007

1st term	$ 9.86
2nd term	10.82
3rd term	11.79
4th term	12.76
MIJ (5th term)	15.71

9-3

Electrician **07/01/2012**

JOB DESCRIPTION Electrician **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
Per hour:

	07/01/2012
Electro pole Electrician	$ 51.00
Electro pole foundation Installer	$ 38.66
Electro Pole Maintainer	$ 33.10

SUPPLEMENTAL BENEFITS
Per Hour:

07/01/2012

Electro pole Electrcian	$ 44.18*
Electro pole foundation Installer	$ 34.12*
Electro pole Maintainer	$ 30.84*

*Hourly benefit rate applies for cumulative wages for the year up to $110,000. for the same employer, thereafter decrease the hourly benefit rate by a percentage of the hourly wage rate as noted below:

Electro pole Electrician 4.20%
Electro pole F/installer 4.54%
Electro pole Maintainer 4.54%

OVERTIME PAY
See (A, *B, **E4, F, K) on OVERTIME PAGE
* Applies to the electro pole foundation installer
** MAKE UP DAYS MAY NOT EXCEED FOUR DAYS IN A MONTH; OVERTIME RATE APPLIES AFTER FIVE CONSECUTIVE DAYS WORKED PER WEEK.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 16, 25, 26) on HOLIDAY PAGE

9-3J

Electrician Lineman 07/01/2012

JOB DESCRIPTION Electrician Lineman **DISTRICT** 4

ENTIRE COUNTIES
Nassau, Queens, Suffolk

WAGES
For Utility Distribution & Transmission Line Construction:

Per Hour:	07/01/2012
Lineman/Splicer	$ 47.13
Material Man	$ 41.00
Heavy Equip. Operator	$ 37.70
Groundman	$ 28.28
Flagman	$ 21.21

For Natural Gasline Construction:

Per Hour:

Journeyman U.G.Mech.	$ 39.45

** IMPORTANT NOTICE - EFFECTIVE 04/01/2009 **
Four (4), ten (10) hour days may be worked at straight time during a week, Monday thru Thursday.

NOTE - In order to use the '4 Day/10 Hour Work Schedule,' you must submit an 'Employer Registration for Use of 4 Day/10 Hour Work Schedule,' form PW30R; additionally, there must be a dispensation of hours in place on the project.

SUPPLEMENTAL BENEFITS
Per Hour:
Utility Distribution & Transmission Line Construction:

All Classifications	22.5% of Hourly Wage Paid + $13.04

NOTE: "Hourly Wage Paid" shall include any and all premium(s) pay

Natural Gasline Construction:
Per Hour:

Journeyman U.G.Mech.	$ 18.71

OVERTIME PAY

See (B, E, Q) on OVERTIME PAGE
OVERTIME for Natural Gas Mechanic:(B,G,P)

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 16, 23, 25, 26) on HOLIDAY PAGE
Same as Above for natural Gas Mechanic.

REGISTERED APPRENTICES
1000 hour Terms at the following Percentage of Journeyman's Wage.

1st	2nd	3rd	4th	5th	6th	7th
60%	65%	70%	75%	80%	85%	90%

SUPPLEMENTAL BENEFIT:

All Terms 22.5% of Hourly Wage Paid + $13.04

Natural Gas Mechanic:

$18.71

4-1049 Line/Gas

Elevator Constructor 07/01/2012

JOB DESCRIPTION Elevator Constructor **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

PARTIAL COUNTIES
Rockland: Entire County except for the Township of Stony Point
Westchester: Entire County except for the Townships of Bedford, Lewisboro, Cortland, Mt. Kisco, North Salem, Pound Ridge, Somers and Yorktown.

WAGES
Per hour:

	07/01/2012	03/17/2013
Elevator Constructor	$55.20	$57.01
Modernization & Service/Repair	$43.79	$45.14

SUPPLEMENTAL BENEFITS
Per Hour:

**PECTENTAGES BASED ON YEARS OF EMPLOYMENT AS FOLLOWS BELOW:
4%-Up to 5 years
6%-6th year to 15 years
8%-15 years or more

	07/01/2012	03/17/2013
Elevator Constructor	$26.54 plus**% of wage per Hour	$28.04 plus**% of wage per Hour
Modernization & Service/Repair	$26.39 plus**% of Wage per Hour	$27.89 plus**% of Wage per Hour

OVERTIME PAY
Constructor. See (D, O) on OVERTIME PAGE.

Modern./Service See (B, H) on OVERTIME PAGE.

HOLIDAY
Paid: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
WAGES PER HOUR:

BASED ON PERCENTAGE OF JOURNEYMANS WAGE IN THE CLASSIFICATION WORKED EITHER ELEVATOR CONSTRUCTOR OR MODERNIZATION,SERVICR/REPAIR

1 YEAR TERMS

1st Term	2nd Term	3rd Term	4th Term
50%	55%	65%	75%

SUPPLEMENTAL BENEFITS

	07/01/2012	03/17/2013
Elevator Constructor		
1st Term	$24.00	$25.41
2nd Term	$24.50	$25.92
3rd Term	$25.51	$26.97
4th Term	$26.53	$28.01
Modernization & Service/Repair		
1st Term	$23.69	$25.10
2nd Term	$24.17	$25.58
3rd Term	$25.12	$26.56
4th Term	$26.06	$27.54

4-1

Glazier **07/01/2012**

JOB DESCRIPTION Glazier **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster, Westchester

WAGES

Per hour:	07/01/2012	11/01/2012	05/01/2013 Additional
Glazier	$ 47.75	$ 48.60	$ 1.50*
Scaffolding	$ 48.75	$ 49.60	$ 1.50*
Repair & Maintenance:			
Glazier	$ 26.50	$ 26.50	$ 1.50*

* To be allocated at a future date

Repair & Maintenance- All repair & maintenance work on a particular building, whenever performed, where the total cumulative contract value is under $100,000.00.

SUPPLEMENTAL BENEFITS

Per hour paid:	07/01/2012	11/01/2012	05/01/2013
Journeyworker...	$ 25.34	$ 25.34	$ 26.60
Repair & Maintenance:			
Glazier	$ 15.14	$ 15.14	$ 15.64

OVERTIME PAY
OVERTIME: See (C*,D* E2, O) on OVERTIME PAGE.

* If an optional 8th hour is required to complete the entire project, the same shall be paid at the regular rate of pay. If a 9th hour is worked, then both hours or more (8th & 9th or more) will be paid at double time rate of pay.

** For Repair & Maintenance see (B,F, P) on overtime page.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (4, 6, 16, 25) on HOLIDAY PAGE
The Following are paid holidays for the Repair & Maintenance Class:
New Years day, Presidents day, Memorial day, Independents day, Labor day, Thanksgiving day, Day after Thanksgiving, and Christmas day.

REGISTERED APPRENTICES
Wage per hour:
(1) year terms at the following wage rates:

	07/01/2012	11/01/2012	05/01/2013 Additional
1st term	$ 16.00	$ 16.35	$ .60*
2nd term	$ 23.81	$ 24.24	$ .75*
3rd term	$ 28.59	$ 29.10	$ .90*
4th term	$ 38.17	$ 38.85	$ 1.20*

* To be allocated at a future date

Supplemental Benefits:
(Per hour worked)

1st term	$ 12.07
2nd term	$ 17.28
3rd term	$ 18.54
4th term	$ 18.89

9-1281 (DC9 NYC)

Insulator - Heat & Frost 07/01/2012

JOB DESCRIPTION Insulator - Heat & Frost **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES
Per Hour:

	07/01/2012	12/31/2012
Insulators Heat & Frost	$61.08	*Additional $1.75/Hr

*Additional may be allocated between Wages & Supplements

SUPPLEMENTAL BENEFITS
Per Hour:

Insulators Heat & Frost	$26.59

OVERTIME PAY
See (A, D, O, V) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages:

Apprentice Insulator(s)

1 year terms at the following wage rate.

1st	2nd	3rd	4th
$24.43	$36.65	$42.76	$48.86

Supplemental Benefits per hour:

Apprentice Insulator(s)

1st	2nd	3rd	4th
$10.64	$15.95	$18.62	$21.27

4-12

Ironworker 07/01/2012

JOB DESCRIPTION Ironworker **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per Hour:	07/01/2012	01/01/2013 Additional	07/01/2013 Additional
IRONWORKER:			
Ironworker Rigger	$ 49.50	$ 1.50*	$ 1.50*
Ironworker Stone Derrickman	$ 49.50	$ 1.50*	$ 1.50*

* To be allocated at a future date

SUPPLEMENTAL BENEFITS
Ironworker: $ 36.53

OVERTIME PAY
See (*A, D1, **E, Q, V) on OVERTIME PAGE
*Time and one-half shall be paid for all work in excess of seven (7) hours at the end of a work day to a maximum of two hours on any regular work day (the eighth (8th) and ninth (9) hours of work) and double time shall be paid for all work thereafter.
**Time and one-half shall be paid for all work on Saturday up to seven (7) hours and double time shall be paid for all work thereafter.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 10, *24, 25) on HOLIDAY PAGE
*Work stops at schedule lunch break with full day's pay.

REGISTERED APPRENTICES
Wage per hour:

(1/2) year terms at the following hourly wage rate:

	1st	2nd	3rd	4th	5th	6th
	$23.75	23.75	34.35	38.40	42.45	42.45
01/01/2013 An additional	$0.75*	$0.75*	$1.05*	$1.20*	$1.35*	$1.358
07/01/2013 An additional	$0.75*	$0.75*	$1.05*	$1.20*	$1.35*	$1.35*

* To be allocated at a future date

Supplemental benefits

Per hour paid:
Registered Apprentice

1st term	$ 19.27
2nd term	$ 19.27
All others	$ 28.15

9-197D/R

Ironworker 07/01/2012

JOB DESCRIPTION Ironworker **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES
Per hour: 07/01/2012

Ornamental	$ 41.00
Chain Link Fence	$ 41.00
Guide Rail Installation	$ 41.00

SUPPLEMENTAL BENEFITS
Per hour paid:

	07/01/2012
Journeyworker:	$40.07

OVERTIME PAY
OVERTIME: See (A*,D1,E**,Q,V) on OVERTIME PAGE.

*Time and one-half shall be paid for all work in excess of seven (7) hours at the end of a work day to a maximum of two (2) hours on any regular work da (8th & 9th hours of work) and double time shall be paid for all work thereafter.
**Time and one-half shall be paid for all work on Saturday up to seven (7) hours and double time shall be paid for all work thereafter.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
1st term represents first 1-4 months, thereafter (1/2) year terms at the following percentage of Journeyman's wage.

APPRENTICES:Employed Prior to 8/01/2008

1st	2nd	3rd	4th	5th	6th
60%	65%	70%	80%	85%	95%

APPRENTICES:Employed After 8/01/2008

1st	2nd	3rd	4th	5th	6th
50%	50%	55%	60%	70%	80%

Supplemental Benefits per hour paid:

APPRENTICES:	07/01/2012
1st Term	$ 31.75
2nd Term	31.75
3rd Term	32.58
4th Term	33.41
5th Term	35.08
6th Term	36.74

4-580-Or

Ironworker **07/01/2012**

JOB DESCRIPTION Ironworker **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES
PER HOUR:

	07/01/2012	01/01/2013	07/01/2013
Ironworker:			
Structural	$45.05	*additional	*additional
Bridges	+ *$2.00	$2.45/Hr	$2.00/Hr
Machinery			

*To be allocated to Wages or Benifits.

SUPPLEMENTAL BENEFITS
PER HOUR:

Journeyman $58.50

OVERTIME PAY

See (B*,E**,Q,V) on OVERTIME PAGE.

* Time and one-half shall be paid for all work in excess of (8) eight hours at the end of a work day to a maximum of two hours on any regular work day (the ninth (9th) and tenth (10th) hours of work)and double time shall be paid for all work thereafter.

** Time and one-half shall be paid for all work on Saturday up to eight (8) hours and double time shall be paid for all work thereafter.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 18, 19) on HOLIDAY PAGE

REGISTERED APPRENTICES
WAGES PER HOUR:

6 month terms at the following rate:

1st Term	$23.62 +*$2.00/Hr	*additional $2.45/Hr for all Terms	*additional $2.00/Hr for all Terms
2nd Term	$24.22 +*$2.00/Hr		
3rd - 6th Term	$24.82 +*$2.00/Hr		

*To be allocated to Wages or Benifits

Supplemental Benefits
PER HOUR:

ALL TERMS $41.86

4-40/361-Str

Ironworker **07/01/2012**

JOB DESCRIPTION Ironworker **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

PARTIAL COUNTIES
Rockland: Southern section - south of Convent Road and east of Blue Hills Road.

WAGES

Per hour:	07/01/2012	07/01/2013
Reinforcing & Metal Lathing	$ 49.73	Additional $ 2.00/Hr*

*To be allocated at a future date

SUPPLEMENTAL BENEFITS
Per hour paid:

Reinforcing & Metal Lathing $ 29.98

OVERTIME PAY
See (B, B1, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 13, 18, 19, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
(1) year terms at the following wage rates:

Wages Per Hour:

Apprentices Registered BEFORE 6/29/2011

1st term	2nd term	3rd term
$ 28.20	$ 32.80	$ 37.86

Apprentices Registered ON or AFTER 6/29/2011

$ 17.71	$ 22.71	$ 27.71

SUPPLEMENTAL BENIFITS

Per Hour:

Apprentices Registered BEFORE 6/29/2011

1st term	2nd term	3rd term
$ 23.17	$ 24.67	$ 25.82

Apprentices Registered On or AFTER 6/29/2011

$ 23.17	$ 24.67	$ 25.82

4-46Reinf

Laborer **07/01/2012**

JOB DESCRIPTION Laborer **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
Per hour: 07/01/2012

Laborer/Excavation:	
**Asbestos and Lead Abatement & Removal,Hazardous Waste Removal (including soil)	$ 38.70
Basic	38.70
Flagman	38.70
Pipelayer	38.70
*Tree Work, *Landscape	38.70

Notes: *Includes trimming, cutting, planting and/or removal of trees.
** Applies to Heavy & Highway projects

SUPPLEMENTAL BENEFITS
Per hour paid:

Journeyworker	$ 31.75

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE
++ Except for Independence Day, holidays which fall on a Saturday will not be observed on the preceding Friday.When an observed holiday falls on a Saturday,work done shall be paid at double time.

