

Torres Rojas, Genara

FOI#14360

From: NEW@NEWWORLD1.BIZ
Sent: Friday, October 18, 2013 3:56 PM
To: Duffy, Daniel
Cc: Torres Rojas, Genara; Van Duyne, Sheree; Qureshi, Ann
Subject: Freedom of Information Online Request Form

Information:

First Name: SIMONE
Last Name: PEELE
Company: A NEW WORLD CONTRACTING CO
Mailing Address 1: 1215 EASTERN PKWAY
Mailing Address 2: 1E
City: BROOKLYN
State: NY
Zip Code: 11213
Email Address: NEW@NEWWORLD1.BIZ
Phone: 347-304-3547
Required copies of the records: Yes

List of specific record(s):
WE ARE SEEKING THE CONTRACT BOOK FOR CONTRACT PAT-624.154 CHRISTOPHER STREET
NYC PATH.

THE PORT AUTHORITY OF NY & NJ

FOI Administrator

November 26, 2014

Ms. Simone Peele
A New World Contracting Co.
1215 Eastern Pkway, 1E
Brooklyn, NY 11213

Re: Freedom of Information Reference No. 14360

Dear Ms. Peele:

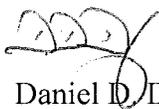
This is in response to your October 18, 2013 request, which has been processed under the Port Authority's Freedom of Information Code (the "Code") for a copy of "the contract book for Contract No. PAT-624.154 Christopher Street New York City PATH."

Material responsive to your request and available under the Code can be found on the Port Authority's website at <http://www.panynj.gov/corporate-information/foi/14360-C.pdf>. Paper copies of the available records are available upon request.

Certain portions of the material responsive to your request are exempt from disclosure pursuant to exemptions (1) and (4) of the Code.

Please refer to the above FOI reference number in any future correspondence relating to your request.

Very truly yours,



Daniel D. Duffy
FOI Administrator

225 Park Avenue South, 17th Fl.
New York, NY 10003
T: 212 435 3642 F: 212 435 7555

THE PORT AUTHORITY OF NY & NJ

Lillian D. Valenti
Director, Procurement

April 24, 2012

VIA FACSIMILE AND DHL NEXT DAY AIR

Mass Electric Construction Co.
470 Chestnut Ridge Road
1st Floor
Woodcliff Lake, NJ 07677

**SUBJECT: THE PORT AUTHORITY TRANS-HUDSON CORPORATION – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF CHRISTOPHER STREET SUBSTATION – CONTRACT PAT-624.154
PURCHASE ORDER UPAT624154**

Gentlemen:

The Port Authority Trans-Hudson Corporation (PATH) hereby accepts your proposal on the subject Contract.

PATH 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.

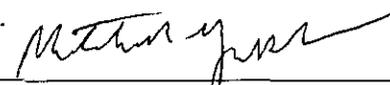
Forwarded herewith for your use and compliance are "General Instructions Relating to the Direction and Processing of Correspondence and of Those Other Items Specified to be Submitted to the PATH Under the Terms of the Contract".

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,

PORT AUTHORITY TRANS-HUDSON
CORPORATION

BY



Director of Procurement

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

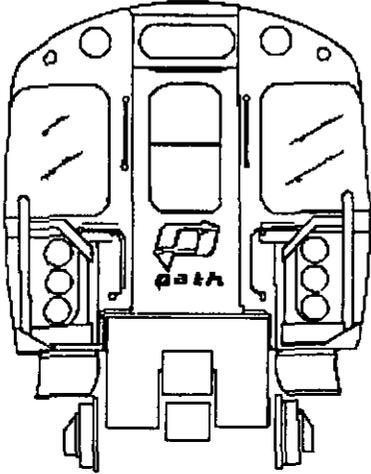
MASS ELECTRIC CONSTRUCTION Co.

**PORT AUTHORITY
TRANS-HUDSON CORPORATION**

CR02624154
PQ

JMcV
Jacobs Engineering, Chu & Gassman Engineering,

0



NEW YORK AND NEW JERSEY PATH FACILITIES

**REPLACEMENT AND UPGRADE OF CHRISTOPHER
STREET SUBSTATION**

CONTRACT PAT-624.154

NOVEMBER 2011

VOLUME 1 OF 2

This proposal is not complete unless bidder's
Signature appears on page 25

C2-02-12P03:51 RCY2

PORT AUTHORITY

TRANS-HUDSON CORPORATION

DIRECTORS

David Samson, Chairman

Anthony R. Coscia

Virginia S. Bauer

Michael J. Chasanoff

Stanley E. Grayson, Vice-Chairman

H. Sidney Holmes III

Henry R. Silverman

Jeffrey A. Moerdler

Raymond M. Pocino

Anthony J. Sartor

David S. Steiner

EXECUTIVE STAFF

Christopher O. Ward, President

Ernesto L. Butcher, Vice President

Michael P. DePallo, Director and General Manager

Robert E. VanEtten, Inspector General

Peter J. Zipf, P.E.

Chief Engineer

The Port Authority of New York and New Jersey

TABLE OF CONTENTS

INFORMATION FOR BIDDERS	1
1. FORM AND SUBMISSION OF PROPOSALS	1
2. PAPERS ACCOMPANYING PROPOSALS	1
3. QUALIFICATION INFORMATION	4
4. ACCEPTANCE OR REJECTION OF PROPOSAL.....	5
5. RETURN OF CERTIFIED CHECKS	6
6. WEBSITE POSTINGS OF CONTRACT DOCUMENTS	6
7. DISPOSAL OF CONTRACT DOCUMENTS.....	6
8. AVAILABLE DOCUMENTS	6
9. MINORITY AND WOMEN'S BUSINESS ENTERPRISES PROGRAM (MBE/WBE).....	7
10. INSPECTION OF SITE	14
11. QUESTIONS BY BIDDERS <i>Construction Site Security Requirements</i>	14
12. PORT AUTHORITY SECURITY REQUIREMENTS	14
13. PREVAILING RATE OF WAGE CERTIFICATION.....	15
14. CERTIFICATION OF NO INVESTIGATION (CRIMINAL OR CIVIL ANTI-TRUST), INDICTMENT, CONVICTION, SUSPENSION, DEBARMENT, DISQUALIFICATION, PREQUALIFICATION DENIAL OR TERMINATION, ETC; DISCLOSURE OF OTHER REQUIRED INFORMATION.....	16
15. NON-COLLUSIVE BIDDING AND CODE OF ETHICS CERTIFICATION; CERTIFICATION OF NO SOLICITATION BASED ON COMMISSION, PERCENTAGE, BROKERAGE, CONTINGENT FEE OR OTHER FEE	19
16. 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	20
17. THE EDWARD J. MALLOY CONSTRUCTION INITIATIVE FOR CONSTRUCTION SKILLS - APPRENTICESHIP PROGRAM.....	21
18. CERTIFICATION OF PARTICIPATION IN A STATE-REGISTERED APPRENTICESHIP PROGRAM	21
PROPOSAL	23
ACKNOWLEDGMENT	26
STATEMENT ACCOMPANYING PROPOSAL	27
BID BOND	28
ACKNOWLEDGMENT	30
FORM OF CONTRACT	31

CHAPTER 1 - GENERAL PROVISIONS

19. DEFINITIONS..... 31
20. GENERAL AGREEMENT..... 33
21. PATH ACCESS TO RECORDS..... 34
22. AGENCY FOR RENTAL OF CONSTRUCTION EQUIPMENT 35
23. EXEMPTION FROM NEW JERSEY STATE SALES TAXES 36
24. EXEMPTION FROM NEW YORK STATE AND NEW YORK CITY SALES TAXES 37
25. PERFORMANCE AND PAYMENT BOND 39

CHAPTER II - ADJUSTMENTS AND PAYMENTS

26. ADJUSTMENTS OF LUMP SUM..... 41
27. COMPENSATION FOR EXTRA WORK..... 41
28. COMPENSATION FOR PREMIUM TIME..... 44
29. COMPENSATION FOR EMERGENCY DELAYS..... 45
30. MONTHLY ADVANCES 46
31. RELEASE OF MONIES PREVIOUSLY WITHHELD FROM MONTHLY ADVANCES UPON
RENDITION OF A CERTIFICATE OF SUBSTANTIAL COMPLETION 47
32. FINAL PAYMENT..... 47
33. WITHHOLDING OF PAYMENTS..... 49

CHAPTER III - PROVISIONS RELATING TO TIME

34. TIME FOR COMPLETION AND DAMAGES FOR DELAY 50
35. EXTENSIONS OF TIME..... 50
36. IDLE SALARIED MEN AND EQUIPMENT..... 52
37. DELAYS TO CONTRACTOR..... 53
38. CANCELLATION FOR DELAY 54

CHAPTER IV - CONDUCT OF CONTRACT

39. AUTHORITY OF CHIEF ENGINEER 55
40. AUTHORITY AND DUTIES OF ENGINEER..... 56
41. NOTICE REQUIREMENTS..... 56
42. EQUAL EMPLOYMENT OPPORTUNITY - NEW YORK..... 57
43. EQUAL EMPLOYMENT OPPORTUNITY - NEW JERSEY 59
44. NO DISCRIMINATION IN EMPLOYMENT 60
45. AFFIRMATIVE ACTION REQUIREMENTS - EQUAL EMPLOYMENT OPPORTUNITY..... 61
46. PREVAILING RATE OF WAGE..... 67
47. EXTRA WORK ORDERS..... 69
48. PERFORMANCE OF EXTRA WORK 69

CHAPTER 1 - GENERAL PROVISIONS

19. DEFINITIONS31
20. GENERAL AGREEMENT33
21. PATH ACCESS TO RECORDS34
22. RENTAL OF CONSTRUCTION EQUIPMENT35
23. EXEMPTION FROM NEW JERSEY SALES AND USE TAXES35
24. EXEMPTION FROM NEW YORK STATE AND NEW YORK CITY SALES TAXES36
25. PERFORMANCE AND PAYMENT BOND39

CHAPTER II - ADJUSTMENTS AND PAYMENTS

26. ADJUSTMENTS OF LUMP SUM41
27. COMPENSATION FOR EXTRA WORK41
28. COMPENSATION FOR PREMIUM TIME44
29. COMPENSATION FOR EMERGENCY DELAYS45
30. MONTHLY ADVANCES46
31. RELEASE OF MONIES PREVIOUSLY WITHHELD FROM MONTHLY ADVANCES UPON
RENDITION OF A CERTIFICATE OF SUBSTANTIAL COMPLETION47
32. FINAL PAYMENT47
33. WITHHOLDING OF PAYMENTS49

CHAPTER III - PROVISIONS RELATING TO TIME

34. TIME FOR COMPLETION AND DAMAGES FOR DELAY50
35. EXTENSIONS OF TIME50
36. IDLE SALARIED MEN AND EQUIPMENT52
37. DELAYS TO CONTRACTOR53
38. CANCELLATION FOR DELAY54

CHAPTER IV - CONDUCT OF CONTRACT

39. AUTHORITY OF CHIEF ENGINEER55
40. AUTHORITY AND DUTIES OF ENGINEER56
41. NOTICE REQUIREMENTS56
42. EQUAL EMPLOYMENT OPPORTUNITY - NEW YORK57
43. EQUAL EMPLOYMENT OPPORTUNITY - NEW JERSEY59
44. NO DISCRIMINATION IN EMPLOYMENT60
45. AFFIRMATIVE ACTION REQUIREMENTS - EQUAL EMPLOYMENT OPPORTUNITY61
46. PREVAILING RATE OF WAGE67
47. EXTRA WORK ORDERS69
48. PERFORMANCE OF EXTRA WORK69