HOLIDAY
Paid: See (2, 20) on HOLIDAY PAGE
Overtime: See (5, 6, 11) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage per hour:

1000 hour terms at the following hourly wage rate.

		07/01/2012
1st	0-1000	$ 19.35
2nd	1001-2000	$ 23.22
3rd	2001-3000	$ 29.03
4th	3001-4000	$ 34.83

Supplemental Benefits per hour paid:

All Apprentices $ 31.75

9-731Ex

Laborer **07/01/2012**

JOB DESCRIPTION Laborer **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
Per hour:

GROUP 14: Blasters.

GROUP 16: Tunnel workers *
* (including Miners, Drill Runners, Iron Men, Maintenance Men, Conveyor Men, Safety Miners, Riggers, Block Layers, Cement Finishers, Rod Men, Caulkers, Powder Carriers, Miners' Helpers, Chuck Tenders, Track Men, Nippers, Brake Men,Derail Men, Form Men, Bottom Bell, Top Bell or Signal men, Form Workers, Movers, Concrete Workers, Shaft Men, Tunnel Laborers and Caulkers' Helpers).

GROUP 17**: All others including: Powder Watchmen, Top Laborers and Changehouse Attendants.

Wages: (per hour)	07/01/2012
Laborer (Tunnel)-FREE AIR:	
Group 14	$ 54.59
Group 16	$ 55.23
Group 17**	$ 48.26
Small Bore Micro Tunnel Machines	80% of rates above
For Repairs on Existing Water Tunnels	90% of rates above
For Repairs of Sewer & Drainage Tunnels	85% of rates above
For Repair & Maintenance of all Subway & Vehicular Tunnels	80% of rates above

**An additional $3.00 per day when using an air spade, jack hammer or pavement breaker.

Note: For jobs bid before July 1, 2010 employer shall pay $6.00 per day for each one half (1/2) mile or fraction starting from a point 500 feet from the shaft. For all jobs bid after July 1, 2010, said premium shall be $10.00 per day.

SUPPLEMENTAL BENEFITS
Per hour paid:

GROUP 14	$ 39.79
GROUP 16	$ 38.09
GROUP 17	$ 35.23
Small Bore Micro Tunnel Machines	80% of rates above
For Repairs on Existing Water Tunnels	90% of rates above
For Repairs of Sewer & Drainage Tunnels	85% of rates above
For Repair & Maintenance of all Subway& Vehicular Tunnels	80% of rates above

OVERTIME PAY
OVERTIME: For Laborer (Free Air) See (D, M, R*) on OVERTIME PAGE.
For Repair Categories See (B, F, R*) on OVERTIME PAGE.
& Micro Tunneling
* Straight time first 8 hours, double time after 8 hours.

HOLIDAY

Paid: See (5, 6, 9, 11, 12, 15, 16, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 9, 11, 12, 15, 16, 25) on HOLIDAY PAGE
Good Friday may be exchanged for one of the holidays listed.

9-147Tnl/Free

Laborer 07/01/2012

JOB DESCRIPTION Laborer **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:	07/01/2012
Laborer:	
Laborer-Concrete (including flag person)	$ 37.55

SUPPLEMENTAL BENEFITS

Per Hour Worked	$ 25.62

OVERTIME PAY
OVERTIME: See (A,E,Q) on OVERTIME PAGE attached.
See (B,E,Q,) for work below street level to top of foundation.

For Work done on Saturdays add an additional $2.75 per hour to Supp. Benefits.
For work done on Sundays & Holidays add an additional $5.50 per hour to Supp. Benefits.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 13, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:
Terms at the following percentage of Journeyworkers wage.

Term:	1st	2nd	3rd
Hours:	0-500	501-2000	2001-4000
	50%	65%	80%

Supplemental Benefits:
(Per Hour Worked)

0-1000 hrs	Over 1000 hrs
$17.49*	$ 22.87*

Additional Benefits:

Add the following benefits based on the criteria below:

501-2000 hours	2001-4000 hours
$0.83*	$1.65*

*For work on Saturdays add the following amount per term to hourly supp. benefits:

1st	2nd	3rd
$ 1.38	$ 1.79	$ 2.20

*For work on Sundays & Holidays add the following amount per term to hourly supp. benefits:

1st	2nd	3rd
$ 2.75	$ 3.58	$ 4.40

9-6A/18A/20-C

Laborer - Building 07/01/2012

JOB DESCRIPTION Laborer - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:	07/01/2012	01/01/2013

		Additional
Building Laborer-Demolition:	$ 34.60	$ 1.00*

* To be allocated at a future date

NOTE: Total Demolition Only: Demolition shall be the complete demolition (wrecking) or dismantling of entire buildings or structures. Also may include the removal of all or any portion of a roof in which structural change is to occur. Structural change is defined as the removal of structural slabs, steel members, concrete members and penetration through the structural slab.

SUPPLEMENTAL BENEFITS
Per hour paid:
Journeyworker: $ 22.65

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 13, 15, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage per hour:

(1) year terms at the following wage.

1st	2nd	3rd	4th
$ 20.81	$ 21.81	$ 23.31	$ 25.81

Supplemental Benefits per hour paid:

Apprentices: $ 14.70

9-79/95

Laborer - Building 07/01/2012

JOB DESCRIPTION Laborer - Building **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:	07/01/2012
Laborer/ Asbestos, lead and Hazardous Material Abatment	$35.10

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2012
Laborer	$15.10

OVERTIME PAY
See (B, H) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8) on HOLIDAY PAGE

REGISTERED APPRENTICES
1000 hour terms at the following:

Per Hour:	07/01/2012
1st term	$27.38
2nd Term	$28.08
3rd Term	$29.14
4th Term	$31.25

SUPPLEMENTAL BENIFIT

Per Hour:	07/01/2012
ALL TERMS	$15.10

4-NYDC(78)

Laborer - Building 07/01/2012

JOB DESCRIPTION Laborer - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:	07/01/2012
Building: Plasterer Tender and Spray Fireproofing.	$ 35.59

SUPPLEMENTAL BENEFITS

Per hour paid:	
Journeyworker	$ 23.35

OVERTIME PAY
See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage per hour:

1000 hours terms at the following wage.

	1st	2nd	3rd	4th
07/01/2012	$21.08	22.08	23.58	26.08

Supplemental Benefits per hour paid:

Apprentices	$15.41**

** Applies to all Apprentices.

9-30 (79)

Laborer - Building 07/01/2012

JOB DESCRIPTION Laborer - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour:	07/01/2012	01/01/2013 Additional	07/01/2013 Additional
Basic Laborer	$ 35.59	$ 1.00*	$ 1.10*
Mason Tender	35.59	1.00*	1.10*
Interior Demolition	34.87	0.75*	

* To be allocated at a future date

SUPPLEMENTAL BENEFITS

Per hour paid:	07/01/2012
Basic Laborer	$ 23.05
Mason Tender	23.05
Interior Demolition	18.22

OVERTIME PAY
See (B, B2, I, R) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 25) on HOLIDAY PAGE
(Easter is paid at Time and One-half if worked)

REGISTERED APPRENTICES
Wage per hour:

1000 hour terms at the following wage rate:

07/01/2012 - Term:	1st	2nd	3rd	4th
Basic Laborer	$ 21.08	$ 22.08	$ 23.58	$ 26.08
Mason Tender	21.08	22.08	23.58	26.08
Interior Demolition	21.23	22.23	23.73	26.23

Supplemental Benefits per hour paid:

07/01/2012 - All Terms:	
Basic Laborer	$ 15.41
Mason Tender	15.41
Interior Demolition	14.66

9-MTDC(79)

Laborer - Concrete & Asphalt Paving 07/01/2012

JOB DESCRIPTION *Laborer - Concrete & Asphalt Paving* ***DISTRICT*** *9*

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
Group 1: Slurry Seal Coater, Maintenance Safety Surface, Small Equipment Operator, Small Power Tool Operator, Play Equipment Installer, Landscape Planting & Maintenance, Temporary Fence Installer & Repairs, Laborer.

Group 2: Shoveler, Small Equipment Operator on Asphalt work.

Per hour:	07/01/2012
Concrete Formsetter	$ 42.21
Asphalt Screedman / Micro Paver	44.86
Asphalt Raker	44.37
Group 1	38.34
Group 2	41.08

SUPPLEMENTAL BENEFITS

Per hour paid:	07/01/2012
Journeyman	$ 30.90

OVERTIME PAY
See (B, E, Q) on OVERTIME PAGE

HOLIDAY
HOLIDAY:
Paid: See (5,11,12,20)* on HOLIDAY PAGE.
Overtime: See (21,22)** on HOLIDAY PAGE.

*If an employee does not work on said holiday, he will receive single time pay rate for the said day, provided that the said employee has worked one (1) day in the calendar week in which the said holiday occurs. If an employee works on said holiday, he will paid only for the single time rate, plus one (1) days pay for the holiday.

**If an employee does not work on these holidays he shall receive no pay.
If an employee works on any of these holidays he will receive the single rate plus 15% of same.

REGISTERED APPRENTICES
Wage per hour:

One (1) year terms at the following wage rate.

1st	2nd	3rd
$ 25.00	$ 26.50	$ 28.00

Supplemental Benefits per hour paid:

	07/01/2012
1st year	$ 15.55
2nd year	15.55
3rd year	15.55

9-1010H/H

Laborer - Trac Drill 07/01/2012

JOB DESCRIPTION Laborer - Trac Drill **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
Per Hour Paid:

	07/01/2012
Hydraulic Trac Drill	$ 46.22
Hydraulic Trac Drill Chuck Tender	40.00
Air Trac, Wagon, Quarry Bar	45.52
Power Tool (Chipper & Jackhammer)	44.59
Chuck Tender & Nipper	39.33
Blaster	50.34
Blaster Hydraulic	51.07
Powder Carrier	41.13
Magazine Keeper	27.05

SUPPLEMENTAL BENEFITS
Per Hour Paid:

	07/01/2012
All Classifications	$ 28.04

OVERTIME PAY
Magazine Keeper See (B,H) on OVERTIME PAGE.

ALL OTHERS SEE (D,E,Q) on OVERTIME PAGE.

HOLIDAY
HOLIDAY:
Paid: For Blaster See (5,6,11,13) on HOLIDAY PAGE.

FOR ALL OTHERS SEE (1) ON HOLIDAY PAGE.

Overtime: See (5,6,11,13) on HOLIDAY PAGE.

9-29

Laborer - Tunnel 07/01/2012

JOB DESCRIPTION Laborer - Tunnel **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
GROUP 6: Tunnel Workers* * (including Miners, Drill Runners,Iron Men, Maintenance Men, Inside Muck Lock Tender, Pumpmen, Electricians, Cement Finishers, Rod Men, Caulkers, Carpenters, Hydraulic Men, Shield Drivers, Monorail Operators, Motor Men, Conveyor Men, Safety Miners, Powder Carriers, Pan Men, Riggers, Miner's Helpers, Chuck Tenders, Track Men, Nippers, Brake Men, Form Workers, Concrete Workers, Tunnel Laborers, Caulker's Helpers), Hose Men, Grout Men, Gravel Men, Derail Men and Cable Men.

GROUP 7: Top Nipper

GROUP 8,9: Outside Man Lock Tender, Outside Muck Lock Tender, Shaft Men,Gauge Tender and Signal Men.

GROUP 10: Powder Watchmen, Top Laborers and Changehouse Attendants.

WAGES: (per hour)

	07/01/2012
Laborer(Compressed Air):	
GROUP 6	$ 55.21
GROUP 7	$ 54.20
GROUP 8,9	$ 53.22
GROUP 10	$ 46.30

Note: For jobs bid before July I, 2010 employer shall pay $6.00 per day for each one half (1/2) mile or fraction starting from a point 500 feet from the shaft. For all jobs bid after July 1, 2010, said premium shall be $10. per day.

SUPPLEMENTAL BENEFITS
SUPPLEMENTAL BENEFITS:
per hour:

GROUP 6	$40.27
GROUP 7	$39.58
GROUP 8,9	$38.83
GROUP 10	$37.20

OVERTIME PAY
See (D, M, *R) on OVERTIME PAGE
NOTE: Time and one-half to be paid for all overtime repair-maintenance work on existing equipment and facilities.

* Straight time first 8 hours, double time after 8 hours.

HOLIDAY
Paid: See (5, 6, 9, 11, 12, 15, 16, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 9, 11, 12, 15, 16, 25) on HOLIDAY PAGE
Good Friday may be exchanged for one of the holidays listed.