49. TITLE TO MATERIALS.....	69
50. ASSIGNMENTS AND SUBCONTRACTS	70
51. CLAIMS OF THIRD PERSONS	70
52. CERTIFICATES OF PARTIAL COMPLETION.....	71
53. CERTIFICATE OF SUBSTANTIAL COMPLETION.....	71
54. CERTIFICATE OF FINAL COMPLETION.....	72
55. NO GIFTS, GRATUITIES, OFFERS OF EMPLOYMENT, ETC.....	72
CHAPTER V - WARRANTIES MADE AND LIABILITY ASSUMED BY THE CONTRACTOR	
56. CONTRACTOR'S WARRANTIES	73
57. RISKS ASSUMED BY THE CONTRACTOR	74
58. NO THIRD PARTY RIGHTS.....	75
59. INSURANCE PROCURED BY PATH.....	76
60. INSURANCE PROCURED BY CONTRACTOR	78
CHAPTER VI - RIGHTS AND REMEDIES	
61. RIGHTS AND REMEDIES OF PATH.....	81
62. RIGHTS AND REMEDIES OF CONTRACTOR.....	82
63. PERFORMANCE OF WORK AS AGENT FOR CONTRACTOR.....	82
64. NO ESTOPPEL OR WAIVER	82
CHAPTER VII - MISCELLANEOUS	
65. SUBMISSION TO JURISDICTION.....	84
66. PROVISIONS OF LAW DEEMED INSERTED.....	84
67. INVALID CLAUSES.....	84
68. NON-LIABILITY OF PATH REPRESENTATIVES	84
69. SERVICE OF NOTICES ON THE CONTRACTOR.....	85
70. MODIFICATION OF CONTRACT	85
71. PUBLIC RELEASE OF INFORMATION	85
PERFORMANCE AND PAYMENT BOND.....	86
ACKNOWLEDGMENT	89
SPECIFICATIONS.....	90
DIVISION 1 - GENERAL PROVISIONS	
72. CONSTRUCTION REQUIRED BY THE SPECIFICATIONS	90
73. AVAILABLE PROPERTY	91
74. OPERATIONS OF OTHERS.....	91
75. LABOR ACTIONS	91
76. CONTRACTOR'S MEETINGS.....	92

77. CONTRACT DRAWINGS.....	92
78. SHOP DRAWINGS, CATALOG CUTS AND SAMPLES.....	106
79. SUBSTITUTION.....	109
80. WORKMANSHIP AND MATERIALS.....	110
81. INSPECTIONS AND REJECTIONS.....	112
82. MANUFACTURERS' CERTIFICATION.....	114
83. NO RELEASE OF CONTRACTOR.....	114
84. ERRORS AND DISCREPANCIES.....	114
85. DIFFERING SUBSURFACE CONDITIONS.....	115
86. ACCIDENTS AND FIRST AID PROVISIONS.....	115
87. SAFETY PROVISIONS.....	115
88. RECYCLING OF CONSTRUCTION DEBRIS MATERIAL.....	117
89. DIESEL-POWERED EQUIPMENT.....	118
90. DAILY PROGRESS, EQUIPMENT AND LABOR REPORTS.....	122
91. LAWS AND ORDINANCES.....	123
92. IDENTIFICATION.....	123
93. SIGNS.....	123
94. CONTRACTOR'S FIELD OFFICE AND REPRESENTATIVE.....	123
95. SURVEYS.....	124
96. TEMPORARY STRUCTURES.....	124
97. PERMIT AND REQUIREMENTS FOR WELDING.....	125
98. FINAL INSPECTION.....	125
99. WARRANTIES.....	125
100. UTILITY DATA COLLECTION.....	125
101. REQUIREMENTS FOR CRANES AND DERRICKS - NEW YORK.....	125
102. REQUIREMENTS FOR CRANES AND DERRICKS - NEW JERSEY.....	132
103. TEMPORARY UTILITY SERVICES.....	134
104. TEMPORARY SANITARY FACILITIES.....	135
105. ASBESTOS COST SUMMARY SUBMITTAL.....	135
106. PROGRESS SCHEDULE.....	137
107. ANALYSIS OF BID.....	143D
108. PERMIT AND REQUIREMENTS FOR CONFINED SPACES.....	143D
109. PATH OPERATIONS AND CONDITIONS.....	143H
110. CONSTRUCTION STAGING.....	143P

SECTION

TITLE

DIVISION 2 - SITEWORK

02073	CUTTING, PATCHING AND REMOVAL
02076	SELECTIVE DEMOLITION FOR INTERIORS
02081	ASBESTOS REMOVAL AND DISPOSAL FOR PORT AUTHORITY OF NEW YORK AND NEW JERSEY
02083	UNIVERSAL WASTE & PCB BALLAST MANAGEMENT (HANDING TRANSPORT AND DISPOSAL OF FLOURESCENT / HIGH ENERGY LAMPS / PCB LIGHTING BALLAST / LEAD BATTERIES)
02084	DISPOSAL OF PCB LIQUID FILLED ELECTRICAL EQUIPMENT
02094	WORKER AND ENVIRONMENTAL PROTECTION FOR LEAD PAINT REMOVAL

DIVISION 3 - CONCRETE

03200	CONCRETE REINFORCEMENT
03301	PORTLAND CEMENT CONCRETE, LONG FORM
03602	GROUTING (NON-METALLIC)
03730	CONCRETE SPALL REPAIRS

DIVISION 4 - MASONRY

04060	MASONRY MOTAR
04070	MASONRY GROUT
04170	JOINT REINFORCEMENT AND STEEL REINFORCING
04220	CONCRETE MASONRY UNITS
04466	REUSED GRANIITE

DIVISION 5 - METALS

05120	STRUCTURAL STEEL
05311	STEEL DECK
05510	METAL STAIRS
05523	STEEL PIPE AND TUBE RAILINGS
05530	GRATINGS
05700	ORNAMENTAL METELWORK

<u>SECTION</u>	<u>TITLE</u>
	DIVISION 7 - THERMAL AND MOISTURE PROTECTION
07270	FIRESTOPPING
07720	PREFABRICATED CURB AND EQUIPMENT SUPPORT UNITS
07811	SPRAY-APPLIED FIRE RESISTIVE MATERIALS
07920	SEALANTS
	DIVISION 8 - DOORS AND WINDOWS
08110	CUSTOM HOLLOW METAL
08306	ACCESS DOORS, FLOOR TYPE
08330	OVERHEAD COILING DOORS AND FIRE DOORS
08715	FINISH HARDWARE
	DIVISION 9 - FINISHES
09250	GYPSUM DRYWALL
09503	LAY-IN PANEL ACOUSTICAL CEILINGS
09660	RESILIENT TILE FLOORING
09910	PAINTING
	DIVISION 10 - SPECIALTIES
10210	METAL WALL LOUVERS
10270	ACCESS FLOORING
10430	ARCHITECTURAL SIGNAGE SYSTEMS
	DIVISION 14 - CONVEYING SYSTEMS
14330	BRIDGE CRANE
14331	MONORAIL CRANE
	DIVISION 15 - MECHANICAL
15313	FM200 FIRE SUPPRESSION SYSTEM
15410	PLUMBING PIPING AND APPURTENANCES
15430	PLUMBING SPECIALTIES
15440	PLUMBING FIXTURES
15491	PLUMBING INSULATION
15502	REFRIGERANT PIPING AND APPURTENANCES
15750	CONTROL ROOM AIR CONDITIONERS
15850	AIR CONDITIONG UNITS
15861	FANS

SECTION TITLE

VOLUME 2 OF 2

15890	METAL DUCTWORK AND ACCESSORIES
15891	AIR INTAKE AND RELIEF VENTS
15900	PROGRAMMABLE CONTROLLER SYSTEM
15920	RLC CONTROL PANEL AND DEVICE
15931	AIR OUTLETS AND INLETS
15939	MOTORS AND MOTOR CONTROLLERS
15940	VIBRATION ISLOATION AND CONTROL
15945	HVAC INSULATION
15973	INSTRUMENT LISTS AND I/O SCHEDULE
15992	TESTING, ADJUSTING, AND BALANCING OF AIR AND HYDRONIC SYSTEMS
	DIVISION 16 - ELECTRICAL
16000	ELECTRICAL GENERAL REQUIREMENTS
16110	RACEWAYS
16114	CABLE TRAYS
16115	UNDERGROUND CONDUIT SYSTEMS
16120	WIRES, CABLES, SPLICES, TERMINATIONS (600 VOLTS OR LESS)
16121	WIRES, CABLES, SPLICES, TERMINATIONS (MEDIUM VOLTAGE: 601 VOLTS TO 34,500 VOLTS, INCLUSIVE)
16122	CABLES, SPLICES TERMINATIONS (D.C. TRACTION POWER CABEL)
16127	CONTROL/SIGNAL TRANSMISSION MEDIA
16128	ARCPROOFING
16133	CONTROL PANELS, ENCLOSURES/CABINETS, AND TERMINAL BOXES
16135	BOXES AND FITTINGS
16140	WIRING DEVICES
16190	SUPPORTING DEVICES
16250	TRANSFER SWITCHES
16315	MEDIUM VOLTAGE LOAD INTERRUPTER SWITCHES
16316	MEDIUM VOLTAGE METAL-CLAD SWITCHGEAR
16317	MEDIUM VOLTAGE (5KV) METAL-CLAD SWITCHGEAR
16320	DRY-TYPE TRANSFORMERS - GENERAL PURPOSE -600 VOLTS OR LESS
16326	CAST COIL, DRY-TYPE TRANFORMERS (MEDIUM VOLTAGE)

<u>SECTION</u>	<u>TITLE</u>
16330	AC TO DC CONVERSION ASSEMBLIES
16335	LOW VOLTAGE SWITCHGEAR
16336	LOW VOLTAGE SWITCHBOARD
16340	DC SWITCHGEAR AND BUSDUCT
16400	ELECTRICALLY INSULATED FLOOR COATING
16450	GROUNDING
16452	ELECTRICAL BONDING
16470	PANELBOARDS
16475	OVERCURRENT PROTECTIVE DEVICES (600 VOLTS OR LESS)
16477	PROTECTIVE DEVICE COORDINATION STUDY
16510	LIGHTING SYSTEMS
16630	SUBSTATION BATTERIES AND BATTERY CHARGERS LEAD-ACID BATTERIES
16635	ENERGY STORAGE SYSTEM DEVICES
16720	FIRE ALARM SYSTEMS
16860	ELECTRIC HEATERS
16862	CEILING MOUNTED ELECTRIC HEATERS
	Exemption (4)
16996	ON-SITE TECHNICAL STAFF AND SUPPORT
16999	SUBSTATION COMMISSIONING TESTING

Schedule of Minimum Wage Rates (FED NJ)

Schedule of Minimum Wage Rates (FED NY)

Notification of M/WBE On-line Directory and Forms

Schedule A

Schedule B

Schedule C

Schedule D

Analysis of Bid

INFORMATION FOR BIDDERS

1. FORM AND SUBMISSION OF PROPOSALS

The Port Authority Trans Hudson Corporation, hereinafter called "PATH", invites Proposals in the annexed form. Proposals will be received until 2:30 P.M. on ~~Wednesday, November 30, 2011~~ ^{Thursday, December 1, 2011} ~~in the office of the Director of Procurement, Attn: Bid Custodian, Two Montgomery Street, 3rd Floor, Jersey City, New Jersey 07302~~ ^{January 17, 2012} ~~at which time they will be opened and publicly read in the Bid Room.~~ ^{February 2, 2012} Each Proposal must be contained in the envelope furnished by PATH, 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. *See Exhibit A*

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 Trans Hudson Corporation, 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.

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.

02-02-12P02:52 RCVD

C.

- 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.
See Exhibit B
- 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.
See Exhibit C

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 PATH 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 PATH 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 or United States Department of Labor-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.

- G. Detailed information in writing setting forth the affirmative action which the bidder proposes to take to ensure equal employment opportunities as required by clause A of the clause of the Form of Contract entitled "No Discrimination in Employment". This action which for the purpose of convenience is referred to as an "Affirmative Action Program", shall be in addition to the action required under clauses B through G thereof. Solely for the information of the bidder and without in any way limiting or defining the affirmative action program to be proposed by the bidder, there are available for inspection in the office of the Director, Office of Business Diversity and Civil Rights of the Port Authority of New York and New Jersey, copies of sample affirmative action programs.

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, PATH 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, PATH 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 ninety (90) days after the opening of the Proposals, PATH 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 PATH who is at present the Authority's Director of Procurement. No other act of PATH, its Directors, officers, agents, or employees shall constitute acceptance of a Proposal. Such notice will state whether or not PATH 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 PATH 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 PATH to accept a Proposal within ninety (90) days after the opening of Proposals; and no other act of PATH, its Directors, officers, agents or employees shall constitute rejection of a Proposal, including any counter offer or other act of PATH, its Directors, officers, agents or employees.

PATH 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 PATH terminates the Contract, PATH reserves the option to accept the Proposal of any other bidder within ninety (90) 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 PATH will return all certified checks deposited by bidders, except those deposited by three bidders to be selected by PATH, which will be returned within three days after one Proposal is accepted by PATH; or if a Performance and Payment Bond is required, within three days after a satisfactory Performance and Payment Bond is furnished to PATH; 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, New Jersey 07302.

AVAILABLE DOCUMENTS

Certain documents, specified below, are available for reference and examination by bidders by contacting Gary Greer at (973) 792-3934, 3 Gateway Center, 3rd Floor, Newark, NJ 07102 during regular business hours. These documents were not prepared for the purpose of providing information for bidders upon the present Contract but they were prepared for other purposes, such as for other contracts or for design purposes for this or other contracts, and they do not form a part of this Contract. PATH makes no representation or guarantee as to, and shall not be responsible for their accuracy, completeness or pertinence, and, in addition, shall not be responsible for the conclusions to be drawn therefrom. They are made available to the bidders merely for the purpose of providing them with such information as is in the possession of PATH, whether or not such information may be accurate, complete or pertinent or of any value to the bidders. Questions concerning the content of the documents shall be submitted in accordance with the clause entitled "Questions By Bidders".

Said documents are as follows:

* NOTE: For the Bidder's convenience, these documents will be transmitted with the Contract Documents

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 a combined goal of 8 percent for firms owned and controlled by minorities and firms owned and controlled by women.

In the event that the Contractor subcontracts any portion of the Work, the Contractor shall use and document every good faith effort to meet the above goals for MBE and WBE participation in the Work. 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 PATH 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 PATH 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 subcontractors in 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; contractor's 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 its MBE/WBE Participation Plan and to permit its 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 PATH 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 Contractor has not made a good faith effort to meet the MBE/WBE participation goals set forth above and that the Contractor 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 its MBE/WBE Participation Plan and in permitting its 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 it 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 its 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 its 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, PATH 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 PATH and the individuals furnishing consultant advice of all liability and responsibility in connection therewith.

PATH has compiled and made available on-line an MBE/WBE Directory which specifies the firms PATH has determined to be (1) MBEs/WBEs and (2) experienced in performing work in the trades and contract dollar ranges indicated in the Directory. PATH 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 Directory² 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 PATH to determine whether the firm is in fact an MBE/WBE and technically competent to perform portions of the Work.

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| 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 |

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.

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| <p>5. Greater Newark Business Development Consortium
744 Broad Street, 26th Floor
Newark, NJ 07102
(973) 242-5563
www.gnbdc.org</p> | <p>6. Jamaica Business Resource Center
90-33 160th Street
Jamaica, NY 11432
(718) 206-2255
Fax (718) 206-3693
www.jbrc.org</p> |
| <p>7. Council for Airport Opportunity
Newark Liberty International Airport Building 80
Newark, NJ 07014
(973) 961-4382
www.caonj.com</p> | <p>8. National Hispanic Business Group
1230 Avenue of the Americas, 7th Floor
New York, NY 10020
(212) 265-2664
www.nhbg.org</p> |
| <p>9. Greater Jamaica Development Corp.
90-04 161st Street
Jamaica, NY 11432
(718) 291-0282
Fax (718) 291-7918
www.gjdc.org</p> | <p>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</p> |
| <p>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</p> | <p>12. NY/NJ Minority Purchasing Council
330 Seventh Avenue, 8th Floor
New York, NY 10001
(212) 502-5663
www.nynjmsdc.org</p> |

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

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| <p>21. Asian Women in Business
42 Broadway, Suite 1748
New York, NY 10004
(212) 868-1368
Fax (212) 868-1373
www.awib.org</p> | <p>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</p> |
| <p>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</p> | <p>24. Orange County Chamber of Commerce
30 Scott Corners Drive
Montgomery, NY 12549
(845) 457-9700 Ext. 1101
www.orangenyc.com</p> |
| <p>25. Regional Alliance For Small Contractors
625 Eighth Avenue, 2nd Floor,
North Wing
New York, NY 10018
(212) 268-2991
www.regional-alliance.org</p> | <p>26. Women Builders Council
500 Hampton Avenue
Brooklyn, NY 11235
(212) 367-2130
www.wbcnyc.org</p> |

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 ~~Bruno Signorelli~~, at (201) 216-6523.

Mourad Rahman

10. QUESTIONS BY BIDDERS

Questions by prospective bidders concerning the Contract may be addressed to Jessamma Vatakencherry, at (212) 435-3953 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 PATH 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 PATH, its Directors, 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. PORT AUTHORITY SECURITY REQUIREMENTS

The Port Authority Trans Hudson Corporation operates facilities and systems at which terrorism or other criminal acts may have a significant impact on life safety and key infrastructures. PATH reserves the right to impose multiple layers of security requirements on the performance of the Work of the Contract, including on the Contractor, its staff and subcontractors and their staff depending upon the level of security required, as determined by PATH. The Contractor shall, and shall instruct its subcontractors, to cooperate with Authority staff in adopting security requirements. These security requirements may include, but are not limited to, the following.

See Addendum NO. 3
See Addendum NO. 4

A. Identity Checks and Background Screening:

Contractor/subcontractor identity checks and background screening shall include but shall not be limited to: (1) inspection of not less than two forms of valid and current government issued identification (at least one having an official photograph) to verify staff's name and residence; (2) screening federal, state and local criminal justice agency information databases and files; (3) screening of any terrorist identification files; (4) multi-year check of personal, employment and/or credit history; (5) access identification to include some form of biometric security methodology such as fingerprint, facial or iris scanning.

See Addendum #3
See Addendum #4

The Contractor may be required to have his staff, and any subcontractor's staff, authorize PATH or its designee to perform background checks. Such authorization shall be in a form acceptable to PATH. If the Engineer directs the Contractor to have identity checks and background screening performed by a particular firm designated by the Engineer, PATH will compensate the Contractor for the cost of such screening at the Net Cost of such screening. "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 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.

B. Issuance of Photo Identification Badges:

No person will be permitted on or about the construction site without a photo identification badge approved by the Engineer. The Contractor shall provide such badges for employees, subcontractors and materialmen. All employees of the Contractor, subcontractors and materialmen shall wear identification badges in a conspicuous and clearly visible position whenever they are working at the construction site.

If PATH requires facility-specific identification badges for the Contractor's and subcontractors' staffs, PATH will supply such identification badges at no cost to the Contractor.

C. Construction Site Access Control:

- 1.) PATH may provide for construction site access control, inspection and monitoring by Authority retained security guards. However, this provision shall not relieve the Contractor of its responsibility to secure its equipment and work at the construction site at its own expense.

See Addendum No. 3
See Addendum No. 4

- 2.) At the beginning of each work period the Contractor shall furnish to the security guards, if any, or to the Engineer a memorandum showing for that work period:

- a. The name and company affiliation of each employee of the Contractor or of a subcontractor who is expected to enter the site and,
b. The name of any firm anticipated to be delivering materials or servicing equipment that day and a description of such materials or services.

PATH may impose, increase, and/or upgrade security requirements for the Contractor, subcontractors and their staff during the duration of this Contract to address changing security conditions and/or new governmental regulations.

12. 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 PATH 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 PATH hereunder as provided in the clauses of the Form of Contract entitled "Monthly Advances" and "Final Payment" or at any other time.

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

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 PATH 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 PATH and that PATH will rely on its truth and accuracy in awarding this Contract. In the event that PATH 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, PATH 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 PATH 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.

**Mass. Electric Construction Co.
Port Authority of New York and New Jersey
Christopher Street Substation**

13. Exceptions to the Certification of No Investigation (criminal or civil anti-trust), Indictment, Conviction, Debarment, Suspension, Disqualification, Prequalification Denial or Termination, etc; Disclosure of Other Required Information

(e) The Bidder, Mass. Electric Construction Co. ("MEC") has never used a name other than that inserted in the Proposal. MEC's parent, Kiewit Infrastructure Co. was formerly known as Kiewit Construction Company.

The following relates to MEC's affiliates:

Present Name	Former Name
Kiewit Infrastructure Co., Parent	Kiewit Construction Company
Kiewit Constructors Inc.	Grow Tunneling Corp.
Jett Industries, Inc.	KiewitJett Industries, Inc.
C&F Fabricators and Erectors, Inc.	KiewitC&F Fabricators and Erectors, Inc.

(i) (1) Mass. Electric Construction Co. ("MEC") was a partner with Balfour Beatty Construction, Inc. in BBC-MEC, Joint Venture (the "Joint Venture"), with Balfour Beatty Construction, Inc. acting as the managing partner of the Joint Venture. The Joint Venture and the National Passenger Railroad Corporation ("Amtrak") were parties to a construction contract pursuant to which the Joint Venture contracted to electrify a high speed rail line from New Haven, Connecticut to Boston, Massachusetts. The Joint Venture and its joint venture partners received letters, dated August 7, 2003, from the U.S. Department of Justice and the United States Attorney for the District of Connecticut ("DOJ"), notifying them that each was a target of a criminal investigation in connection with the contract. The letters specified potential violations of various federal statutes based on allegations of misconduct in connection with a portion of the work, and invited the Joint Venture to meet with the DOJ. The parties thereafter met to discuss the issues, with the Joint Venture providing additional information to the DOJ. The DOJ subsequently notified the Joint Venture and its two joint venture partners in July 2004, that it had reached a decision not to pursue criminal charges.