9-147Tnl/Comp Air

Mason 07/01/2012

JOB DESCRIPTION Mason **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES

Per Hour:	07/01/2012	07/01/2013
Brick/Blocklayer	$51.97	*Additional $1.97/Hr

*Additional to be allocated between Wages and or Benifits

SUPPLEMENTAL BENEFITS
Per Hour:

Brick/Block Layer	$24.06

OVERTIME PAY
See (A, E, E2, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
(800 hour) Terms at the following Percentage of Journeyworkers Wage:

1st	2nd	3rd	4th	5th
50%	60%	70%	80%	90%

Supplemental Benefits per hour:

All Apprentices $ 13.88

4-1Brk

Mason - Building **07/01/2012**

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES
Building:

Per Hour:	07/01/2012	07/01/2013 Additional
Mosaic & Terrazzo Mechanic	$ 45.93 plus $ 1.25*	$ 1.25*
Mosaic & Terrazzo Finisher	$ 44.36 plus $ 1.22*	$ 1.23*

* To be allocated at a future date

SUPPLEMENTAL BENEFITS
Journeyworker:

Mechanic	$ 29.75
Overtime*	$ 38.45
Overtime**	$ 47.15
Finisher	$ 29.75
Overtime*	$ 38.45
Overtime**	$ 47.15

* Applies to overtime on weekdays & saturdays
** Apllies to overtime hours on Sundays & Holidays & work on Saurdays over 10 hours

OVERTIME PAY
See (A, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage per hour:
(750 Hour) terms at the following amount of the Terrazzo Mechanic's wage.

1st 1-750	2nd 751-1500	3rd 1500-2250	4th 2251-3000	5th 3001-3750	6th 3751-4500	7th 4501-5250	8th 5251-6000
$22.97	$25.26	$27.56	$29.85	$32.15	$34.45	$39.04	$43.63

Supplemental benefits per hour paid:
(750 hour) terms at the following percentage of Terrazzo Mechanic's benefit.

1st 1-750	2nd 751-1500	3rd 1501-2250	4th 2251-3000	5th 3001-3750	6th 3751-4500	7th 4501-5250	8th 5251-6000
50%	55%	65%	70%	75%	85%	90%	95%

9-7/3

Mason - Building **07/01/2012**

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES
Per hour: 07/01/2012 12/03/2012

		Additional
Building:		
Tile Setters	$ 49.64 plus $ 1.43*	$ 1.43*

*to be allocated at a future date

SUPPLEMENTAL BENEFITS
Journeyworker:

Per Hour:

Tile Setters	$ 27.56
Overtime *	37.56*
Overtime**	47.56**

*Applies to overtime on weekdays & Saturdays
** Applies to Sundays & Holidays, & over 10 hours on Saturdays

OVERTIME PAY
See (A, *E, **Q) on OVERTIME PAGE
* Work beyond 10 hours on Saturday shall be paid at double the hourly wage rate.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage per hour:

Tile Setters:
(750 hr)terms at the following wage rate:

Term: 1st 1-750	2nd 751-1500	3rd 1501-2250	4th 2251-3000	5th 3001-3750	6th 3751-4500	7th 4501-5250	8th 5251-6000	9th 6001-6750
$25.45	$28.29	$32.15	$33.79	$36.49	$37.81	$43.32	$48.57	$49.64

07/01/2012 - Apprentices receive an additional amount* based on term.

1st	2nd	3rd	4th	5th	6th	7th	8th
$0.65	$0.72	$0.78	$0.85	$0.91	$0.98	$1.11	$1.24

12/03/2012 - Apprentices receive an additional amount* based on term.

1st	2nd	3rd	4th	5th	6th	7th	8th
$0.65	$0.72	$0.78	$0.85	$0.91	$0.98	$1.11	$1.24

*To be allocated at a future date

Supplemental Benefits per hour paid:

Term: 1st 1-750	2nd 751-1500	3rd 1501-2250	4th 2251-3000	5th 3001-3750	6th 3751-4500	7th 4501-5250	8th 5251-6000	9th 6001-6750
$13.15	$14.17	$14.17	$16.39	$17.55	$20.09	$22.30	$24.79	$27.56

9-7/52

Mason - Building **07/01/2012**

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per hour:	07/01/2012	01/01/2013 Additional
Building-Marble Restoration:		
Marble, Stone &	$ 37.28	

	+ $ 0.75*	$ 0.75*
Polisher, etc		

* To be allocated at a future date

SUPPLEMENTAL BENEFITS
Per Hour:

Journeyworker:

Building-Marble Restoration:
Marble, Stone &
Polisher $ 21.30

OVERTIME PAY
See (A, E, Q, V) on OVERTIME PAGE
ON SATURDAYS, 8TH HOUR AND SUCCESSIVE HOURS PAID AT DOUBLE HOURLY RATE.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 15, 25) on HOLIDAY PAGE
1ST TERM APPRENTICE GETS PAID FOR ALL OBSERVED HOLIDAYS.

REGISTERED APPRENTICES
WAGES per hour:

(900 hour)terms at the following wages:

	1st 0-900	2nd 901-1800	3rd 1801-2700	4th over 2700
07/01/2012	$ 25.50 + $.53*	$ 30.25 + $.60*	$34.00 + $. 68*	$ 37.28 + $ .75*
01/01/2013	Additional $ 0.53*	Additional $ 0.60*	Additional $ 0.68*	Additional $ 0.75*

* To be allocated at a future date

Supplemental Benefits Per Hour:

$ 19.45	$ 20.06	$ 20.69	$ 21.30

9-7/24-MP

Mason - Building **07/01/2012**

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES
Westchester

PARTIAL COUNTIES
Bronx: Entire 5 Boroughs EXCEPT for projects that fall within a fifty-mile radius of Columbus Circle in New York City.
Kings: Entire 5 Boroughs EXCEPT for projects that fall within a fifty-mile radius of Columbus Circle in New York City.
New York: Entire 5 Boroughs EXCEPT for projects that fall within a fifty-mile radius of Columbus Circle in New York City.
Queens: Entire 5 Boroughs EXCEPT for projects that fall within a fifty-mile radius of Columbus Circle in New York City.
Richmond: Entire 5 Boroughs EXCEPT for projects that fall within a fifty-mile radius of Columbus Circle in New York City.

WAGES

Wages:	07/01/2012	01/01/2013 Additional
Building:		
Marble Cutters&Setters	$ 53.20 plus $ 1.30*	$ 1.30*

* To be allocated at a future date

SUPPLEMENTAL BENEFITS
Per Hour:

Journeyworker $ 27.08

OVERTIME PAY
See (A, *E, O, Q, V) on OVERTIME PAGE
* Work beyond 7 hours on Saturday shall be paid at double the hourly wage rate.
** When an observed holiday falls on a Sunday, it will be observed the next day.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 15, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage Per Hour:

750 hour terms at the following wage.

1st 1-750	2nd 751-1500	3rd 1501-2250	4th 2251-3000	5th 3001-3750	6th 3751-4500	7th 4501-5250	8th 5251-6000
$ 26.60	$29.26	$31.92	$34.58	$37.24	$39.90	$45.22	$50.54

07/01/2012 - Apprentices receive an additional amount* based on term of Apprentice:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th
$0.65	$0.72	$0.78	$0.85	$0.91	$0.98	$1.11	$1.24	$1.30

01/01/2013 - Apprentices receive an additional amount* based on term of Apprentice:

$0.65	$0.72	$0.78	$0.85	$0.91	$0.98	$1.11	$1.24	$1.30

*To be allocated at a future date

Supplemental Benefits per hour paid at the following term:

1st	2nd	3rd	4th	5th	6th	7th	8th
$21.10	$21.69	$22.29	$22.89	$23.49	$24.09	$25.29	$26.48

9-7/4

Mason - Building **07/01/2012**

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES

Per hour:	07/01/2012	12/03/2012 Addtional
Building:		
Tile Finisher	$ 39.28 plus $1.18*	$ 1.18*

* To be allocated at a future date

SUPPLEMENTAL BENEFITS
Per Hour:

Journeyworker	$ 24.52
Overtime*	33.02*
Overtime**	41.52**

* Applies to weekdays & Saturdays
** Applies to overtime hours on Sunday & Holidays, and work on Saturdays over 10 hours.

OVERTIME PAY
See (A, E, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE

9-7/88-tf

Mason - Building 07/01/2012

JOB DESCRIPTION Mason - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per hour:	07/01/2012	01/01/2013 Additional
Marble, Stone,etc. Finishers	$ 20.15 plus $.50*	$.50*

* To be allocated at a future date

SUPPLEMENTAL BENEFITS
Journeyworker:
Per Hour:

Marble, Stone, etc Finisher	$ 10.86

OVERTIME PAY
See (A, E, Q, V) on OVERTIME PAGE
Double hourly rate after 7 hours on Saturday

HOLIDAY
Paid: See (*5, 6, 11, 15) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15) on HOLIDAY PAGE

REGISTERED APPRENTICES
WAGES per hour:
(750 hour)terms at the
following wages: 07/01/2012

1st term	0-750		$ 14.32
2nd term	750-1500		15.14
3rd trem	1501-2250	15.94	
4th term	2251-3000	16.77	
5th term	3001-3750	17.99	
6th term	3751-4500	19.62	

07/01/2012 - Apprentices receive an additional amount*:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th
$0.25	$0.28	$0.30	$0.33	$0.35	$0.38	$0.43	$0.48	$0.50

01/01/2013 - Apprentices receive an additional amount*:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th
$0.25	$0.28	$0.30	$0.33	$0.35	$0.38	$0.43	$0.48	$0.50

* To be allocated at a future date

Supplemental Benefits:
(Per Hour)

1st term	$ 10.79
2nd term	10.80
3rd term	10.81
4th term	10.82
5th term	10.83
6th term	10.86

9-7/24M-MF

Mason - Building / Heavy&Highway 07/01/2012

JOB DESCRIPTION Mason - Building / Heavy&Highway **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk, Westchester

WAGES

Per hour:	07/01/2012	01/01/2013 Additional
Marble-Finisher	$ 43.15 plus $ 1.00*	$ 0.90*

* To be allocated at a future date

SUPPLEMENTAL BENEFITS
Journeyworker: $ 26.48

OVERTIME PAY
See (A, *E, Q, V) on OVERTIME PAGE

HOLIDAY
Overtime: See (5, 6, 15, 25) on HOLIDAY PAGE
* Work beyond 7 hours on a Saturday shall be paid at double the rate.
** When an observed holiday falls on a Sunday, it will be observed the next day.

REGISTERED APPRENTICES
Wages:

750 hour terms at the following percentage of Journeyworkers wage:

1st 1-750	2nd 751-1500	3rd 1501-2250	4th 2251-3000	5th 3001-3750	6th 3751-4500	7th 4501-5250	8th 5251-6000
50%	55%	60%	65%	70%	75%	85%	95%

Supplemental Benefits:	07/01/2012
1st-6th terms	$ 14.50 + term wage % of $9.83
7th and 8th terms	$ 24.33

9-7/20-MF

Mason - Building / Heavy&Highway 07/01/2012

JOB DESCRIPTION Mason - Building / Heavy&Highway **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES
WAGES

NOTE: Shall include but not limited to Precast concrete slabs (London Walks)
Marble and Granite pavers 2'x 2' or larger.
Per Hour:

	07/01/2012
Stone Setter	$ 57.61
Stone Tender	$ 39.28

SUPPLEMENTAL BENEFITS
Per Hour:

Stone Setter	$ 24.96
Stone Tender	$ 16.01

OVERTIME PAY
See (*C, **E, Q) on OVERTIME PAGE
* On weekdays the eighth (8th) and ninth (9th) hours are time and one-half all work thereafter is paid at double the hourly rate.
** The first nine (9) hours on Saturday is paid at time and one-half all work thereafter is paid at double the hourly rate.

HOLIDAY
Paid: See (*18) on HOLIDAY PAGE
Overtime: See (5, 6, 10) on HOLIDAY PAGE
Paid: *Must work First 1/2.

REGISTERED APPRENTICES
Per Hour:

Stone Setter(800 hour) terms at the following wage rate per hour:

1st	2nd	3rd	4th	5th	6th
$28.81	$34.57	$40.32	$46.09	$51.85	$57.61

Supplemental Benefits:
All Apprentices $15.53

4-1Stn

Mason - Heavy&Highway **07/01/2012**

JOB DESCRIPTION Mason - Heavy&Highway **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES
Per Hour: 07/01/2012

Cement Mason $ 49.50

SUPPLEMENTAL BENEFITS
Per Hour:

Cement Mason $ 32.25

OVERTIME PAY
See (D, O, V) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 13, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
(1) year terms at the following Percentage of Journeyworkers Wage.

1st Term 50%
2nd Term 60%
3rd Term 70%

Supplement Benefits per hour paid:
Apprentices:
1st term $ 22.05
2nd term 24.09
3rd term 26.13

4-780

Mason - Heavy&Highway **07/01/2012**

JOB DESCRIPTION Mason - Heavy&Highway **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES
Per Hour: 07/01/2012

Pointer, Cleaner & Caulkers $ 44.56

SUPPLEMENTAL BENEFITS
Per Hour:

Pointer, Cleaners & Caulkers $ 20.81

OVERTIME PAY
See (B, E2, H) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:

One (1) year terms at the following wage rates.

	07/01/2012			
	1st	2nd	3rd	4th
	$25.40	$28.76	$33.43	$39.92
Apprentices Supplemental Benefits: (per hour paid)	$3.05	$7.00	$10.00	$10.00

4-1PCC

Operating Engineer - Building 07/01/2012

JOB DESCRIPTION Operating Engineer - Building **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
Wages:

(Per Hour)	07/01/2012	07/01/2013 Addtional
Building Constr:		
Party Chief	$55.74	$2.42
Instrument Man	$43.30	$2.07
Rodman	$27.97	$1.63
Steel Erection:		
Party Chief	$55.74	$2.52
Instrument Man	$43.49	$2.16
Rodman	$29.25	$1.73
Heavy Construction: Foundation, Excavation., etc.		
Party Chief	$60.28	$3.22
Instument man	$44.28	2.61
Rodman	$37.11	2.39

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2012
All Classifications	$ 29.78
Premium*	
All Catergories	$ 38.47
Premium**	
All Classes	$ 53.16

*Apply to instances where 1-1/2 regular rate are paid
**Applies to instances where 2 times the regular rate are paid

OVERTIME PAY
See (A, B, *E, Q) on OVERTIME PAGE
* Doubletime paid on the 8th hour on Saturday.
Note:Overtime code "A" applies to Building Construction Category.