(2) MEC made a voluntary reporting on June 23, 2005, after it discovered a limited number of billings may have included vacation time for certain craft employees and that certain apprentice labor had been billed at journeyman rates. The billings had been submitted for Time and Material work performed by MEC as a subcontractor on the I-93 Tunnel Finishes Project (Contract C17AA) associated with the Central Artery/Tunnel project in Boston. As a result of its reporting, MEC was notified on June 28, 2005, that the U.S. DOT and U.S. DOL would be conducting their own

investigations. The U.S. Attorney notified MEC, by letter dated November 8, 2006, that it would not be seeking an indictment. In June 2009 the U.S. Attorney's office contacted MEC to discuss the return of MEC documents. Due to this inquiry, the passage of time and lack of activity by the government, it is reasonably assumed that the investigations are now concluded.

(3) In May of 1989, MEC's parent, Kiewit Infrastructure Co., under its former name of Kiewit Construction Company ("Kiewit") and two of Kiewit's affiliates, (the "Companies") were served with grand jury subpoenas requesting documents seeking information to determine if the Companies' practices with regard to contracts with Disadvantaged Business Enterprises in Seattle were in violation of the False Claims Act. In 1991 the Companies received confirmation by the Assistant U. S. Attorney for the Western District of Washington, that the grand jury expired without bring charges. Three years later, the Government filed a civil suit which was settled in late 1995 without any admission of wrongdoing.

(4) Kiewit was a member of the joint venture of J. F. Shea Co., Inc., Kiewit Construction Company (now known as Kiewit Infrastructure Co.), and Kenny Construction Company (Shea being the managing partner) when it was investigated by the U. S. Attorney – Los Angeles, regarding a contract with the Los Angeles County Metropolitan Transportation Authority for the Red Line Rail Transit Project. The investigation appeared to be centered on whether the use of certain construction materials was in strict compliance with the specifications. The joint venture was notified in December of 1997 that the investigation was completed; no charges were brought.

(5) Mass. Electric Construction Co. is providing this information with respect to a matter involving a joint venture in which its direct affiliate, Kiewit Constructors Inc., is a partner.

In July 2007, the New York City Department of Transportation awarded the Willis Avenue Bridge Project to Kiewit Constructors Inc./Weeks Marine, Inc., A Joint Venture (K/W), a joint venture consisting of partners Kiewit Constructors Inc. and Weeks Marine, Inc., two separate companies. Subsequently, K/W awarded a material purchase agreement to Global Marine Construction Supply ("GMCS") to provide steel piles, casings and other materials to the project. GMCS is a disadvantaged business enterprise then certified by the New York State Department of Transportation to supply the specific materials that K/W contracted with it to provide.

On March 4, 2010, the United States Attorney for the Southern District of New York served a subpoena upon K/W that requested K/W produce certain documents in K/W's possession relating to GMCS pursuant to an investigation of GMCS. K/W immediately complied. K/W continues to cooperate fully with the United States Attorney in its investigation of GMCS.

On September 20, 2010, an Assistant United States Attorney for the Southern District of New York verbally informed K/W that it was a subject in an investigation by the United States Department of Justice and the United States Department of Transportation relating to the investigation of GMCS. The Assistant United States

Attorney specifically informed K/W that neither Kiewit Constructors Inc. nor Weeks Marine, Inc. individually were subjects of any investigation.

The investigation appears to relate to whether GMCS performed its work as a regular dealer supplier or a broker under the federal regulations. At the time K/W entered into the contract with GMCS, GMCS was certified as a disadvantaged business enterprise supplier by the New York State Department of Transportation for the materials within its contract scope. K/W continues to cooperate with the Government during its investigation. K/W met with the Assistant United States Attorney and US DOT investigators twice in late 2010 and provided numerous documents. Counsel for K/W spoke with the Assistant United States Attorney in April 2011. The Assistant United States Attorney then informed K/W's counsel that there was nothing new to report about the investigation but he would contact K/W if necessary. Presently, K/W is not requested to take any additional action or provide any additional information or assistance to the Government related to this matter. If new events arise, we will update this response.



Gregory A. Hill, Senior Vice-President

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.

**14. 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 PATH 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 PATH and that PATH will rely on its truth and accuracy in awarding this Contract. In the event that PATH 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, PATH 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 the 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 PATH 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.

15. 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 PATH 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.

16. APPRENTICESHIP PROGRAMS

The Authority is a participant in both the Edward J. Malloy Construction Initiative for Construction Skills and Construction Careers, cooperative programs among schools, union and public agencies in New York and New Jersey respectively. The Edward J. Malloy Construction Initiative for Construction Skills and Construction Careers create career opportunities in the construction industry for high school graduates by providing systematic pathways 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 programs approved by the New York State Department of Labor or United States 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 either a New York State-registered or United States Department of Labor-registered apprenticeship program.

17. CERTIFICATION OF PARTICIPATION IN A STATE-REGISTERED OR UNITED STATES DEPARTMENT OF LABOR-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 either the New York State Department of Labor or the United States 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 United States Department of Labor or (b) individually sponsors an apprenticeship program registered by the New York State Department of Labor or United States 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.).

PROPOSAL

To The Port Authority Trans Hudson Corporation:

The undersigned³ *MASS. Electric Construction Co. a corporation organized under the laws of the State of Delaware.*

(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 price inserted by the undersigned in the clause of the Form of Contract entitled "General Agreement".

This offer shall be irrevocable for ninety (90) days after the date on which The Port Authority Trans Hudson Corporation 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 PATH 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 PATH, its Directors, 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 PATH without liability of any kind except as may arise under letters patent of the undersigned, if any.

02-02-12P02:48 RCVD

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 office⁴:

MASS. Electric Construction Co.
470 Chestnut Ridge Road 1st Fl.
Woodcliff Lake NJ 07677

The telephone number of the bidder is:

201-571-2613

The fax number of the bidder is:

201-930-4930

The E-Mail address of the bidder is:

rrothey@masselectric.com
Chief Estimator

02-02-12P02:48 RCVD

⁴ Insert office address.

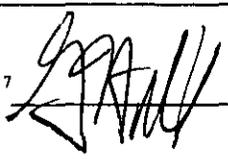
SIGNATURE AND CERTIFICATE OF AUTHORITY⁵

Dated, November 30, 2011

(Signature of individual or name of corporation or partnership)

MASS. Electric Construction Co.

(Signature of agent, partner or corporate officer)

By^{6,7} 

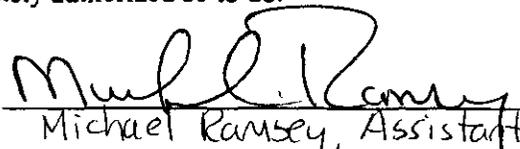
(Acknowledgment of signature to be taken on proper form on following page(s))

Gregory A. Hill, Senior Vice-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)


Michael Ramsey, Assistant Secretary

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.).

STATEMENT ACCOMPANYING PROPOSAL⁹

Names and Residences of Officers, If Bidder is a Corporation

Name	Title	Residence ¹⁰
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See ~~Exhibit~~ A ATT.

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 Individual¹²

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.

Mass. Electric Construction Co.

RESIDENTIAL ADDRESSES

OFFICERS

<u>Officer Title</u>	<u>Officer Name</u>
PRESIDENT	ALFREDO E. SORI
SENIOR VICE PRESIDENT	JOSEPH A. FORSYTHE
SENIOR VICE PRESIDENT	GREGORY A. HILL
VICE PRESIDENT	STEPHEN P. ALLEN
VICE PRESIDENT	FREDERICK A. HAMMEL, JR.
VICE PRESIDENT	JACK E. ORAM, JR.
VICE PRESIDENT	MICHAEL J. PIECHOSKI
VICE PRESIDENT	PHILLIP B. REYNOLDS
VICE PRESIDENT	ROHIT SHARDA
VICE PRESIDENT	PHILIP F. SHEPLEY
VICE PRESIDENT	THOMAS R. WALTNER
CONTROLLER	MICHAEL J. WHETSTINE
ASSISTANT CONTROLLER	JEAN DULMAINE
ASSISTANT CONTROLLER	TIMOTHY S. RILEY
TREASURER	STEPHEN S. THOMAS
SECRETARY	MICHAEL F. NORTON
ASSISTANT SECRETARY	KURT W. CARLSON
ASSISTANT SECRETARY	JASON D. CLARKE
ASSISTANT SECRETARY	RICHARD FEDERICO
ASSISTANT SECRETARY	CRAIG B. HOLLINGWORTH
ASSISTANT SECRETARY	MICHAEL A. IANNITTI
ASSISTANT SECRETARY	DEAN J. KAMPSCHNEIDER
ASSISTANT SECRETARY	WILLIAM A. NORDBERG
ASSISTANT SECRETARY	JAMES M. O'HARA

Exemption (1)

DIRECTORS

Director Name

SCOTT L CASSELS

Exemption (1)

A Delaware, USA Corporation
Organized 5/31/2002

ALL INFORMATION CONTAINED ON THIS REPORT SHOULD BE TREATED AS CONFIDENTIAL UNLESS SPECIFICALLY STATED OTHERWISE

ACKNOWLEDGMENT⁸

ACKNOWLEDGMENT OF BIDDER, IF A CORPORATION

State of New Jersey

SS:

County of Bergen

On this 30th day of Nov, 2011, before me personally came and appeared Gregory A. Hill, to me known, who, being by me duly sworn, did depose and say that he resides at _____

Exemption (1) _____ 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)

Donna A. Carpentier

(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)

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)

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

02-02-12P02:48 RCVD

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned¹³

Mass. Electric Construction Co., a corporation organized under the laws of Delaware
as principal(s); and¹⁴ Travelers Casualty and Surety Company of America

as surety are hereby held and firmly bound unto The Port Authority Trans Hudson Corporation (herein called "PATH") in the penal sum of Three Million Five Hundred Thousand Dollars (\$3,500,000), 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 16th day of December, 2011

The condition of the above obligation is such that whereas the above named principal(s) has submitted to PATH 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 PAT-624.154, "PATH - Replacement and Upgrade of Christopher Street Substation", now therefore:

- A. If said Proposal shall not be accepted, or
- B. If said Proposal shall be accepted and PATH does not require the principal(s) to furnish a Performance and Payment Bond, or
- C. If said Proposal shall be accepted and PATH requires the principal(s) to furnish a Performance and Payment Bond and either the principal(s) furnishes a Performance and Payment Bond satisfactory to PATH in accordance with the requirements of said Proposal or PATH 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.

02-02-12 P02:47 RCVD

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 PATH may receive or accept such Proposal or within which the principal(s) may furnish a Performance and Payment Bond or by any waiver by PATH 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.

Mass. Electric Construction Co.

Principal ¹⁵

(Seal)

By¹⁶



Gregory A. Hill, Senior Vice-President

Travelers Casualty and Surety Company of America

Surety

(Seal)

By¹⁷



Christina M. Harden, Attorney-in-Fact

02-02-12 P02:52 RCVD

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.

ACKNOWLEDGMENT¹⁸

ACKNOWLEDGMENT OF BIDDER, IF A CORPORATION

State of New Jersey

SS:

County of Bergen

On this 30th day of NOV, 2011, before me personally came and appeared Gregory A Hill, to me known, who, being by me duly sworn, did depose and say that he resides at [Exemption (1)] that he is the Senior Vice-President of MASS Electric Construction Co., 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)

Donna A. Carpenter
(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)

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)

AFFIX ACKNOWLEDGMENT AND JUSTIFICATION OF SURETY

¹⁸ 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.

02-02-12 P02:53 RCVD

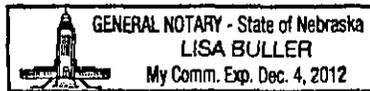
STATE OF NEBRASKA
COUNTY OF DOUGLAS

I, Lisa Buller a Notary Public in and for said County and State,
do hereby certify that

Christina M. Harnden Attorney-in-Fact
of Travelers Casualty and Surety Company of America, proved to me on the basis of
satisfactory evidence to be the person(s) who appeared before me, and
acknowledged that she signed, sealed and delivered a said instrument, for and on
behalf of Travelers Casualty and Surety Company of America for the uses and
purposes therein set forth.

Given under my hand and notarial seal, the 16th day of

December A.D., 20 11.




Lisa Buller, Notary Public



POWER OF ATTORNEY

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

Attorney-In Fact No. 221586

Certificate No. 003814122

KNOW ALL MEN BY THESE PRESENTS: That St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company and St. Paul Mercury Insurance Company are corporations duly organized under the laws of the State of Minnesota...

Philip G. Dehn, Terry K. Bartel, Tammy Pike, Paul A. Foss, Lisa Buller, Marie Huggins, and Christina M. Harnden

of the City of Omaha, State of Nebraska, their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above...

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed and their corporate seals to be hereto affixed, this 15th day of December, 2009.

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company



State of Connecticut
City of Hartford ss.

By: [Signature]
George W. Thompson, Senior Vice President

On this the 15th day of December, 2009, before me personally appeared George W. Thompson, who acknowledged himself to be the Senior Vice President of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company...

In Witness Whereof, I hereunto set my hand and official seal.
My Commission expires the 30th day of June, 2011.



[Signature]
Marie C. Tetreault, Notary Public

PA 2009-2011-20-20

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice 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 Resident Vice Presidents, Resident 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 on the Company in the future with respect to any bond or understanding to which it is attached.

I, Kori M. Johanson, the undersigned, Assistant Secretary, of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Companies this 16th day of December, 20 11

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

Kori M. Johanson
Kori M. Johanson, Assistant Secretary



To verify the authenticity of this Power of Attorney, call 1-800-421-3880 or contact us at www.travelersbond.com. Please refer to the Attorney-In-Fact number, the above-named individuals and the details of the bond to which the power is attached.

TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA

HARTFORD, CONNECTICUT 06183

FINANCIAL STATEMENT AS OF DECEMBER 31, 2009

CAPITAL STOCK \$ 6,480,000

ASSETS		LIABILITIES & SURPLUS	
CASH & INVESTED CASH	\$ 91,852,774	UNEARNED PREMIUMS	\$ 838,517,654
BONDS	3,873,398,648	LOSSES	898,279,087
INVESTMENT INCOME DUE AND ACCRUED	81,425,446	LOSS ADJUSTMENT EXPENSES	381,684,338
PREMIUM BALANCES	183,601,016	COMMISSIONS	34,630,568
NET DEFERRED TAX ASSET	72,285,733	TAXES, LICENSES AND FEES	59,474,472
REINSURANCE RECOVERABLE	4,839,080	OTHER EXPENSES	31,738,727
REINSURANCE RECEIVABLE INTERCOMPANY	247,774,261	FUNDS HELD UNDER REINSURANCE TREATIES	101,203,708
OTHER ASSETS	6,728,714	CURRENT FEDERAL AND FOREIGN INCOME TAXES	6,951,413
		REMITTANCES AND ITEMS NOT ALLOCATED	49,206,888
		AMOUNTS WITHHELD / RETAINED BY COMPANY FOR OTHERS	47,770,209
		RETROACTIVE REINSURANCE RESERVE	3,174,788
		POLICYHOLDER DIVIDENDS	8,825,121
		PROVISION FOR REINSURANCE	7,950,503
		CEDED REINSURANCE NET PREMIUMS PAYABLE	(47,812,192)
		PAYABLE TO PARENT, SUBSIDIARIES AND AFFILIATES	60,758,201
		OTHER ACCRUED EXPENSES AND LIABILITIES	1,322,881
		TOTAL LIABILITIES	\$ 2,484,857,039
		CAPITAL STOCK	\$ 6,480,000
		PAID IN SURPLUS	433,603,760
		OTHER SURPLUS	1,398,664,801
		TOTAL SURPLUS TO POLICYHOLDERS	\$ 1,838,648,881
TOTAL ASSETS	\$ 4,331,795,701	TOTAL LIABILITIES & SURPLUS	\$ 4,331,795,701

STATE OF CONNECTICUT)
 COUNTY OF HARTFORD)SS.
 CITY OF HARTFORD)

MICHAEL J. DOODY, BEING DULY SWORN, SAYS THAT HE IS SECOND VICE PRESIDENT, OF TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA, AND THAT TO THE BEST OF HIS KNOWLEDGE AND BELIEF, THE FOREGOING IS A TRUE AND CORRECT STATEMENT OF THE FINANCIAL CONDITION OF SAID COMPANY AS OF THE 31st DAY OF DECEMBER, 2009.



SUBSCRIBED AND SWORN TO BEFORE ME THIS 19th DAY OF APRIL, 2010

Michael J. Doody
 SECOND VICE PRESIDENT

 NOTARY PUBLIC - MY COMMISSION EXPIRES 11/30/2012

CERTIFICATE OF SOLVENCY UNDER SECTION 1111 OF THE NEW YORK
INSURANCE LAW

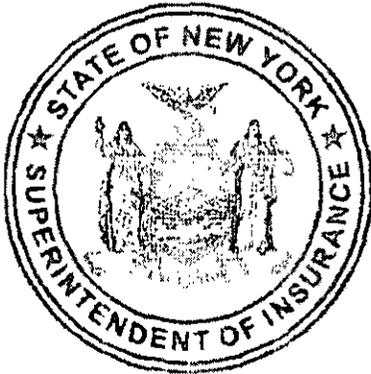
STATE OF NEW YORK
INSURANCE DEPARTMENT

It is hereby certified that

Travelers Casualty and Surety Company of America
Of Hartford, Connecticut

a corporation organized under the laws of the State of Connecticut and duly authorized to transact the business of insurance in this State, is qualified to become surety or guarantor on all bonds, undertakings, recognizances, guaranties and other obligations required or permitted by law; and that the said corporation is possessed of a capital and surplus including gross paid-in and contributed surplus and unassigned funds (surplus) aggregating the sum of \$1,906,290,907 (Capital \$6,480,000) as is shown by its sworn financial statement for the quarter ended March 31, 2010 on file in this Department, prior to audit.

The said corporation cannot lawfully expose itself to loss on any one risk or hazard to an amount exceeding 10% of its surplus to policyholders, unless it shall be protected in excess of that amount in the manner provided in Section 4118 of the Insurance Law of this State.



In Witness Whereof, I have here-
unto set my hand and affixed the
official seal of this Department
at the City of Albany, this 14th
day of June, 2010.

James J. Wrynn
Superintendent of Insurance

By *Clark J. Williams*

Clark J. Williams
Special Deputy Superintendent

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, PATH'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 the Christopher Street Substation at the PATH Christopher Street Station and the vicinity thereof in Manhattan, New York and Caisson #1 Substation 15 and the Washington Street Substation 2 and the vicinity thereof in the State of New Jersey..

"Work" shall mean all structures, equipment, plant, labor, materials (including materials and equipment, if any, furnished by PATH) and other facilities and all other things necessary or proper for or incidental to performing removal, furnishing and installation of electrical equipment, associated electronics, wiring and conduit; excavation, pavement removal and restoration, asbestos abatement, architectural, mechanical, plumbing and related Work at the Christopher Street Substation No. 1 at the PATH Christopher Street Station and the vicinity thereof in Manhattan, New York and Caisson #1 Substation 15 and the Washington Street Substation 2 and the vicinity thereof in the State of New Jersey; 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).~~ *Per Addendum 7*

"Equipment" and "plant" shall include construction equipment and plant rented as agent for the Authority.

"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" which is in addition to that required by the Contract Drawings and Specifications in their present form.

"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.

"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 PATH) to be constructed, installed or left by the Contractor at or about the construction site (or elsewhere in the possession of PATH) 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.

"Lump Sum" shall mean the amount stipulated in the clause hereof entitled "General Agreement".

"Notice" shall mean a written notice.

Addendum No. 7

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.

"Authority" or "Port Authority" shall mean The Port Authority of New York and New Jersey which is acting as agent for PATH for the purposes of this Contract.

19. GENERAL AGREEMENT

The Contractor agrees to perform removal, furnishing and installation of electrical equipment, associated electronics, wiring and conduit; excavation, pavement removal and restoration, asbestos abatement, architectural, mechanical, plumbing and related Work at the Christopher Street Substation at the PATH Christopher Street Station and the vicinity thereof in Manhattan, New York and Caisson #1 Substation 15 and the Washington Street Substation 2 and the vicinity thereof in the State of New Jersey 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 furnishing of equipment and plant, however, shall be subject to the provisions of the clause hereof entitled "Agency for Rental of Construction Equipment".

21. AGENCY FOR RENTAL OF CONSTRUCTION EQUIPMENT

With respect to the performance of Work in the State of New York:

A. General Provisions

The Contractor further agrees to act as the agent of PATH, subject to the provisions of this numbered clause relating to such agency for the rental of all construction equipment necessary or desirable for or incidental to the performance of the Contract (other than construction equipment owned and also used by the Contractor or owned and also used by any subcontractor) and, in the exercise of such agency, to assume all the obligations and duties imposed upon him by this Contract. The Contractor may authorize any subcontractor to act as his subagent for rental of such equipment for use by such subcontractor, subject to all the provisions of this Contract. "Construction equipment" as used in this numbered clause shall include plant.

PATH will pay the rental charges for said equipment directly to the lessors thereof, but the charges so paid shall be deducted from the compensation payable to the Contractor under the Contract; provided, however, that PATH will pay such charges, and the Contractor is authorized by PATH to act as such agent, to the extent only that the charges payable for such rental do not exceed the compensation payable to the Contractor under the Contract; and provided further that the Contractor performs all the obligations relating to said agency imposed upon him by this Contract.

PATH will provide the Contractor with a statement to be furnished by him and the subcontractors to such lessors which will identify this Contract as the one under which the Contractor is authorized to rent said equipment and which will identify the site to which delivery must be made. The Contractor shall arrange for delivery of said equipment directly to the construction site. Payment of the rental charges therefore shall be made by PATH on the basis of invoices made out to PATH in which is contained the place of delivery and on which the Contractor has certified by endorsement that such construction equipment is being or has been used in the performance of the Contract, said invoices to be submitted through the Contractor to PATH at the time said equipment is put into use at the construction site. In the event said invoices are not submitted promptly, at the time stated above, but are submitted at a time when, by reason of prior advances and payments to the Contractor or for his account, the amounts still payable to the Contractor in connection with the Contract are insufficient to pay said invoices, then PATH shall not be liable to the lessors for any amounts in excess of said amounts still payable to the Contractor which remain in the possession of PATH.