HOLIDAY

Paid: See (5, 6, 8, 11, 12, 15, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 12, 25) on HOLIDAY PAGE
** Applies to Building Construction category

9-15Db

Operating Engineer - Building, Maintenance, Steel Erection & Heavy Construction

07/01/2012

JOB DESCRIPTION Operating Engineer - Building, Maintenance, Steel Erection & Heavy Construction **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
STEEL ERECTION:

Group 1: Derrick, travelers, tower, crawler tower & climbing cranes

Group 2: Oiler (Truck Crane)

Group 3: Oiler (Crawler Crane)

BUILDING CONSTRUCTION:

Group 1: Installing, repairing, maintaining, dismantling of all equipment including Steel cutting& bending machines, mechanical heaters, mine hoists, climbing cranes, tower cranes, Linden Peine, Lorain, Liebherr, Mannes and machines of a similar nature;Well Point system, Deep Well pumps, Concrete mixers with loading devices, Concrete plants, motor generators (When used for temporary power and lights(Driving maintenance trucks and mounted-welded machines)-All Pumps(excluding River Cofferdam Pumps and Well Point Pumps), Motorized Concrete Buggies(When three or more are on jobsite), Skid-Steer and similar machines

Group 2:Maintenance of: Pumps, Generators,Mixers,Heaters

Group 3: Oilers of all gasoline, electric, deisel or air operated Gradalls; Concrete Pumps, Overhead Cranes in Power Houses,Assist in oiling, greasing and repairing of all machines, including: Driving Truck Cranes, Driving and operating Fuel and Grease Trucks, Cherry Pickers(Hydraulic Cranes) over 70,000 GVW and machines of a similar nature

Group 4: Oiler on Crawler Cranes, Backhoes, Trenching Machines, Gunite Machines, Compressors(3 or more in battery)

Group 5: Maintenance on Radiant Mechanical Heaters

HEAVY CONSTRUCTION (Excavation, Foundations, etc)

Group 1:Maintenance of: Generators, Light Towers

Group 2:Maintenance of: Pumps, Mixers including mudsucking

Group 3: Base Mounted Tower Cranes

Group 4: Installing, repairing, maintaining, dismantling(of all equipment including Steel cutting & Bending machines, Fusion Coupling Machines, Vermeer Trenching machines, on-site crushing plant, mechanical heaters(1 through 7),Mine hoists, Tower Cranes, Linden Peine, Lorrain, Lebherr, Mannes or machines of a similar nature, Wellpoints)-Driving maintenance trucks and truck mounted welding machines, burning, welding-operating of accumilator for shield-driven tunnels, in addition to the performance of other duties:Handling,installation, jointing, coupling of all perminent steel and plastic pipe. RIDE UPON MOLES-tunnel boring machines-MICRO TUNNELING SYSTEMS, All temporary pipefitting;When three or more motorized concrete buggies(Ride type)are utilized on the jobsite they shall be serviced, maintained and repaired by the maintenance engineer.The Operating Engineer on autogrades(C.M.I.)is to be assisted by the maintenance engineer who shall in addition perform other duties.

WAGES: Per hour	07/01/2012	07/01/2013 Additional
Steel Erection:		
Group 1	$ 55.44	$ 2.52*
Group 2	51.92	2.42*
Group 3	39.69	2.06*
Building Construction:		
Group 1	$ 52.58	$ 2.37*

Group 2	40.97	2.04*
Group 3	50.01	2.30*
Group 4	37.28	1.94*
Group 5	32.30	1.84*

Heavy Construction:

Group 1	$ 37.56	$ 2.45*
Group 2	38.53	2.49*
Group 3	74.44	3.77*
Group 4	56.74	3.14*

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2012
All Classifications	$ 31.12
Premium Time	$ 55.84

OVERTIME PAY
See (D, O) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 7, 11, 16) on HOLIDAY PAGE
Overtime: See (5, 6, 7, 11, 16) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages Per Hour:

(1) year terms at the following wage rates:

Apprentices:	1st	2nd	3rd	4th.
07/01/2012	$21.64	$27.05	$29.75	$32.45

Supplemental Benefits:
Per Hour:

All Apprentices:	$ 20.12
Premium Time	$ 33.84

9-15Ab

Operating Engineer - Building / Heavy&Highway 07/01/2012

JOB DESCRIPTION Operating Engineer - Building / Heavy&Highway **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
EQUIPMENT COVERED: Jet-Rodder/Vacuum Truck, Flusher, Sewer Rodder, Stetco Hoist and similar, Sewer Winch/Tugger Hoist and similar, Vacall/Vactor, Closed Circuit Television Inspection Equipment, Chemical Grouting Equipment and similar, John Beame, Meyers and similar.

Per Hour:

	07/01/2012	07/01/2013 Additional
Maintenance Engineer (Sewer Systems)	$ 56.74	$ 3.14*

* To be allocated at a future date

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2012
Journeyman	$ 31.12
Premium Time	$ 55.84

OVERTIME PAY
See (D, O) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 7, 11, 16) on HOLIDAY PAGE
Overtime: See (5, 6, 7, 11, 16) on HOLIDAY PAGE

REGISTERED APPRENTICES

Per Hour:

(1) year terms at the following wage rates.

Apprentices:

1st	2nd	3rd	4th
$21.64	$27.05	$29.75	$32.45

Supplemental Benefits:
Per Hour:

All Apprentices:	$ 20.12
Premium Time	$ 33.84

9-15Sewer

Operating Engineer - Building & Steel Erection 07/01/2012

JOB DESCRIPTION Operating Engineer - Building & Steel Erection **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
Per Hour: 07/01/2012

Building Construction & Steel Erection:

STEEL ERECTION:

Three Drum Derricks	$ 68.77
Cranes,Two Drum Derricks, Hydraulic Cranes & Fork Lifts, Boom Trucks	$ 66.22
Compressors, Welding Machines, Bridge Inspection Machines, Moog and machines of a similar nature)	$ 40.88
Compressors(Not combined with welding machines)	$ 39.13

BUILDING CONSTRUCTION:

Cranes, Stone Derrick, Boom Trucks, Hydraulic Cranes	$ 67.05
Double Drum	$ 63.25
4 Pole Hoists and Single Drum Hoists	$ 61.06
Fork Lifts,Plaster(Platform Machine)Plaster Bucket, Concrete Pumps and all other equipment used for hoisting	$ 55.46
House Cars and Rack & Pinion	$ 50.60
*House Cars (New Projects)	$ 40.38
Erecting and dismantling of Cranes	$ 61.72
Compressors, Welding Machines(Cutting Concrete-Tank Work), Paint Spraying, Sand Blasting, Pumps(With the exclusion of concrete pumps), House Car (Settlement basis only), All Engines irrespective of power(Power-Vac)used to drive auxiliary equipment Air, Hydraulic,etc.,Boilers, Jacking System	$ 41.32

*APPLIES TO PROJECTS STARTED AFTER 07/01/2011.

APPLICABLE TO ALL CATEGORIES:
CRANES: Crawler Or Truck

	In Addition To Above Crane Rates
100' to 149' Boom	$ 1.75/hr
150' to 249' "	2.00/hr

250' to 349' "	2.25/hr
350' to 450' "	2.75/hr
Tower Crane	2.00/hr

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2012
All Operator Classes	$ 30.43
Premium Time	$ 55.41

OVERTIME PAY
See (*C, **D, O) on OVERTIME PAGE
*Note:Applies to Building Construction category
**Note: Applies to Steel Erection

HOLIDAY
Paid: See (5, 6, 7, 8, 11, 12, 16) on HOLIDAY PAGE
Overtime: See (5, 6, 7, 8, 11, 12, 16) on HOLIDAY PAGE
Note:
Codes 8 and 12 apply ONLY to Steel Erection
Code 16 applies ONLY to Building Construction

REGISTERED APPRENTICES
Wage Per Hour:

Apprentices (1) year terms at the following rates:

	07/01/2012		
	1st	2nd	3rd
	$ 26.34	$ 32.93	$ 39.52

Supplemental Benefits Per Hour:	
Straight Time	$ 20.43
Premium Time	$ 35.41

9-14 B&S

Operating Engineer - Heavy Construction **07/01/2012**

JOB DESCRIPTION Operating Engineer - Heavy Construction **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES
Per Hour:
Group 1: Tower Crane/Climbing Crane

Group 2: Backhoes (Including all track and rubber tire backhoes over 37,000 lbs), Power Shovels, Steel Erection:Hydraulic Clam Shells,Moles and machines of a similar nature

Group 3: Mine Hoists, Cranes, etc, used as Mine Hoists

Group 4: Gradalls, Keystones, Cranes (With digging buckets), Bridge Cranes, Trenching Machines, Vermeer Cutter and machines of a similar nature

Group 5: Pile Drivers and Rigs (Employing Dock-Builders Foreman), Derrick Boats, Tunnel Shovels,

Group 6: All Drills and machines of a similar nature

Group 7: Back-Filling Machines and Cranes, Mucking Machines, Dual Drum Pavers

Group 8: Mixers (Concrete with loading attachment), Concrete Pavers, Cableways, Land Derricks, Power House (Low pressure units)

Group 9: Concrete Pumps, Concrete Plant, Stone Crushers, Double Drum Hoists, Power Houses (Other than above)

Group 10: Concrete Mixer

Group 11: Elevators

Group 12: Concrete Breaking Machines, Single Drum Hoists, Load Masters, Locomotives and Dinkies (Over 10 tons), Hydraulic Crane-Second Engineer

Group 13: On-Site Concrete Plant Engineers, On-Site Asphalt Plant Engineer and Vibratory Console

Group 14: Barrier Mover, Barrier Transport and machines of a similar nature

Group 15: Compressors (Portable, 3 or more), Truck Compressor (Engineer Driver), Tugger Machines, Well Point Pumps, Chum Drill

Group 16: Boilers(High pressure),Compressors, Pumps(River Cofferdam) and Welding Machines(except where arc is operated by another Operating Engineer) Push Button Machines, All Engines,irrespective of power(Power Pac) used to drive auxiliary equipment, Air, Hydraulic, etc.

Group 17: Utility-Horizontal Boring Rig

Group 18: Utility Compressors

Group 19: Paving-Asphalt Spreader, Autogrades (C.M.I.), Roto-Mill

Group 20: Paving-Asphalt Roller

Group 21 Paving-Asphalt Plant

Group 22: Roller (non paving, all sizes)

Group 23: Cherry Picker (Over 20 tons), Loader (Over 6 yards)

Group 24: Backhoes and Loaders (Up to 37,000lbs), Bulldozers, Scrapers, Turn-A-Pulls, Tugger Hoists, Tractors, Hysters, Rooustabout Cranes, Conveyers, Balast Regulators (Ride On), Track Removal Machine or similar, Motor Graders, Locomotives (10 tons and under),Curb & Gutter Pavers and machines of a similar nature

Group 25:Post Hole Digger,Ditch Winch, Road Finishing Machines, Rollers (5 tons and under, Dual Purpose Trucks,Forklifts, Dempsey Dumpsters, Fireman

Group 26: Oiler (Gradalls, Concrete Pumps, Cold Planers Grader)

Group 27: Oiler (Crawler Cranes, Backhoes, Trenching Machines, Compressors (3 or more in battery)

Group 28:Steam Equipment Operator (Water rigs, steam shovels, power boilers, derrick boats)

WAGES:(per hour)

	07/01/2012	07/01/2013 Additional
Group 1	$ 81.09	$ 3.98*
Group 2	66.70	3.47*
Group 3	68.86	3.55*
Group 4	67.21	3.49*
Group 5	65.86	3.44*
Group 6	63.18	3.34*
Group 7	64.38	3.39*
Group 8	62.51	3.32*
Group 9	61.14	3.27*
Group 10	58.43	3.17*
Group 11	54.50	3.03
Group 12	55.73	3.08*
Group 13	56.19	3.09*
Group 14	50.27	2.88*
Group 15	42.11	2.59*
Group 16	39.03	2.48*
Group 17	59.39	3.21*
Group 18	38.78	2.47*
Group 19	62.51	3.32*
Group 20	60.85	3.26*
Group 21	51.32	2.92*

Group 22	60.95	3.36*
Group 23	58.75	3.21*
Group 24	57.00	3.15*
Group 25	54.09	3.04*
Group 26	51.19	2.94*
Group 27	35.50	2.38*
group 28	52.46	3.04*

* To be allocated at a future date

Cranes: Crawler or Truck

100' to 149'	$0.50 per hour additional to above Crane Rates
150' to 249'	$0.75 per hour additional to above Crane Rates
250' to 349'	$1.00 per hour addiional to above crane Rates
350' to 450'	$1.50 per hour additional to above crane Rates

SUPPLEMENTAL BENEFITS

Per Hour: 07/01/2012

Groups 1-22

Regular Time	$ 30.43
Premium Time	$ 55.41

Groups 23-28

Regular Time	$ 31.12
Premium Time	$ 55.84

OVERTIME PAY

See (D, O) on OVERTIME PAGE

HOLIDAY

Paid: See (5, 6, 7, 11, 16) on HOLIDAY PAGE
Overtime: See (5, 6, 7, 11, 16) on HOLIDAY PAGE

REGISTERED APPRENTICES

Per Hour:

(1) year terms at the following wage rates:

Apprentices:	1st	2nd	3rd	
Groups 1-22	$26.34	$32.93	$39.52	
Apprentices:	**1st**	**2nd**	**3rd**	**4th**
Groups 23-28	$21.64	$27.05	$29.75	$32.45

Supplemental Benefits:
Per Hour:

Apprentices:
Groups 1-22

Regular Time	$ 20.43
Premium Time	$ 35.41

Groups 23-28

Regular Time	$ 20.12
Premium Time	$ 33.84

9-14 HC

Operating Engineer - Marine Construction **07/01/2012**

JOB DESCRIPTION Operating Engineer - Marine Construction **DISTRICT** 4

ENTIRE COUNTIES

Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

Per Hour:
DREDGING OPERATIONS 07/01/2012
CLASS A

Operator, Leverman, Lead Dredgeman	$ 32.89
CLASS A1 Dozer,Front Loader Operator	To conform to Operating Engineer Prevailing Wage in locality where work is being performed including benefits.
CLASS B Spider/Spill Barge Operator, Tug Operator(over1000hp), OperatorII, Fill Placer, Derrick Operator, Engineer, Chief Mate, Electrician, Chief Welder, Maintenance Engineer	$ 28.49
Certified Welder, Boat Operator(licensed)	$ 26.84
CLASS C Drag Barge Operator, Steward, Mate, Assistant Fill Placer,	$ 26.14
Welder (please add)$ 0.06	
Boat Operator	$ 25.29
CLASS D Shoreman, Deckhand, Rodman, Scowman, Cook, Messman, Porter/Janitor	$ 21.09
Oiler(please add)$ 0.09	

SUPPLEMENTAL BENEFITS
Per Hour:
THE FOLLOWING SUPPLEMENTAL BENEFITS APPLY TO ALL CATEGORIES

	07/01/2012
All Classes A & B	$ 8.45 plus 7% of straight time wage overtime hours add $ 0.63
All Class C	$ 8.10 plus 8% of straight time wage overtime hours add $ 0.48
All Class D	$ 7.85 plus 8% of straight time wage overtime hours add $ 0.33

OVERTIME PAY
See (B, F, R) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 15, 26) on HOLIDAY PAGE

4-25a-MarConst

Painter **07/01/2012**

JOB DESCRIPTION Painter **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Suffolk, Westchester

WAGES

Per hour:	07/01/2012	11/01/2012	05/01/2013
Brush	$ 39.85	$ 40.35	$ 41.85
Abatement/Removal of lead based or lead containing paint on materials to be repainted.	$ 39.85	$ 40.35	$ 41.85
Spray & Scaffold	$ 42.85	$ 43.35	$ 44.85
Fire Escape	$ 42.85	$ 43.35	$ 44.85
Decorator	$ 42.85	$ 43.35	$ 44.85
Paperhanger/Wall Coverer	$ 37.44	$ 37.44	$ 39.00

*Before calculating premium pay, deduct $0.10 from hourly wage rate.
Does not apply to paperhanger.

SUPPLEMENTAL BENEFITS

Per hour worked:	07/01/2012	11/01/2012	05/01/2013
Paperhanger	$ 29.71	$ 29.72	$ 29.73
All others	$ 20.97	$ 20.97	$ 20.97
Premium	$ 23.09*	$ 23.47*	$ 23.47*

* Applies only to " All others" catergory, not paperhanger journeyman.

OVERTIME PAY
See (A, H) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Indentured after 5/31/93 (1) year terms at the following wage rate.
(per hour)

	07/01/2012	11/01/2012	05/01/2013
Appr 1st term...	$ 15.05	$ 15.25	$ 15.85
Appr 2nd term...	$ 19.76	$ 19.91	$ 20.76
Appr 3rd term...	$ 23.94	$ 24.24	$ 25.14
Appr 4th term...	$ 31.92	$ 32.32	$ 33.52
Spplemental benefis: (per Hour worked)			
Appr 1st term...	$ 10.23	$ 10.23	$ 10.23
Appr 2nd term...	$ 12.92	$ 12.92	$ 12.92
Appr 3rd term...	$ 15.20	$ 15.20	$ 15.20
Appr 4th term...	$ 19.70	$ 19.70	$ 19.70

9-NYDC9-B/S

Painter **07/01/2012**

JOB DESCRIPTION Painter **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

PARTIAL COUNTIES
Nassau: Atlantic Beach, Ceaderhurst, East Rockaway,Hewlett, Hewlett Bay, Hewlett Neck, Hewlett Park, Inwood, Lawrence, Lido Beach, Long Beach, parts of Lynbrook, parts of Oceanside, parts of Valley Stream, and Woodmere. Starting on South side of Sunrise Hwy in Valley Stream running east to Windsor and Rockaway Ave, Rockville is the boundary line up to Lawson Blvd, turning right going west all the above territory. Starting at Union Turnpike &Lakeville Rd going north to northern Blvd. the west side of Lakeville Rd to Northern Blvd. At Northern Blvd doing east the district north of Northern blvd to Port Washington blvd. West of Port Washington blvd to St.Francis Hospital then north of first traffic light to Port Washington & Sands Point, Manor Haven, & Harbour Acres.

WAGES
Per hour:

	07/01/2012	12/26/2012	06/26/2013	01/01/2014
Drywall Taper	$ 47.48	$ 47.98	$ 48.48	$ 48.98

SUPPLEMENTAL BENEFITS
Per Hour:

Journeyworker: $ 18.22

OVERTIME PAY

See (A, H) on OVERTIME PAGE
Before calculating premium pay subtract $ 4.16 from hourly wage rate

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (4, 6, 8, 11, 18, 19, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wage per hour:

One (1) year terms at the following percentages of journeyworker rate (year consists of 1500 hours).

	07/01/2012	12/26/2012	06/26/2013	01/01/2014
1st term	$ 17.43	$ 17.63	$ 17.83	$ 48.98
2nd term	$ 28.53	$ 28.83	$ 29.13	$ 29.43
3rd term	$ 38.01	$ 38.41	$ 38.81	$ 39.21

Note: Before calculating premium pay, deduct the amount shown below from Apprentice hourly wage.

1st term	$ .10 from hourly wage rate
2nd term	$ 2.54 from hourly wage rate
3rd term	$ 3.35 from hourly wage rate

Supplemental Benefits per hour worked:

One (1) year term at the following dollar amount:

1st term	$ 10.35
2nd term	$ 14.17
3rd term	$ 16.20

9-NYC9-1974-DWT

Painter - Bridge & Structural Steel 07/01/2012

JOB DESCRIPTION Painter - Bridge & Structural Steel **DISTRICT** 9

ENTIRE COUNTIES
Albany, Bronx, Clinton, Columbia, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Kings, Montgomery, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Sullivan, Ulster, Warren, Washington, Westchester

WAGES
Per Hour Worked:

	07/01/2012	10/1/2012
STEEL:		
Bridge Painting	$ 51.23	$ 52.23
Power Tool/Spray	57.23	58.23

Note: For Bridge Painting Contracts, ALL WORKERS on and off the bridge (including Flagmen) are to be paid Painter's Rate; the contract must be ONLY for Bridge Painting.

SUPPLEMENTAL BENEFITS
Per Hour Worked:

	07/01/2012	10/1/2012
Journeyworker	$ 26.80* $ 31.04**	$ 27.05
Hourly Rate after 40 hours from May 1st to Nov. 15th	$ 6.75 only	
Hourly Rate after 50 hours from Nov. 16th to April 30th	$ 6.75 only	

*For the period of May 1st to November 15th:
This rate shall be paid up to maximum of forty (40) hours worked per week. For all hours exceeding 40, the hourly rate shall drop to the hourly rate shown above by date.
EXCEPT for the first and last week of employment on the project, and for the weeks of Memorial Day, Independence Day and Labor Day, this rate shall be paid for the actual number of hours worked.

**For the period of November 16th to April 30th:
This rate shall be paid up to a maximum of fifty (50) hours worked per week. For all hours exceeding 50, the hourly rate shall drop to the hourly rate shown above by date.

OVERTIME PAY
See (A, F, R) on OVERTIME PAGE
NOTE: Calculate overtime rate as follows: Bridge Painting and Power Tool/Spray titles subtract $4.98 from the hourly rate. After calculation of overtime add $6./hr to the Power Tool/Spray title amount.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (4, 6) on HOLIDAY PAGE

REGISTERED APPRENTICES
(Wage per hour Worked):

Apprentices: (1) year terms

	1st	2nd	3rd
07/01/2012	$ 20.55	$ 30.78	$ 41.00
10/01/2012	$ 20.95	$ 31.38	$ 41.80

Supplemental Benefits per hour worked:

07/01/2012	$ 8.35	$ 19.00	$ 22.90
10/01/2012	$ 8.70	$ 19.15	$ 23.10

9-DC-9/806/155-BrSS

Painter - Line Striping 07/01/2012

JOB DESCRIPTION Painter - Line Striping **DISTRICT** 9

ENTIRE COUNTIES
Albany, Bronx, Clinton, Columbia, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Kings, Montgomery, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Sullivan, Ulster, Warren, Washington, Westchester

WAGES
Per hour:

Painter (Striping-Highway):	07/01/2012
Striping-Machine Operator*	$26.61 plus an additional $0.50**
Linerman Thermoplastic	$31.87 plus an additional $0.50**

**To be allocated at a future date

Note: * Includes but is not limited to: Positioning of cones and directing of traffic using hand held devices. Excludes the Driver/Operator of equipment used in the maintenance and protection of traffic safety

SUPPLEMENTAL BENEFITS
Per hour paid: 07/01/2012
Journeyworker:

Striping-Machine operator	$ 14.18
Linerman Thermoplastic	$ 14.55

OVERTIME PAY
See (*B, **B2, E, E2, P, S) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 20) on HOLIDAY PAGE
Overtime: See (5, 8, 11, 12, 15, 16, 17, 20, 21, 22) on HOLIDAY PAGE

9-8A/28A-LS

Painter - Metal Polisher 07/01/2012

JOB DESCRIPTION Painter - Metal Polisher **DISTRICT** 9

ENTIRE COUNTIES

Albany, Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, St. Lawrence, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, Yates

WAGES

	07/01/2012
Metal Polisher	$ 26.11
Metal Polisher**	$ 27.02
Metal Poilsher***	$ 29.61

**Note: Applies on New Construction & complete renovation
*** Note: Applies when working on scaffolds over 34 feet.

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2012
Journeyworker:	
All classification	$ 12.92

OVERTIME PAY
See (B, E, Q, T) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE
Overtime: See (5, 6, 9, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages per hour:
One (1) year term at the following wage rates:

1st	2nd	3rd
$13.50	$15.00	$18.00

Supplentals benefits:
Per hour paid:

1st	2nd	3rd
$10.27	$10.39	$10.63

9-8A/28A-MP

Plasterer 07/01/2012

JOB DESCRIPTION Plasterer **DISTRICT** 9

ENTIRE COUNTIES
Kings, Nassau, Queens, Suffolk

PARTIAL COUNTIES
New York: Includes work in all Islands in New York City, except Manhattan.

WAGES
Per hour:

	07/01/2012
Building:	
Plasterer/Traditional	$ 35.53

SUPPLEMENTAL BENEFITS
Per hour worked:

Journeyworker	$ 21.80

OVERTIME PAY
See (B, E, E2, Q) on OVERTIME PAGE

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 8, 11, 13, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES
Wages:
(per hour)

(1) year terms at the following % Journeyworkers wage rate.

First year:	1st 6 months	2nd 6 months
	40%	45%
Second year:	1st 6 months	2nd 6 months
	55%	60%
Third year:	1st 6 months	2nd 6 months
	70%	75%

Supplemental Benefits:
(per hour paid):
(1) year term broken down into six month periods:
1st year:

1st six months	$ 8.37
2nd six months	9.35
3rd six months	11.35
4th six months	12.33
5th six months	14.33
6th six months	15.33

9-530-Z1

Plumber **07/01/2012**

JOB DESCRIPTION Plumber **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, New York, Queens, Richmond

WAGES

Per hour worked:	07/01/2012
Plumber	$ 52.04
Residential**	$ 36.97
Repairs & Alterations*	$ 32.84 plus $0.80***

*Repair & alteration work is any repair and/or replacement of present plumbing system that does not change existing roughing or water supply lines.
**(RESIDENTIAL RATES FOR 1, 2 AND 3 FAMILY HOME CONSTRUCTION)
***To be allocated at a future date

THERE ARE NO HELPERS UNDER THIS CLASSIFICATION; WHEN USING APPRENTICES, MUST FOLLOW RATIO FOR PLUMBERS.

On tower work, bridges, elevated highway, or buildings, where pipe is being installed, fifty (50) or more feet vertically in a free drop from its base,
an additional $1.00 per hour.

SHIFT WORK:
Shift work,when directly specified in public agency or authority contract documents, and continues for a period of not less than ten (10) consecutive work days. A shift shall consist of seven(7) hours with one-half (1/2) hour for lunch after the first four (4) hours of each shift. A premium of thirty percent (30%) for wages and supplemental benefits on shift work performed Monday through Friday on the 4 P.M.and midnight shifts.
For shift work performed on weekends the shift premium shall be fifty percent (50%) of wages and supplemental benefits.
For shift work performed on holidays designated below, double time wages and supplemental benefits shall be paid. Also noted that the normal workday Monday through Friday 8:00 A.M. to 3:00 P.M. is not considered shift work, and therefore not subject to shift premium.

SUPPLEMENTAL BENEFITS

Per hour worked:	07/01/2012
Plumber: Journeyworker	$36.91
Residential	$25.46
Repairs & Alerations	$15.25

OVERTIME PAY
OVERTIME:

Plumber	See (C, O, V) on OVERTIME PAGE.
Residential	See (D, O, V) on OVERTIME PAGE.
Repairs & Alterations	See (B, H) on OVERTIME PAGE.

Before calculating premium pay, subtract $ 0.28 from regular hourly wage rate.