Notwithstanding the above agency arrangement, PATH shall not be liable to lessors of construction equipment for any amounts except rental charges based on time of use of such equipment, and the Contractor's agency is limited accordingly. All obligations incurred by the Contractor or subcontractors for any other expenses, including repairs and damages for breach of the rental agreement, shall be obligations incurred by the Contractor or subcontractors as principal not as agent of PATH. Moreover, as between PATH and the Contractor, the Contractor shall be responsible for all amounts due to lessors of construction equipment notwithstanding the above agency arrangement.

The Contractor shall indemnify PATH against any claim of any kind whatsoever made against PATH 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.

The agency provided for under this numbered clause shall not relieve the Contractor of any of his duties and obligations elsewhere provided for under this Contract.

B. Option Not to Act as Agent

Notwithstanding the provisions of A above, the Contractor shall have the right to elect not to act as the agent of PATH for the rental of any particular item or items of said construction equipment, in which event, with regard to any such rentals by the Contractor as principal and not agent, the provisions of A of this numbered clause shall be inapplicable as well as those provisions of the clause of the Form of Contract entitled "Exemption From New York State and New York City Sales Taxes", which relate to rental of construction equipment.

22. EXEMPTION FROM NEW JERSEY STATE SALES TAXES

With respect to the performance of Work in the State of New Jersey, the attention of the Contractor is directed to the following provision of the New Jersey State Sales and Use Tax Act:

Receipts from sales made to contractors or repairmen of materials, supplies or services for exclusive use in erecting structures or building on, or otherwise improving, altering or repairing real property of:

(a) organizations described in subsections (a) and (b) of section 9 of the "Sales and Use Tax Act," P.L. 1966, c.30 (C. 54:32B-9);

*** are exempt from the tax imposed under the "Sales and Use Tax Act," provided any person seeking to qualify for the exemption shall do so pursuant to such rules and regulations and upon forms as shall be prescribed by the director. N.J.S.A. 54:32B-8:22.

PATH is an exempt organization of the type described in subsection (a) of section 9 of the act.

In view of the foregoing, the Contractor should not include in his price(s) any amounts for New Jersey State sales and use taxes on such materials, supplies and services.²⁰

If (i) any claim is made against the Contractor by the State of New Jersey for such sales or compensating use taxes, 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 Jersey for such sales or compensating use taxes, then the Authority will reimburse the Contractor in an amount equal to the amount of such tax required to be paid in accordance with the requirements of law, provided that:

- A. the Contractor, or the Contractor and any such subcontractor, as the case may be, have complied with such rules and regulations as may have been promulgated relating to the claiming of the exemption from such taxes and have filed all the forms and certificates required by the applicable laws, rules and regulations in connection therewith; and
- B. PATH is afforded the opportunity before any payment of tax is made, to contest said claim in the manner and to the extent that PATH may choose and to settle or satisfy said claim, and such attorney as PATH may designate is authorized to act for the purpose of contesting, settling and satisfying said claim; and

²⁰ Note regarding equipment rentals: The attention of the Contractor is directed to the fact that the New Jersey State Sales Tax Bureau has ruled that the "rental of equipment is taxable whether or not the job is performed for an exempt organization." Therefore in the case of equipment rentals, if any, the Contractor should include in his prices an amount for taxes thereon.

- C. the Contractor, or the Contractor and any such subcontractor, as the case may be, give immediate notice to PATH of any such claim, cooperate with PATH and its designated attorney in contesting said claim and furnish promptly to PATH 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. EXEMPTION FROM NEW YORK STATE AND NEW YORK CITY SALES TAXES

With respect to the performance of Work in the State of New York:

A. **Materials Incorporated in Permanent Construction**

The attention of the Contractor is directed to the following provision of the New York State and New York City Sales and Compensating Use Tax Act:

"#1115. Exemptions from sales and use taxes. (a) Receipts from the following shall be exempt from the tax on retail sales imposed under subdivision (a) of section eleven hundred five and the compensating use tax imposed under section eleven hundred ten:

(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."

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

In view of the foregoing, the Contractor should not include in his price(s) any amounts for New York State and New York City sales and compensating use taxes on such tangible personal property.

If (i) any claim is made against the Contractor by the State of New York or City of New York for such sales or compensating use taxes, 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 or compensating use taxes, then PATH will reimburse the Contractor in an amount equal to the amount of such tax required to be paid in accordance with the requirements of law, provided that:

- 1.) the Contractor, or the Contractor and any such subcontractor, as the case may be, have complied with such rules and regulations as may have been promulgated relating to the claiming of the exemption from such taxes and have filed all the forms and certificates required by the applicable laws, rules and regulations in connection therewith;

- 2.) and PATH is afforded the opportunity before any payment of tax is made, to contest said claim in the manner and to the extent that PATH may choose and to settle or satisfy said claim and such attorney as PATH may designate is authorized to act for the purpose of contesting, settling and satisfying said claim; and
- 3.) the Contractor, or the Contractor and any such subcontractor, as the case may be, give immediate notice to PATH of any such claim, cooperate with PATH and its designated attorney in contesting said claim and furnish promptly to PATH 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 PATH elects to contest any such claim, it will bear the expense of such contest.

B. Rental of Construction Equipment

The rental by the Contractor or subcontractor of construction equipment not owned by the Contractor or subcontractors for use in the performance of the Contract will also not be subject to New York State or New York City sales or compensating use taxes, provided that:

- 1.) the Contractor's and any subcontractor's use of construction equipment rented from others, and any agreement for such rental, is based upon the agency arrangement provided for in the clause hereof entitled "Agency for Rental of Construction Equipment" and the Contractor and subcontractors have performed all their obligations under said clause;
- 2.) delivery of said equipment is to the construction site;
- 3.) the Contractor or subcontractor has furnished to the lessor the statement from PATH identifying this Contract as the one under which the Contractor or subcontractor has been authorized to rent said equipment and identifying the construction site to which delivery must be made;
- 4.) the invoice for said equipment is made out to PATH and prescribes the place of delivery; and
- 5.) the amounts payable for rental of said equipment do not exceed the amount of compensation payable in connection with the Work.

In view of the above, the Contractor should not include in his price(s) any amounts for New York State and New York City sales and compensating use taxes on such rentals of equipment.

If (i) any claim is made against the Contractor by the State or City of New York for sales or compensating use taxes on such rental of construction equipment or (ii) any claim is made against the Contractor by a materialman, lessor or a subcontractor on account of a claim against such materialman, lessor or subcontractor by the State or City of New York for sales or compensating use taxes on rental of said equipment, then PATH will reimburse the Contractor in an amount equal to the amount of such tax required to be paid in accordance with the requirements of law, provided that the provisos listed above in this numbered clause as A.1 through A.3 and B.1 through B.5 are complied with.

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

24,660,000

PATH agrees to pay to the Contractor and the Contractor agrees to accept from PATH, in full consideration for the performance by the Contractor of his duties and obligations under this Contract and the whole thereof, a compensation of:

TWENTY Four Million Six HUNDRED SIXTY THOUSAND Dollars
00/100 Cents
(\$ 24,660,000.00)¹⁹

(throughout this Contract called the "Lump Sum"), and such compensation only, subject only to the express provisions of this Contract specifically setting forth actual, defined additions to or deductions from such compensation.

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 PATH, or 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. PATH ACCESS TO RECORDS

PATH 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 PATH 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 PATH; 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 PATH 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 PATH has notified the Contractor in writing of a pending claim by PATH 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 PATH, 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 PATH a right of access to records and documents is intended to impair or affect any right of access to records and documents which PATH would have in the absence of such provision.

Appendix 10.7

"Exemption From New Jersey Sales and Use Taxes"

¹⁹ For sales tax exemptions, see clauses entitled "~~Exemptions from New Jersey State Sales Taxes~~" and "Exemptions from New York State and New York City Sales Taxes".

21. RENTAL OF CONSTRUCTION EQUIPMENT

The rental of construction equipment shall be subject to all applicable New York sales and use taxes notwithstanding PATH'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 PATH against any claim of any kind whatsoever made against PATH 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 JERSEY SALES AND USE TAXES

With respect to performance of Work in the State of New Jersey:

The tax laws of the State of New Jersey (New Jersey Sales and Tax Act, P.L. 1966, c. 30 (§54:32B et seq.)) exempt from New Jersey sales and use taxes "[r]eceipts from sales made to contractors or repairmen of materials, supplies, or services for exclusive use in erecting structures or building on, or otherwise improving, altering or repairing real property of...[o]rganizations described in subsections (a) and (b) of section 9 of the "Sales and Use Tax Act"... that are exempt from the tax imposed [thereunder]."²⁰ In order to qualify for this exemption, the Contractor shall comply with the rules and regulations prescribed by the State of New Jersey Division of Taxation. The attention of the Contractor is directed to Form ST-13, Contractor's Exempt Purchase of Certificate, available on the State of New Jersey Division of Taxation's website: www.state.nj.us/treasury/.

PATH is an organization of the type described in subsection (a)(1) of section 9 of the Sales and Use Tax Act.^{20A}

In view of the foregoing, the Contractor shall not include in his price(s) any amounts for sales and use taxes on materials, supplies, or services for use in the performance of improvements, alterations, or repairs at the construction site. However, receipts for the rental of equipment to be used for the performance of such Work at the construction site may be subject to sales and use taxes, and therefore, the Contractor should include in his price(s) any amounts for sales and use taxes on rental of equipment.

If (i) any claim is made against the Contractor by the State of New Jersey for such sales or compensating use taxes, 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 Jersey for such sales or compensating use taxes, then PATH will reimburse the Contractor in an amount equal to the amount of such tax required to be paid in accordance with the requirements of law, provided that:

- A. the Contractor and any subcontractor, has or have complied with the rules and regulations of the State of New Jersey Division of Taxation relating to the procedure by which the tax exemption may be claimed, and has or have filed all the forms and certificates required by applicable laws, rules and regulations in connection with such exemption; and
- B. PATH is afforded the opportunity before any payment of tax is made, to contest said claim in the manner and to the extent that PATH may choose and to settle or satisfy said claim, and such attorney as PATH may designate is authorized to act for the purpose of contesting, settling and satisfying said claim; and

²⁰ N.J.S.A. 54:32B-8.22.

^{20A} N.J.S.A. 54:32B-9.

- C. the Contractor and any subcontractor, has given immediate notice to PATH of any such claim, has or have cooperated with PATH and its designated attorney in contesting said claim, and has or have furnished promptly to PATH 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 PATH elects to contest any such claim, it will bear the expense of such contest.

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

With respect to performance of Work in the State of New York:

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."

PATH 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 PATH 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.) PATH is afforded the opportunity before any payment of tax is made, to contest said claim in the manner and to the extent that PATH may choose and to settle or satisfy said claim and such attorney as PATH 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 PATH of any such claim, cooperate with PATH and its designated attorney in contesting said claim and furnish promptly to PATH 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 PATH elects to contest any such claim, it will bear the expense of such contest.

PAGE NOT USED

24. PERFORMANCE AND PAYMENT BOND

If PATH 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 Lump Sum and such bond shall be signed by one or more sureties²¹ satisfactory to PATH. 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, PATH may give notice to one or more bidders to advise PATH as to the names of their proposed sureties. Within forty-eight hours thereafter each bidder so notified shall so advise PATH. 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 PATH not to require a bond.

If PATH elects to require the Contractor to furnish a bond, he shall deliver such bond to PATH 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 PATH 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 PATH.

PATH 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.

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 PATH 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 PATH. Inasmuch as the damages to PATH 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 Lump Sum 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 PATH; and
- C. The sum of \$500 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.