HOLIDAY

HOLIDAY:
Plumber & Residential
Paid: See (1) on HOLIDAY PAGE.
Overtime: See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE.
Repairs & Alterations
Paid: See (1) on HOLIDAY PAGE.
Overtime: See (5, 6, 25) on HOLIDAY PAGE.

REGISTERED APPRENTICES
Wages:
(Per Hour)
(1/2) year terms at the following wage:

*Apprentices:	1st&2nd	3rd&4th	5th&6th	7th&8th	9th	10th
07/01/2009	$14.28	$18.44	$20.34	$23.19	$24.59	$36.66

Supplemental Benefits per hour paid:
(1/2) year term at the following dollar amount:

07/01/2009	1st	2nd	3rd-10th
	$.43	$2.68	$15.97

*Note: The Repairs & Alterations Category has NO Apprentices.

9-1

Roofer 07/01/2012

JOB DESCRIPTION Roofer **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Dutchess, Kings, New York, Orange, Putnam, Queens, Richmond, Rockland, Sullivan, Ulster, Westchester

WAGES
Per Hour: 07/01/2012

Roofer/Waterproofer $ 39.00

SUPPLEMENTAL BENEFITS
Journeyworker $ 27.92

OVERTIME PAY
See (B, H) on OVERTIME PAGE
Note: An observed holiday that falls on a Sunday will be observed the following Monday.

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 13, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
(1) year terms at the following percentage of Journeyworkers hourly wage.

1st	2nd	3rd	4th
35%	50%	60%	75%

Supplements per hour paid at the following rates:

Apprentice:	1st	2nd	3rd	4th
	$ 4.24	$ 14.13	$ 16.88	$ 21.03

9-8R

Sheetmetal Worker 07/01/2012

JOB DESCRIPTION Sheetmetal Worker **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Suffolk, Westchester

WAGES
Per Hour: 07/01/2012

Sign Erector $43.30

*NOTE: Overhead Highway Signs and Structurally Supported Signs
(See IRON WORKER CLASS)

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2012
Sign Erector	$41.44

OVERTIME PAY
See (A, F, S) on OVERTIME PAGE

HOLIDAY
Paid: See (5, 6, 11, 12, 16, 25) on HOLIDAY PAGE
Overtime: See (5, 6, 10, 11, 12, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
Per Hour:
6 month Terms at the following percentage of
Sign Erectors wage rate:

1st Term	35%	2nd Term	40%
3rd Term	45%	4th Term	50%
5th Term	55%	6th Term	60%
7th Term	65%	8th Term	70%
9th Term	75%	10th Term	80%

SUPPLEMENTAL BENIFITS
Per Hour:

1st Term	$13.20	2nd Term	$14.69
3rd Term	16.19	4th Term	17.69
5th Term	23.27	6th Term	24.89
7th Term	27.17	8th Term	28.80
9th Term	30.47	10th Term	30.47

4-137-SE

Sheetmetal Worker 07/01/2012

JOB DESCRIPTION Sheetmetal Worker **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES

Per Hour:	07/01/2012
Sheetmetal Worker	$48.90
Temporary Operation or Maintenace of Fans	$39.77

SUPPLEMENTAL BENEFITS

Per Hour:	07/01/2012
Sheetmetal Worker	$39.16
Maintenance Worker	$39.16

OVERTIME PAY
See (A, E, E2, Q) on OVERTIME PAGE
For Maintenance See Codes B,E & Q

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15, 16, 25, 26) on HOLIDAY PAGE

REGISTERED APPRENTICES
Per Hour:
6 Month Terms as Follows:

1st Term	$16.41
2nd Term	$18.80
3rd Term	$21.35
4th Term	$24.04

5th Term	$25.30
6th Term	$27.43
7th Term	$33.35
8th Term	$35.95
9th Term	$38.98

Supplemental Benifits as Follows:

1st Term	$18.01
2nd Term	$19.76
3rd Term	$21.47
4th Term	$23.21
5th Term	$24.77
6th Term	$26.81
7th Term	$30.23
8th Term	$31.34
9th Term	$32.45

4-28

Steamfitter **07/01/2012**

JOB DESCRIPTION Steamfitter **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES

Per Hour:	07/01/2012
Steamfitter/Maintenance & AC Service Work	$36.55

Refrigeration, A/C, Oil Burner and Stoker Service and Repair.
Refrigeration Compressor installation up to 5hp (combined).
Air Condition / Heating Compressor installation up to 10hp (combined).

SUPPLEMENTAL BENEFITS
Per Hour

Steamfitter/Maintenance & AC Service Work	$ 9.35

OVERTIME PAY
OVERTIME:....See (B, E, Q*, S**) on OVERTIME PAGE.

HOLIDAY
HOLIDAY:
Paid:.....See (2, 6, 9, 10, 11, 15, 17, 26,Memorial Day) on HOLIDAY PAGE.
Overtime:.... * (2, 6, 9, 15, 17)
** (10, 11, 26, Memorial Day)

4-638B-StmFtrRef

Steamfitter **07/01/2012**

JOB DESCRIPTION Steamfitter **DISTRICT** 4

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Queens, Richmond, Suffolk

WAGES

Per Hour:	07/01/2012	12/26/2012
Steam/Sprinkler Fitter	$56.81	*Additional $0.75/Hr
Temporary Heat & AC	$43.19	*Additional $0.75/Hr

*Additional to be allocated to either Wages or benefits.

NOTE: Add 30% to Hourly Wage for "Contracting Agency"

Mandated Off Shift Work.

SUPPLEMENTAL BENEFITS
Per Hour:

Steam/Sprinkler Fitter	$44.96
Temporary Heat & AC	$36.24

OVERTIME PAY
See (C, *D, O, V) on OVERTIME PAGE
(*D) ON ALL HVAC AND MECHANICAL CONTRACTS THAT DO NOT EXCEED $15,000,000.00
and ON ALL FIRE PROTECTION/SPRINKLER CONTRACTS THAT DO NOT EXCEED $ 1,500,00.00

HOLIDAY
Paid: See (1) on HOLIDAY PAGE
Overtime: See (5, 6, 11, 15, 16, 25) on HOLIDAY PAGE

REGISTERED APPRENTICES
1 year Terms at the Following:

WAGES per hour:

1st Term	2nd Term	3rd Term	4th Term	5th Term
$22.76	$28.44	$36.95	$45.46	$48.30

SUPPLEMENTAL BENEFIT
Per Hour:

1st Term	2nd Term	3rd Term	4th Term	5th Term
$18.83	$23.20	$29.72	$36.35	$38.43

4-638A-StmSpFtr

Survey Crew Consulting **07/01/2012**

JOB DESCRIPTION Survey Crew Consulting **DISTRICT** 9

ENTIRE COUNTIES
Bronx, Kings, Nassau, New York, Putnam, Queens, Richmond, Suffolk, Westchester

PARTIAL COUNTIES
Dutchess: Only the portion south of the north city line in Poughkeepsie.

WAGES
Feasibility and preliminary design surveying, line and grade surveying for inspection or supervision of construction when performed under a Consulting Engineer agreement.

Categories cover GPS & underground surveying.

WAGES: (per hour)

Survey Rates:	07/01/2012
Party Chief.....	$ 33.70
Instrument Man..	$ 28.38
Rodman.....	$ 25.02

SUPPLEMENTAL BENEFITS
Per Hour:

All Crew Members: $ 11.70

OVERTIME PAY
OVERTIME:.... See (B, E*, Q, V) ON OVERTIME PAGE.
*Doubletime paid on the 9th hour on Saturday.

HOLIDAY
Paid: See (5, 6, 7, 11, 16) on HOLIDAY PAGE
Overtime: See (5, 6, 7, 11, 16) on HOLIDAY PAGE

9-15dconsult

NOTIFICATION
OF
MINORITY BUSINESS ENTERPRISES
AND
WOMEN'S BUSINESS ENTERPRISES
ON-LINE DIRECTORY
AND
FORMS

The Port Authority has a long-standing practice of making its contract available to as many firms as possible and has taken affirmative steps to encourage Minority Business Enterprises (MBEs) and Women's Business Enterprises (WBEs) to seek business opportunities with it. The Port Authority's on-line Directory of Qualified MBE/WBEs lists the firms that are registered to assist Contractors in meeting and exceeding their Good Faith Goals.

The MBE/WBE Directory specifies the firms the Authority has determined to be (1) MBEs/WBEs and (2) experienced in performing work in the trades and contract dollar ranges indicated.

Contractors are provided with an interactive directory and the ability to view and print a current listing of M/WBE contractors. Information may be selected and sorted according to categories, state, dollar range, and type (MBE, WBE, DBE, and SBE).

To view the directory, type in www.panynj.gov/business-opportunities/mwsbe-search.cfm. For further information about MWBE Qualified Vendors, contact the Office of Business Diversity and Civil Rights at (212) 435-7802.

Revised 12/17/2008

THE PORT AUTHORITY OF NY & NJ

Certification Application for the Minority and Women-owned Business Enterprise Program

PLEASE PRINT OR TYPE CLEARLY

General Instructions:

- DO NOT LEAVE ANY SPACES BLANK ON THE APPLICATION - if a question is not applicable to your business insert "N/A" in the space provided for your answer
- Whenever the space is insufficient to answer the questions completely, attach additional sheets as necessary. Use the question number to identify any answer continued on an additional sheet
- For questions, call the Certification Helpline at 212-435-7808 or E-mail objocert@panynj.gov.
- Once you have completed the application, please return it and all required documentation to:

The Port Authority of NY & NJ
Office of Business & Job Opportunity - Certification Unit
233 Park Avenue South, 4th floor
New York, NY 10003

SECTION I: MAIN COMPANY INFORMATION

1. Business Name

Legal name of company applying to be certified

2. D.B.A.

"Doing Business As"- Complete if company does business under a name which is different from its legal name.

3. Business Address (must represent a physical location; cannot be a Post Office Box)

Street Address | Suite / Apt / Room/ Unit

City | State | Zip/Zip+4

County

4. Business Mailing Address (complete only if different from the address given in Question 3)

Street Address | Suite / Apt / Room/ Unit

City | State | Zip/Zip+4

5. Business Phone ( ) —

5a. Business Fax ( ) —

6. Business Website

7. Your E-mail Address

7a. Your Cell Phone Number ( )

8. Federal EIN or SSN

Schedule A

9. Name/title of an authorized representative to contact during the application review process:

Mr./Miss/Mrs./Ms. First Name : Last Name

Title Phone Ext. E-Mail Address

10. This company is applying for certification as ("X"all that apply)

Minority-owned Business Enterprise (MBE) ☐

Women-owned Business Enterprise (WBE) ☐

Refer to page _____ of the Application Guidelines to determine the appropriate designation for your company.

11. Are you currently involved in the bidding process or other contract/purchase order negotiations with the Port Authority or Port Authority tenants?

Yes_____ No_____

If "Yes", identify the department within the Port Authority and/or name of tenant and contact name

12. Has your company ever applied for certification as an M/W/SBE, or a DBE (whether SBA 8(a), Transportation, or other) with another governmental agency, department, or authority?

Yes_____ No_____

If "Yes", provide the following details

Name of Governmental Entity	Program (MBE, WBE, SBE, DBE)	Status (Pending, Certified, Decertified, Denied, Rejected, Revoked, On Appeal)	Date (mm/yy)

13. How did you first hear about The Port Authority of NY & NJ's M/W/DBE Certification program(s)? (please choose only one)

Letter/Call/E-mail ☐

Port Authority Web site ☐

Event ☐

Please specify name or sponsor of event and date

Other ☐

Please specify what and when

SECTION II: COMPANY OWNERSHIP

14. Business Structure

Sole Proprietorship	☐	Partnership (including LLP)	☐
Limited Liability Company (LLC)	☐	Corporation (including S-Corp.)	☐

15. Date company was established _____/ _____/ _____

16. Has the business existed under a different type of business structure prior to the Date Established indicated in question? 16

    Yes_____ No_____

    If "Yes", please provide copy of original Business Certificate

17. Has your Certificate of Incorporation, Business Certificate, or Certificate of Trade Name been amended?

    Yes_____ No_____

    If "Yes", please provide copy of amended Business Certificate

18. Method of Business Origination or Acquisition (check all applicable)

Started New Business	☐	Secured Franchise	☐
Bought Existing Business	☐	Secured Concession	☐
Merger or Consolidation	☐	Inherited Business	☐

Other ☐ _____

19. Date of origination (or acquisition, if later) _____/ _____/ _____

For the remaining questions in Section II which ask for ethnic identification of owners, shareholders, officers, board members, and managers, please use the following group codes to identify the ethnicity of each individual where required.

01	Black	02c	Spanish	04	Native American
02a	Hispanic	03a	Asian-Pacific	05	White (Non-Minority)
02b	Portuguese	03b	Asian-Indian	06	Other

20. Please provide the following information for all person(s) with ownership interest in the company (all proprietors, partners, and members OR, in the case of a corporation, all shareholders).

Name (First and Last)	Position In Company	% Owned	Date Ownership Established (mm/yy)	Gender (M/F)	Ethnicity (see group code table)	US Citizen or Permanent Resident Alien (Y/N)

*** QUESTIONS 22-24 APPLY ONLY TO CORPORATIONS. *** *** IF YOUR COMPANY IS NOT A CORPORATION, SKIP TO QUESTION 25 ***

21. If the company is a corporation, please provide the following information for all shareholders identified in Question 21

Name (First and Last)	Position In Company	Number of Shares Owned	Unit Share Price Paid When Purchased

22. State the number of company shares in each of the following

Common Authorized _____ Common Issued _____

Preferred Authorized _____ Preferred Issued _____

23. Name and position of current Officers and/or Board of Directors

Name (First and Last)	Position	Position Effective Date (mm/yy)	Gender (M/F)	Ethnicity (see group code table)

** ALL APPLICANTS SHOULD RESUME COMPLETING THE APPLICATION HERE **

24. Please identify the capital contributions to the company by each person identified in Question 21, including cash, equipment, property, and expertise

Name (First and Last)	Type of Contribution	Total Dollar Value	Date of Contribution (mm/yy)

25. If your company is owned in whole or in part by another company, please identify the company and the percentage of ownership interest. Include venture capitalists and other similar investors

Company Name	Percentage Owned	Date Ownership Established (mm/yy)

SECTION III: COMPANY MANAGEMENT

26. Identify individuals responsible for managerial operations (*state if owner or non-owner*). Refer to group code definitions on prior page.

Name & Title	Gender (M/F)	Group Code	Owner? (Y/N)
a) Financial Decisions			
b) Estimating			
c) Preparing Bids			
d) Negotiating Bonding			
e) Marketing & Sales			
f) Hiring & Firing			
g) Supervising Field Operations			
h) Purchasing Equipment/Supplies			
i) Managing & Signing Payroll			
j) Negotiating Contracts			
k) Signatures for Business Accounts			

27. Do any principals, officers, employees and/or owners of the firm have an affiliation, i.e. business interest or employment with any other firm?

Yes_____ No_____ (If "Yes", complete the following)

Name (First and Last)	Name and Address of Affiliated Firm	Nature of Business	Nature of Affiliation

28. Number of Employees (if necessary, average over the past year)

Permanent		Temporary		Field	
Full-Time	_____	Full-Time	_____	Full-Time	_____
Part-Time	_____	Part-Time	_____	Part-Time	_____

SECTION IV: COMPANY FINANCES

29. Does your company have a Line of Credit?

Yes_____ No_____ If "Yes", please provide details:

_____

Bank Dollar Limit Name of Guarantor(s)

30. Please list all major current lenders to the company

Name of Lender	Amount of Loan	Terms of Repayment

31. Identify bank(s) where company accounts are maintained

Bank Name	Address	Contact Name	Contact Title	Type of Account

32. Please provide gross receipts (sales) for each of the last three fiscal years. (If in business for less than three years, complete as applicable)

Current Year _____ $_____

Last Year _____ $_____

Previous Year _____ $_____

SECTION V: COMPANY OPERATIONS

33. Check the industry which best describes your PRIMARY line of business

- ☐ Construction-related
- ☐ Consultants
- ☐ Consumer Service
- ☐ Manufacturer/Supplier
- ☐ Professional Service
- ☐ Purchasing
- ☐ Technical Service
- ☐ Other _____

34. If a license, permit or certification (e.g. Master Electrical License, PE for engineers, CDL for truck drivers, etc.) is required to conduct any part of your company's business, please identify the individual(s) holding the license, permit or certification and provide a copy

Name of the Holder/Registrant	Type of License/ Permit/Certification	Issued by	Issue Date (mm/yy)	Exp. Date (mm/yy)

35. Is your company bonded? Yes_____ No_____

If "Yes", please provide detail:

Name of Agent/Broker	Surety Co.	Bonding Limit	
		Single $	Aggregate $

36. Is your company insured? Yes_____ No_____ If "Yes", please provide detail:

Carrier Name $ Amount of Liability Insurance

37. Please list the company's major equipment or machinery

Type	Depreciated $ Value	Acquisition Date (mm/yy)	Owned or Leased

38. List rented, leased or owned warehouse, plant and office facilities – Submit copy of lease, deed or mortgage

Facility Type	Owner or Name of Lessor and/or rental agent	Amt of yearly payment

39. Does your company share office space, personnel or equipment with any other company?

Yes_____ No_____

If "Yes", please provide details.

Company Name	Phone	Personnel (X)	Office Space ("X")	Yard Space (X)	Equipment ("X")	Machinery (X)

ACKNOWLEDGEMENTS AND VERIFICATION

FIRST, this certification application form, the supporting documents, and any other information provided in support of the application is considered part of the application. Any false statements or misrepresentations in the application may result in the applicant's disqualification from certification as Minority and/or Woman-owned Business Enterprise (M/WBE) by The Port Authority of New York and New Jersey for him/herself and its subsidiaries, which are included in the term "Port Authority".

SECOND, the information contained herein is subject to the Port Authority's Freedom of Information policy as reflected in the resolution adopted by the Committee on Operations of the Port Authority on August 13, 1992.

THIRD, the Port Authority may require further proof of eligibility for certification in addition to the information disclosed in this application and the applicant shall cooperate with the Port Authority in supplying the additional information. By completing this application, the applicant agrees to submit the additional proof required and acknowledges that the Port Authority may decide to deny the application if the additional proof is not submitted within 30 days after it is requested.

FOURTH, by filing this application, the applicant consents to examination of its books and records and interviews of its principals and employees by the Port Authority for the purpose of determining whether the applicant is, or continues to be, an eligible M/WBE. The applicant acknowledges that its certification may be denied if such examinations or interviews are refused or if the Port Authority determines, as a result of the examinations or interviews, that the applicant does not qualify for certification as a M/WBE.

FIFTH, by filing this application, the applicant consents to inquiries being directed by the Port Authority to the applicant's bonding companies, banking institutions, credit agencies, contractors, clients and other certifying agencies for the purpose of ascertaining the applicant's eligibility for certification. If the applicant fails to permit such inquiring to be made, such failure may be grounds for denying or revoking the applicant's certification.

SIXTH, the applicant agrees that it will advise the Port Authority of any change in the ownership or operational and managerial control of applicant's business after the certification application has been filed within 30 days of such change.

SEVENTH, certification is normally granted for a period of five (5) years. However, the Port Authority may require submission of a new application, additional information, examinations of the applicant's principals and employees at any time before the expiration of the five-year certification period. The applicant's failure to submit such material or to consent to such examinations and interviews will be grounds for revocation of certification.

EIGHT, the filing of this application, its acceptance by the Port Authority, and any subsequent certification of the applicant by the Port Authority, is not intended to and does not create any procedural or substantive rights enforceable at law by the applicant against the Port Authority, its Commissioners, officers, agents or employees and any such certification is only intended to facilitate the identification of qualified and bona fide M/WBEs.

NINTH, the Code of Ethics certification attached hereto shall be considered part of this certification application and the applicant is advised to familiarize him/herself with the terms of the certification prior to submitting this application.

TENTH, in submitting this application the applicant and each person signing on behalf of the applicant certifies that, to the best of their knowledge and belief, the following statements are true and correct:

A) No individual who is current or former employee of the Port Authority or its subsidiaries (i.e., Port Authority Trans-Hudson Corporation (PATH), Newark Legal and Communications Center Urban Renewal Corporation) other than those individuals identified in the space immediately below (1) owns an interest in; or (2) has involvement in a relationship with the applicant firm (a) from or as a result of which the individual has received within the past year, or is entitled to receive in any future year, more than $1,000 or its equivalent; or (b) which has a market value in excess of $1,000. *(List here any such current or former Port Authority Employee (s))

_____

B) No individual who is a current or former employee of the Port Authority or its subsidiaries other than those individuals identified in the space immediately below (1) holds a position in the applicant firm such as an officer, director, trustee, partner, employee, or a position of management: or (2) acts as a consultant, agent or representative of the firm in any capacity. *(List here any current or former Port Authority Employee (s))

_____

*Included within the scope of this certification are the individuals identified by the applicant in response to questions 4, 4a, 8d, 9, 10, 10a, 17, 18, 19, 24 and 25.

ELEVENTH, the criteria for certification by the Port Authority as a Small Business Enterprise are outlined in the documentation entitled "Small Business Enterprise Program (SBE) Administered by The Port Authority of New York and New Jersey" which accompanies this application. If the applicant believes that he/she is eligible for SBE certification, he/she may request that this application also be treated as
an SBE certification application by signing below. If signature is provided, all acknowledgments and provisions of this M/WBE certification shall also apply.

Applicant _____ Date _____

VERIFICATION

STATE OF _____)

SS:

COUNTY OF_____)

(A) (For Sole Proprietorships, Partnerships, and Limited Liability Partnerships)

_____, being duly sworn, states that he or she is the owner of (or a Partner in) the entity making the foregoing application and that the statements and representations made in the application are true to his/her own knowledge.

_____ _____
Signature Date

(B) (For Corporations and Limited Liability Companies)

_____, being duly sworn, states that he/she is the
Name of Corporate Officer

_____ of _____,
Title of Corporate Officer Name of Corporation

the entity making the foregoing application, that he/she has read the application and knows its contents, that the statements and representations made in the application are true to his/her knowledge, and that the application is made at the direction of the Board of Directors of the Corporation.

Corporate Seal _____
Signature Date

Sworn to before me this _____ day of _____, 20_____

_____
Notary Public

Mail to: *The Port Authority of New York and New Jersey*
Office of Business & Job Opportunity – Certification Unit
233 Park Avenue South, 4th Floor
New York, NY 10003

CODE OF ETHICS CERTIFICATION

In signing and submitting the annexed Certification Application, each applicant and each person signing on behalf of any applicant certifies that they have not made any offers or agreements or given or agreed to give anything of value or taken any other action with respect to any employee or former employee of The Port Authority of New York and New Jersey or any of its subsidiaries (hereinafter referred to as the "Authority") or any immediate family member of either which would constitute a breach of ethical standards under the Code of Ethics and Financial Disclosure dated as of July 18, 1994 (a copy of which is available upon request to the Office of Regional and Economic Development /Business & Job Opportunity), nor do they have any knowledge of any act on the part of such employee or former employee relating either directly or indirectly to the applicant which constitutes a breach of the ethical standards set forth in said code.

> 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 an Authority contract), etc., which might tend to obligate the Authority employee to the Contractor 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 any Authority contract.

The foregoing certification shall be deemed to have been made by the applicant as follows: If the applicant is a corporation, such certification shall be deemed to have been made not only with respect to the application itself, but also with respect to each director and officer, as well as, to the best of the certifier's knowledge and belief, each stockholder with an ownership interest in excess of 10%; if the applicant is a partnership, such certification shall be deemed to have been made not only with respect to the applicant itself, but also with respect to each partner. Moreover, the foregoing certification, if made by a corporate applicant, shall be deemed to have been authorized by the Board of Directors of the applicant, 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 applicant cannot make the foregoing certification, the applicant shall so state and shall furnish with the application, a signed statement that sets forth in detail the reasons thereof.

The foregoing certification or signed statement shall be deemed to have been made by the applicant with full knowledge that it would become part of the records of the Authority and that the Authority will rely on its truth and accuracy in granting certification.

Applicants 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.). Applicants are also advised that the inability to make such certification will not, in and of itself disqualify an applicant, and that in each instance the Authority will evaluate the reasons therefore provided by the applicant.

Supporting Documentation Checklist

REQUIRED FOR ALL APPLICANTS Attach copies of the following documents, as applicable. Indicate documents submitted by checking appropriate boxes. PLEASE PROVIDE COPIES OF SUPPORTING DOCUMENTS ONLY - NOT THE ORIGINALS. The minimum documentation required for certification is listed below, but is not limited to this list. A representative may request additional documents during the application review process, if warranted.

- ☐ 1 Résumés for all principals, partners, officers and/or key employees of the firm. Provide home address, telephone number, education, training, and employment with dates and specific duties with the company
- ☐ 2 Proof of ethnicity for each person with ownership interest (valid passport, ethnic birth certificate)*
- ☐ 3 Proof of U.S. Citizenship (valid U.S. passport, ethnic birth certificate, naturalization certificate)*
- ☐ 4 Proof of permanent resident alien status (valid permanent resident alien "green" card showing expiration date)*
- ☐ 5 Bank signature card, bank resolution or letter from bank identifying persons authorized to conduct transactions on each account
- ☐ 6 Lease agreement or proof of ownership (deed/mortgage) for business location(s)
- ☐ 7 Proof of any certification (including SBA 8(a)), decertification, or denial from another governmental agency, department, or authority
- ☐ 8 Copies of any licenses, permits and/or accreditations required for conducting business
- ☐ 9 Proof of sources of capitalization/investments (purchase receipts, any loan agreements)
- ☐ 10 Any employment agreements
- ☐ 11 All third party agreements including: equipment rental, purchase agreements, management service agreements, etc.
- ☐ 12 Vehicle registration(s) for any vehicle used for business purposes
- ☐ 13 Current financial statement (statement of cash flows, balance sheet, or profit and loss statement)
- ☐ 14 Most recent three years' business Federal, State and City tax returns (all pages, all schedules); Prior two (2) years of personal tax returns (1040's) for each person with ownership interest, including all applicable W-2 forms and schedules if in business less than three years

If you have one document that satisfies the requirements for numbers 2 – 4, submit only one copy.

REQUIRED FOR A SOLE PROPRIETORSHIP

☐ Copy of Business Trade Name or Certification Trade Name filed with County Clerk (If doing business under an assumed name)

REQUIRED FOR A PARTNERSHIP AND JOINT VENTURE PARTNERSHIP

Attach copies of the following: (Indicate documents submitted by checking appropriate boxes)

☐ 1. Business Certificate

☐ 2. Partnership Agreement

REQUIRED FOR A LIMITED LIABILITY COMPANY (Check appropriate boxes below)

☐ 1. Sole Proprietorship

☐ 2. Corporation

☐ 3. Partnership Agreement

Attach required documents and indicate documents submitted by checking appropriate boxes

☐ 1. Certificate of formation and/or organization

☐ 2. Operating and/or managing agreements

☐ 3. Franchise and/or third-party agreement

REQUIRED FOR A CORPORATION

Attach documents of the following: (Indicate documents submitted by checking appropriate boxes)

☐ 1. Articles of incorporation, including date approved by State

☐ 2. Corporation By-Laws

☐ 3. Minutes of first corporate organizational meeting and amendments

☐ 4. Copies of all issued stock certificates front and back, as well as next un-issued certificate

☐ 5. Copy of stock ledger

☐ 6. If applicable, furnish copies of agreements relating to:

a. stock options
b. shareholder agreements
c. shareholder voting rights
d. restriction on the disposal of stock loan agreements
e. facts pertaining to the value of shares
f. buy-out rights
g. restrictions on the control of the corporation

SMALL BUSINESS ENTERPRISE PROGRAM
ADMINISTERED BY
THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

The Small Business Enterprise Programs are designed to promote New York and New Jersey businesses and to provide them with the advantage of competing against firms of like size and expertise in a limited competitive environment. In order to be eligible to participate in opportunities set-aside for the programs, the Port Authority must certify a firm as a Small Business Enterprise. To be eligible for certification, firms at a minimum:

- Must have a principal place of business in either New York or New Jersey.
- Must have operated that specific type of business for at least three (3) years.
- Must not exceed the average annualized gross revenue limitations cited below for the last three (3) fiscal years.