²¹ 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 PATH 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 recovery of the damages above specified, PATH 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 PATH under this numbered clause, PATH 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, PATH shall pay to the Contractor by check the amount provided in this numbered clause.

If at any time PATH shall be or become dissatisfied with any surety or sureties then upon any bond furnished in accordance with the requirements of PATH, or if for any other reason such bond shall cease to be adequate security to PATH, the Contractor shall, within five days after notice from PATH 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 PATH to constitute adequate security.

CHAPTER II

ADJUSTMENTS AND PAYMENTS

25. ADJUSTMENTS OF LUMP SUM

If any 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 PATH 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) premiums, if any, actually paid by the employer for Workers' Compensation Insurance upon the basis of such wages, (b) vacation allowances and union dues and assessments which the employer actually pays pursuant to contractual obligation upon the basis of such wages, and (c) 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 PATH 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
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- 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 rates and amounts of Workers' Compensation Insurance premiums, if any, and 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 PATH under this numbered clause; and accordingly, they shall constitute a condition precedent to such payment and the failure of the Contractor 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 PATH. The Engineer will notify the Contractor that an audit review will be conducted no later than 90 days from the dates 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 PATH. If the Contractor disagrees in whole or in part with the audit findings, the Contractor shall notify PATH of such disagreement in writing within 30 days of receipt of said audit findings or PATH 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 Specifications entitled "PATH 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) the premiums actually paid by the employer for Workers' Compensation Insurance, if any, upon the basis of such salaries and wages, (b) taxes actually paid by the employer pursuant to law upon the basis of such salaries and wages, and (c) 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 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 PATH the approximate amount of Work performed and compensation earned by the Contractor up to that time showing separately:

- A. The amount of 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 Work performed (other than Extra Work) bears to the Work performed and to be performed (other than Extra Work).
- B. 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, PATH shall, within fifteen days after the receipt of each such monthly certificate, advance to the Contractor by check the sums so certified, minus, however, five per cent (5%) of the sum certified pursuant to subparagraph A of this numbered clause, and ~~minus all prior advances and payments to the Contractor or for his account and minus payments by PATH to lessors of construction equipment~~ *and minus all prior advances and payments to the Contractor or for his account.*

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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, PATH 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 PATH 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 PATH 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 PATH 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 PATH and to the Contractor the total compensation earned by the Contractor.

See the Form of Contract clause entitled "Certificate of Final Completion" which requires as a prerequisite for the issuance of such certificate the submission of a "Summary of Asbestos Removal and Disposal Costs".

If so required, the Contractor shall thereupon (i) certify to PATH 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 PATH 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), PATH 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 PATH 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 PATH 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 PATH 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 PATH and the Contractor (including his obligation to PATH 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 PATH) or (2) any claim (just or unjust) which arises out of or in connection with this Contract or any other agreement between PATH and the Contractor is made against PATH or (3) any subcontractor under this Contract or any other agreement between PATH 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 PATH and the Contractor or if in the opinion of the Chief Engineer any of the aforesaid contingencies is likely to arise, then PATH 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 PATH 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 PATH does not intend to exercise its right with respect to such contingency. Neither the above provisions for rights of PATH to withhold and apply monies nor any exercise or attempted exercise of, or omission to exercise, such rights by PATH 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 PATH 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, PATH 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 PATH, 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 PATH an amount equal to PATH's cost of any investigation conducted by or on behalf of PATH, 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 PATH, PATH may deduct from any amount payable to the Contractor by PATH, under the Contract or under any other open contract between the Contractor and PATH, 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 PATH, PATH 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 within 1825 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 PATH that the Performance and Payment Bond furnished by him is satisfactory;
- B. The date of receipt by him of notice from PATH that the insurance procured by him in accordance with the clauses hereof entitled "Insurance Procured by the Authority" and "Insurance Procured by Contractor", if any is required, is satisfactory, as evidenced by the certificates to be furnished in accordance with said clauses.

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 PATH 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 PATH 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 PATH 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 Five Hundred Dollars (\$500) per calendar day.

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 PATH 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 PATH, and since, with sufficient opportunity, PATH 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 PATH 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 PATH 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 PATH 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 the premiums actually paid for Workers Compensation Insurance upon the basis of such salaries, if any, 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 PATH 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 the rates and amounts of Workers' Compensation Insurance premiums, if any, 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 PATH, 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 PATH, 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, PATH 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 PATH 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 PATH as to the time of such performance and the delay of PATH in fulfilling such requirement shall not result in liability of any kind on the part of PATH 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 PATH's own ability to perform it, either directly or through others, PATH 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 PATH. In the event of such cancellation, no allowance shall be made for anticipated profits.

CHAPTER IV

CONDUCT OF CONTRACT

38. 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 PATH, 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.

If at any time it shall be, from the viewpoint of PATH, impracticable or undesirable in the judgment of the Chief Engineer to proceed with or continue the performance of the Contract or any part thereof, whether or not for reasons beyond the control of PATH, 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 PATH impracticable or undesirable in the judgment of the Chief Engineer to proceed with or continue the performance of the Contract or any part thereof whether or not for reasons beyond the control of PATH, 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.

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 PATH 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.

39. 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.

40. NOTICE REQUIREMENTS

No claim against PATH 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 PATH 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 PATH.

The above referred to notices and information are required whether or not PATH is aware of the existence of any circumstances which might constitute a basis for a claim and whether or not PATH 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 PATH representative above designated to receive it may not be sufficient to come to the attention of the representative of PATH 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.

41. EQUAL EMPLOYMENT OPPORTUNITY - NEW YORK

During the performance of this Contract, within the State of New York 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 PATH 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 PATH 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, PATH 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 PATH 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 PATH, the Contractor shall promptly so notify the General Counsel to PATH, requesting him to intervene and protect the interests of PATH.
- 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.

42. EQUAL EMPLOYMENT OPPORTUNITY - NEW JERSEY

With respect to the performance of Work in the State of New Jersey and in order to conform with the policy of PATH the Contractor agrees that the provisions of N.J.S.A. 10:2-1 through 10:2-4, dealing with discrimination in employment on public contracts, and the Rules and Regulations promulgated pursuant thereto, are hereby made a part of this Contract and are binding upon him and that it shall not be a defense to the Contractor in any action arising directly or indirectly out of such legislation and Rules and Regulations that PATH may not be subject thereto.

The provisions of this numbered clause are for the benefit of the Attorney General of the State of New Jersey, Division on Civil Rights in the Department of Law and Public Safety of the State of New Jersey, and the Director thereof, as well as for the benefit of PATH, and said Division and Director shall have a right of action against the Contractor to effectuate the intent of this clause.

43. NO DISCRIMINATION IN EMPLOYMENT

During the performance of this Contract, within the State of New Jersey the Contractor agrees as follows:

- A. The Contractor will not discriminate against any employee or applicants for employment because of race, creed, color, national origin, sex, age, disability or marital status, and will undertake or continue existing programs of affirmative action to ensure that minority group persons are afforded equal employment opportunity without discrimination. Such programs shall include but not be limited to, recruitment, employment, job assignment, promotion, upgrading, demotion, transfer, layoff, termination, rates of pay or other forms of compensation, and selections for training or retraining, including apprenticeships and on-the-job training,
- B. The Contractor shall request such employment agency, labor union, or authorized representative of workers with which it has a collective bargaining or other agreement or understanding and which is involved in the performance of the Contract to furnish a written statement that such employment agency, labor union or representative shall not discriminate because of race, creed, color, national origin, sex, age, disability or marital status and that such union or representative will cooperate in the implementation of the Contractor's obligations hereunder,
- C. The Contractor will state, in all solicitations or advertisements for employees placed by or on behalf of the Contractor in the performance of the Contract with the Port Authority, that all qualified applicants will be afforded equal employment opportunity without discrimination because of race, creed, color, national origin, sex, age, disability or marital status,
- D. The Contractor will include the provisions of A. through C. of this numbered clause in every subcontract or purchase order in such a manner that such provisions will be binding upon each subcontractor or vendor as to its work in connection with the Contract with the Port Authority,
- E. The Contractor will submit to PATH every two weeks a report indicating the number of workers employed at the construction site as of the 1st and 15th days of each month and the projected number of workers to be so employed during the following month. This report shall also indicate the trade in which such workers are employed and, with respect to current employment (but not projected employment), shall indicate the number of such workers who are members of the following groups:
 - 1.) Black persons having origins in any of the Black African racial groups not of Hispanic origin;
 - 2.) Hispanic persons of Puerto Rican, Mexican, Dominican, Cuban, Central or South American culture or origin, regardless of race;
 - 3.) 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;
 - 4.) American Indian 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.

- F. The Contractor agrees that he will fully cooperate with the office of the Attorney General of the State of New Jersey and with PATH which seeks to deal with the problem of unlawful or invidious discrimination, and with all other State efforts to guarantee fair employment practices under this contract, and said Contractor will comply promptly with all requests and directions from the Attorney General of the State of New Jersey and PATH in this connection, both before and during construction.
- G. Full cooperation as expressed in F. foregoing shall include, but not be limited to, being a witness or complainant in any proceeding involving questions of unlawful or invidious discrimination if such is deemed necessary by the Attorney General of the State of New Jersey, permitting employees of said Contractor to be witnesses or complainants in any proceeding involving questions of unlawful or invidious discrimination, if such is deemed necessary by the Attorney General of the State of New Jersey, signing any and all documents involved in any proceeding involving questions of unlawful or invidious discrimination, the execution of which are deemed necessary by the Attorney General of the State of New Jersey, participating in meetings, submitting periodic reports on the racial aspects of present and future employment, assisting in inspection at the construction site, and promptly complying with all State directives deemed essential by the Attorney General of the State of New Jersey to insure compliance with all Federal and State laws, regulations and policies against racial or other unlawful or invidious discrimination.
- H. Upon the basis of a finding by the Attorney General of the State of New Jersey that the Contractor has not complied with these nondiscrimination requirements and that by reason thereof there has been a material breach of this Contract, the Executive Director of the Authority shall have the sole discretion and power to declare this Contract null and void upon 10 days' notice to the Contractor. In such event the Contractor shall become liable for any and all damages which shall accrue to PATH including, but not limited to, the difference between the total cost of completion and the contract price under this Contract.
- I. The provisions of this numbered clause which refer to the Attorney General are inserted in this Contract for the benefit of the Attorney General of the State of New Jersey as well as for the benefit of PATH, and said Attorney General shall have a direct right of action against the Contractor to effectuate the intent of this clause.

44. 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 clauses entitled 'Equal Employment Opportunity - New York' and 'Equal Employment Opportunity - New Jersey' 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 bid.

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 clauses entitled 'Equal Employment Opportunity - New York' and 'Equal Employment Opportunity - New Jersey', 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 starting 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 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 "Equal Employment Opportunity", including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered by PATH. Any Contractor who fails to carry out such sanctions and penalties shall be in violation hereof.
- 12.) The Contractor, in fulfilling its 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, PATH 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).

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 in the locality in which the Work is being performed as determined by the Engineer.

For purposes of this Contract, the Engineer has determined that the prevailing rates of wage and supplements are those established by the Secretary of Labor of the United States pursuant to the Davis-Bacon Act (40 U.S.C.A. 276a) for the locality in which the Work is to be performed. The schedule of wages and supplemental benefits which are currently in effect is attached hereto. However, the applicable rates shall be those which are in effect on the date of opening of Proposals.