Average Annualized Gross Revenue Limitation and other Port Authority Pre-requisites by Procurement Category.

- **Construction - $14 million**
  The Port Authority's Engineering Department must also qualify construction firms. This requires the submittal of acceptable references for completed contracts. A minimum of three acceptable references is required for each construction specialty area.

- **Architectural & Engineering (A&E) - $4.5 million**
  - ***Landscape Architectural Services - $7 million***
  - ***Marine Engineering & Naval Architecture - $18.5 million***

  In addition to adhering to maximum gross revenues Thresholds, A&E firms must also have minimum average annual revenues of more than $100,000 over the last three (3) fiscal years.

- **Commodity - $7 million**
  Commodity firms eligible to participate are provided a five percent (5%) price preference in designated contracts solicited by the Port Authority's Procurement Division.

- **Janitorial Maintenance - $16.5 million**

- **Unarmed Guard Service - $18.5 million**

- **Financial Services - $7 million**

INFORMATION FOR DETERMINING JOINT VENTURE ELIGIBILITY

Return your submittal to:	*The Port Authority of NY & NJ* *Office of Business and Job Opportunity* *233 Park Avenue South, 4th Floor* *New York, NY 10003*
	Firms not currently certified should call (212) 435-7808 for information

**(NOTE: This form need not be completed if all joint venture firms are *M/W/DBEs*
The Joint Venture approval is valid through the duration of the Port Authority contract)**

1. NAME OF JOINT VENTURE: _____

2. ADDRESS OF JOINT VENTURE: _____

_____

_____

3. TELEPHONE NUMBER (S) OF JOINT VENTURE: _____

_____

4. (A) IDENTIFY THE FIRMS WHICH COMPRISE THE JOINT VENTURE. (THE MINORITY OR WOMAN-OWNED OR DISADVANTAGED BUSINESS ENTERPRISE PARTNER MUST COMPLET A UNIFORM CERTIFICATION APPLICATION – SCHEDULE A)

_____

_____

(B) DESCRIBE THE ROLE OF THE M/W/DBE IN THE JOINT VENTURE:

_____

_____

_____

5. NATURE OF THE JOINT VENTURE'S BUSINESS: _____

_____

_____

6. PROVIDE A COPY OF THE JOINT VENTURE AGREEMENT.

SCHEDULE B

7. WHAT IS THE CLAIMED PERCENTAGE OF MBE OR WBE OF DBE OWNERSHIP? _____

8. OWNERSHIP OF JOINT VENTURE: (THIS NEED NOT BE FILLED IN IF DESCRIBED IN THE JOINT VENTURE AGREEMENT)

(A) PROFIT AND LOSS SHARING: _____

_____

(B) CAPITAL CONTRIBUTIONS, INCLUDING EQUIPMENT:

_____

_____

_____

(C) OTHER APPLICABLE OWNERSHIP INTERESTS:

_____

_____

_____

9. CONTROL OF AND PARTICIPATION IN THIS CONTRACT. IDENTIFY BY NAME, RACE, SEX AND "FIRM" THOSE INDIVIDUALS AND THEIR TITLES WHO ARE RESPONSIBLE FOR DAY-TO-DAY MANAGEMENT AND POLICY DECISION-MAKING, BUT NOT LIMITED TO, THOSE WITH PRIME RESPONSIBILITY FOR:

NAME & TITLE	SEX	GROUP CODE*	FIRM
FINANCIAL DECISIONS			
_____	☐M ☐F	_____	_____
_____	☐M ☐F	_____	_____
MANAGEMENT DECISIONS, SUCH AS:			
ESTIMATING			
_____	☐M ☐F	_____	_____
_____	☐M ☐F	_____	_____
MARKETING AND SALES			
_____	☐M ☐F	_____	_____
_____	☐M ☐F	_____	_____

HIRING AND FIRING OF MANAGEMENT PERSONNEL

_____	☐M	☐F	_____	_____
_____	☐M	☐F	_____	_____

PURCHASING OF MAJOR ITEMS OR SUPPLIES

_____	☐M	☐F	_____	_____
_____	☐M	☐F	_____	_____

SUPERVISION OF FIELD OPERATIONS

_____	☐M	☐F	_____	_____
_____	☐M	☐F	_____	_____

***GROUP CODE KEY**

01 – BLACK	02A – HISPANIC	03A – ASIAN-PACIFIC	04 – NATIVE AMERICAN
	02B – PORTUGUESE	03B – ASIAN-INDIAN	05 – NON-MINORITY
	02C – SPANISH		06 - OTHER

Affidavit

"The undersigned swear that the foregoing statements are correct and include all material information necessary to identify and explain the terms and operation of the joint venture and the intended participation by each joint venturer in the undertaking. Further, the undersigned agree to provide to the grantee current and complete information and any proposed changes to the joint venture arrangement. The undersigned also agree to permit authorized representatives of the grantee or the Federal-funding agency to audit and examine the books, records and files of the joint venture, or those of each joint venturer relevant to the joint venture. Any material misrepresentation will be grounds for terminating any contract which may be awarded and for initiating action under Federal or State laws concerning false statement."

_____	_____
NAME OF FIRM	NAME OF FIRM
_____	_____
SIGNATURE	SIGNATURE
_____	_____
NAME	NAME
_____	_____
TITLE	TITLE
_____	_____
DATE	DATE

State of _____ County of _____

On this _____ day of _____, 20____, before me appeared (name) _____ to me personally known, who, being duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by (name of firm) _____ to execute the affidavit and did so as his or her free act and deed.

_____
Notary Public

State of _____ County of _____

On this _____ day of _____, 20____, before me appeared (name) _____ to me personally known, who being duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by (name of firm) _____ to execute the affidavit and did so as his or her free act and deed.

_____
Notary Public

-4-

THE PORT AUTHORITY OF NY & NJ

CONSTRUCTION M/W/B PARTICIPATION PLAN

PA 5710 (05-07)

Office of Business and Job Opportunity

PAGE _____ OF _____

NOTE: The Contractor is required to submit to the Engineering Dept. a MODIFIED PLAN for any changes to the original plan: i.e.; subcontractor, dollar amount or work performed.
If more than 1 page is used, complete totals on last page.

Contract Number: _____ **Contract Description:** _____

Contractor Name: _____

Mailing Address: _____ **Contract Amount:** _____

Telephone Number: _____ ***Contract Goals:*** **MBE** _____ **WBE** _____ **DBE** _____

Name, Address, _Phone Number of PA Certified MBE/WBE/DBE subcontractor (including name of contact person)	Indicate MBE, WBE Or DBE	Description of Work, Services to be provided. Where applicable, specify, "supply" or "install or both "supply" and "install."	Anticipated date work will start and finish	*Approximate $ amount of M/W/DBE Subcontract	MBE/WBE/DBE % of Total Contract Amount
			TOTAL:		

Signature of Contractor: _____

Print Name: _____

Title: _____ Date _____

FOR OBJO USE ONLY
Contract Goals: ☐ Approved ☐ Waived ☐ Rejected
Reviewed by: _____
OBJO Business Development Representative
Print Name: _____ Date _____

Distribution: Original – OBJO; Copy 2 – Engineer of Construction; Copy 3 – Contractor; Copy 4 – Line Department
*Please Note: supplies, equipment and material men are only credited 60% towards the M/W/DBE goal. Please adjust calculations accordingly.

Schedule C

INSTRUCTIONS

CONTRACTOR INSTRUCTIONS: Contractor is required to submit a MBE/WBE Participation Plan and/or best efforts documentation to the designee identified in the contract book within 7 days after the opening of the Proposals for this Contract.

ENGINEER OF CONSTRUCTION INSTRUCTIONS: After the review of the submitted MBE/WBE Participation plan, forward to the Office of Business and Job Opportunity via fax at (212) 435-7828 or PAD to 233 PAS 4th Floor for review and approval. Approved/waived/rejected plan will be returned within 10 business days of receipt of this document. Engineer of Construction will advise vendor of the results of the MBE/WBE Participation Plan review.

PA 3749 A/ 5-07

THE PORT AUTHORITY OF NY & NJ
Office of Business and Job Opportunity

CONSTRUCTION
MBE/WBE/DBE PARTICIPATION PLAN
MODIFIED

PAGE _____ OF _____

Contract Number: _____

Contractor Name: _____

Mailing Address: _____

Telephone Number: _____

Contract Description: _____

Contract Amount: _____

Contract Goals: **MBE** _____ **WBE** _____ **DBE** _____

Name, Address, _Phone Number of PA Certified MBE/WBE/DBE subcontractor (including name of contact person)	Indicate MBE, WBE Or DBE	Description of Work, Services to be provided. Where applicable, specify "supply" or "install or both "supply" and "install."	Anticipated date work will start and finish	*Approximate $ amount of M/W/DBE Subcontract	MBE/WBE/DBE % of Total Contract Amount
			TOTAL:		

Signature of Contractor: _____

Print Name: _____

Title: _____ Date _____

FOR OBJO USE ONLY
Contract Goals: ☐ Approved ☐ Waived ☐ Rejected
Reviewed by: _____
OBJO Business Development Representative
Print Name: _____ Date _____

Distribution: Original – OBJO; Copy 2 – Engineer of Construction; Copy 3 – Contractor; Copy 4 – Line Department
*Please Note: supplies, equipment and material men are only credited 60% towards the M/W/DBE goal. Please adjust calculations accordingly.

Schedule C

STATEMENT OF PAYMENTS TO M/W/DBE SUBCONTRACTORS/LESSORS/SUPPLIERS

Contract No: _____ Period Reporting: _____ (Example: 10/1/99 - 10/31/99)

Contract Title: _____ Payment Appl #: _____

Contractor: _____ % Project Completed: _____

SUBCONTRACTOR'S NAME	(Indicate) MBE WBE DBE	ESTIMATED TOTAL SUBCONTRACT AMOUNT	Column A AMOUNTS PAID Prior Statement	+ Column B This Statement	= Column C Cumulative To-Date
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0

SUPPLIERS/LESSORS	(Indicate) MBE WBE DBE	TOTAL AMOUNT SUPPLIER AGREEMENT	AMOUNTS PAID (Amount entered should reflect 100% paid. The 20% check will be handled by the office.) Prior Statement	This Statement	Cumulative To-Date
					$0
					$0
					$0
					$0
					$0
					$0

Date Prepared: _____

Prepared by: _____

Title: _____

Officer's Signature: _____

The Port Authority of N.Y. & N.J. Resident Engineer's Office

Date Received: _____

Reviewed By: _____

Title: _____

Schedule D

FINAL

STATEMENT OF PAYMENT
TO M/W/DBE SUBCONTRACTORS/LESSORS/SUPPLIERS

Contract No:	Period Reporting: (Example: 10/1/98 - 10/31/98)
Contract Title:	Payment Appl #: & Final
Contractor:	% Project Completed: 100%

SUBCONTRACTOR'S NAME	(Indicate) MBE WBE DBE	TOTAL SUBCONTRACT AMOUNT	Column A AMOUNTS PAID & TO BE PAID Prior Statement	+ Column B This Statement	= Column C Cumulative To-Date
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0
					$0

SUPPLIERS/LESSORS	(Indicate) MBE WBE DBE	TOTAL AMOUNT SUPPLIER AGREEMENT	AMOUNTS PAID & TO BE PAID (Amounts entered should reflect 100% paid. The 40% credit will be handled by the office.) Prior Statement	This Statement	Cumulative To-Date
					$0
					$0
					$0
					$0
					$0
					$0

Date Prepared:	For Use of The Bi-State Authority of NY & NJ Resident Engineer's Office
Prepared by:	
Title:	Date Received:
Officer's Signature:	Reviewed By:
	Title:

Schedule D

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102

August 2, 2012

ADDENDUM NO. 1

TO PROSPECTIVE BIDDERS ON CONTRACT **JFK-924.105** – JOHN F. KENNEDY INTERNATIONAL AIRPORT – REHABILITATION OF 148TH STREET AND THREE JFK EXPRESSWAY RAMPS

The following changes are hereby made in the Contract Documents for the subject Contract.

This communication should be physically annexed to back cover of the book and initialled by each bidder before submitting his bid.

In case any bidder fails to conform to these instructions, his Proposal will nevertheless be construed as though this communication had been so physically annexed and initialled.

CHANGES IN THE CONTRACT BOOKLET

Page 1 - In the second line of the first paragraph change the date for receipt of Proposals to "August 21, 2012".

Page 7 - In the first line of the first paragraph delete "goals of 12 percent for firms owned and controlled by minorities, and 5 percent for firms owned and controlled by women." and substitute therefor "a combined goal of 27 percent for firms owned and controlled by minorities and firms owned and controlled by women."

08-21-12 P03:37

THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

Peter J. Zipf, P.E.
Chief Engineer

Tully Construction Co. Inc
INITIALLED BY THE BIDDER:

Peter K. Tully
President