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 PATH; 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. PATH 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 "PATH 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 PATH (on forms furnished by PATH) of all his payroll records and those of each of his subcontractors as PATH 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 PATH (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 PATH 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 PATH 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 PATH 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 PATH 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 PATH.

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 PATH shall be void and of no effect as to PATH, 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 PATH 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 or United States Department of Labor-Registered Apprenticeship Program". The Certification of Participation in a State-Registered or United States Department of Labor-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 PATH, 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 PATH or the Engineer shall create any rights in favor of such subcontractor and against PATH; and as between PATH 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 PATH for other purposes, the Engineer may render to PATH 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 PATH 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 PATH 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 PATH 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 PATH shall not operate to release the Contractor or his sureties from any obligations under or upon this Contract or the Performance and Payment Bond.

As a condition precedent to rendition of the Certificate of Final Completion, the Contractor shall submit the "Summary of Asbestos Removal and Disposal Costs" in accordance with the clause of Division 1 - GENERAL PROVISIONS entitled "Asbestos Cost Summary Submittal".

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 PATH, 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 PATH of duties involving transactions with the Contractor on behalf of PATH, 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 PATH 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 Director, 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 PATH, its Directors, 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 PATH as to the feasibility of performance of this Contract or any part thereof. Moreover, PATH 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 PATH 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 PATH's consent to enter into this Contract and that without such provisions, PATH 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 PATH, 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 PATH 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 D 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 PATH;
- B. The risk of loss, damage to or alterations of the structures to be demolished occurring prior to completion of demolition by the Contractor (such structures being still included, however, in the term "Work"). In the event of such loss, damage or alterations, the Contractor shall nevertheless complete the performance of the Work, including the demolition, without additional cost to PATH and without compensation for lost salvage value;

- C. 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 PATH 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 PATH 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;
- D. The risk of loss or damage to any property of the Contractor, and of claims made against the Contractor or PATH 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 PATH against all claims described in subparagraphs C and D 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 C and D 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 PATH, governmental nature of PATH or the provisions of any statutes respecting suits against PATH. Unless a claim is one which the Contractor is not required to indemnify PATH 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 PATH, 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 PATH is named, including a direct right of action against the Contractor to enforce the foregoing indemnity, except, however, that PATH 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.

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 PATH

In order to reduce the cost of this Contract, PATH 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 PATH, 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 its Proposal the Contractor shall deliver to the General Manager, Risk Management, 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 through C of this numbered clause are available for examination by appointment in the office of the General Manager, Risk Management, 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 through C above.

PATH 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 through 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 PATH and PATH 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 PATH 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 its 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, PATH 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 PATH 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 PATH 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 it has examined and is familiar with the above stated coverages and that in submitting its Proposal it has relied solely on its own interpretation thereof and not on any representations or statements, oral or written, of PATH, its Directors, 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.

PATH 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 PATH all such returned premiums, dividends and credits and the subcontractors shall be deemed to have assigned to PATH 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 PATH's right to such returned premiums, dividends and credits.

Notwithstanding any payment by PATH of any insurance premiums, PATH 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 PATH in all matters relating to the aforementioned insurance and shall comply with all requirements of all insurance policies procured by PATH. 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 its 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 its 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 commercial available form:
 - 1.) Combined single limit for bodily injury and property damage liability with a minimum limit of \$5 million each accident.

- 2.) Hazardous/contaminated waste transportation insurance shall be provided by any Contractor or subcontractor hauling hazardous/contaminated waste with a limit of \$5 million each occurrence.

B. Environmental Liability Insurance:

The Contractor shall procure and maintain in force an Environmental Liability Insurance Policy covering the Contractor's pollution legal liability, including cleanup, with limits not less than \$5 million per occurrence for bodily injury and property damage tailored to the specific exposures as they relate to the Work of this Contract. The policy will be in effect commencing on or about the date of the Authority's acceptance of the Contractor's Proposal.

Such policy and any certificate of insurance submitted hereunder in relation to such policy shall (I) be expressly endorsed for each Authority facility under this Contract and each transfer location, travel route and material disposition location selected by the Contractor, (II) state that claims disputes and coverage shall be litigated in United States courts having jurisdiction, and not be limited to arbitration, and (III) acknowledge the Contractor's disclosure to the insurance carrier that the material may be considered a hazardous substance/waste under applicable law including, but not limited to, RCRA and/or CERCLA and/or the Toxic Substance Control Act (TSCA). It should be noted that the substances may be considered "hazardous" under CERCLA, but not necessarily "hazardous" under RCRA and that such materials if RCRA "hazardous" would require a manifest and disposal certificate under RCRA at a Subtitle C hazardous waste disposal facility. A copy of this Contract, including all schedules and documents attached hereto, shall be provided to the insurance carrier.

C. Lead Abatement Liability Insurance

The Contractor shall procure Lead Abatement Liability Insurance, on an occurrence basis, with a limit of liability of \$5 million /occurrence and \$5 million /aggregate. The Policy shall include the Authority and all subcontractors as additional insureds. The policy shall include coverage for environmental cleanup on land and on water. The policy shall be endorsed to include coverages for premises-operation, products-completed operations (for 2 years after the completion of the Contract), broad form property damage, independent contractors, personal injury, blanket contractual liability in accordance with ISO policy form GG 00 01 1185. The policy shall not contain a sunset provision, commutation clause, or any other provision which would prohibit the reporting of a claim and the subsequent defense and indemnify that would normally be provided by the policy. Self-funded, policy fronting, or other non-risk transfer insurance mechanisms are not acceptable to the Authority, unless full disclosure is made to the Authority prior to any consideration being given. The liability of the Contractor shall not be limited in any manner to the provision of coverages of applicable limits of liability contained within any section of the Contract. The Authority shall be provided a waiver of subrogation.

See Addendum No 5

The policy shall provide transportation coverage for the hauling of lead based paint from the construction site to the final disposition location. Deductibles shall not reduce the limit of liability. The policy shall have coverage for cross-liability/severability of interest. The policy form must "pay on behalf of" rather than "indemnify the insured". If the policy or any endorsement contains a provision which limits or eliminates bodily injury or property damage coverage based on airborne lead levels, the policy shall be modified so that it is consistent with environmental/monitoring requirements for lead as contained in the Contract Specifications and inclusive of 40 CFR50, Appendix G, and the appropriate analytical testing protocol contained in the Contract Specifications. The Contractor's insurance shall be primary insurance as respects the Authority, its representatives, officials and employees. Any insurance or self-insurance maintained by the Authority shall be excess of this insurance and shall not contribute with it. The policy shall provide pollution coverage as respects lead-based paint for all phases of the abatement process. The policy shall not contain any provision or definition that would serve to eliminate third party over-claims, including exclusions of the premises owner. The policy must be modified to include, "The insolvency or bankruptcy of the insured or of the insured's estate will not relieve the insurance company of its obligations under this policy".

PATH 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.

See Addendum No 5

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 its 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 PATH. 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 to PATH, raise any defense involving in any way the jurisdiction of the tribunal over the person of PATH, raise any defense involving in any way the jurisdiction of PATH, its Directors, officers, agents or employees, the governmental nature of PATH or the provisions of any statute respecting suits against PATH". 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 PATH as to form or substance, or if the carrier issuing any such certificate or policy shall be or become unsatisfactory to PATH, the Contractor shall promptly obtain a new and satisfactory certificate and policy. Upon request of the General Manager, Risk Management, the Contractor shall furnish PATH 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 PATH as to the adequacy of the insurance to protect the Contractor against the obligations imposed on them by law or by this or any other Contract.

CHAPTER VI
RIGHTS AND REMEDIES

60. RIGHTS AND REMEDIES OF PATH

PATH 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 PATH 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 PATH 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 or United States Department of Labor-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 PATH shall not be deemed to limit any other rights or remedies which PATH would have in the absence of such enumeration; and no exercise by PATH 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 PATH, the Contractor expressly agrees that no default, act or omission of PATH 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 PATH.

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 PATH as agent for the Contractor, credit to PATH the cost thereof, and credit to the Contractor the compensation earned thereby; and the difference between them shall be payable by the Contractor to PATH, or vice versa as the case may be. If such difference is in its favor, PATH 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 PATH 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

PATH 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 PATH, 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 PATH 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 PATH, the Engineer, or any officer, agent or employee of PATH, nor any permission or direction to continue with the performance of Work, nor any performance by PATH of any of the Contractor's duties or obligations, nor any aid lent to the Contractor by PATH in his performance of such duties or obligations, nor any other thing done or omitted to be done by PATH, its Directors, 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 PATH 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 PATH may be entitled because of such breach. Moreover, no waiver by PATH 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 PATH, 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 PATH REPRESENTATIVES

Neither the Directors of PATH 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 PATH 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 PATH 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 undersigned²² Contractor and surety company (or companies), as principal and surety (or sureties), respectively,

Contractor

Surety

²² 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 Trans Hudson Corporation (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 PATH, a copy of which is hereby made a part of this bond as though herein set forth in full and which is designated Contract PAT-624.154 - "PATH - Replacement and Upgrade of Christopher Street Substation", and

WHEREAS, PATH 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 PATH 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 PATH 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 PATH.

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 PATH 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.

(Seal)

By²³

Principal

Surety

By²⁴ _____

APPROVED AS TO ACCEPTABILITY OF SURETIES:

Credit Manager

20

²³ If bond is signed by an officer or agent, give title; if signed by a corporation, affix corporate seal.

²⁴ 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 removal, furnishing and installation of electrical equipment, associated electronics, wiring and conduit; excavation, pavement removal and restoration, asbestos abatement, architectural, mechanical, plumbing and related Work at the Christopher Street Substation at the PATH Christopher Street Station and the vicinity thereof in Manhattan, New York and Caisson #1 Substation 15 and the Washington Street Substation 2 and the vicinity thereof in the State of New Jersey.

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 PATH 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.

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. 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 routine facility operations and maintenance all of which shall remain uninterrupted.

The Contractor shall so plan and conduct his operations as to work in harmony with others engaged at the construction site and not to delay, endanger or interfere with the operations of others (whether or not specifically mentioned above), all to the best interests of PATH and the public and as may be directed by the Engineer.

74. 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.

75. 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.

76. CONTRACT DRAWINGS

The Contract Drawings which accompany and form a part of these Specifications bear the general title "Port Authority Trans Hudson Corporation - PATH - Replacement and Upgrade of Christopher Street Substation - Contract PAT-624.154" and are separately numbered and entitled as follows:

G001		
G002	LOCATION PLAN	General
G003	INDEX OF DRAWINGS (SHEET 1 OF 4)	General
G004	INDEX OF DRAWINGS (SHEET 2 OF 4)	General
G005	INDEX OF DRAWINGS (SHEET 3 OF 4)	General
G006	INDEX OF DRAWINGS (SHEET 4 OF 4)	General
G007	GENERAL NOTES	General
A101	CODE DATA LEGEND AND ABBREVIATIONS	Architectural
A102	BASEMENT LEVEL REMOVAL PLAN	Architectural
A103	FIRST FLOOR REMOVAL PLAN	Architectural
A104	SECOND FLOOR REMOVAL PLAN	Architectural
A105	THIRD FLOOR REMOVAL PLAN	Architectural
A106	FOURTH FLOOR REMOVAL PLAN	Architectural
A107	FIFTH FLOOR REMOVAL PLAN	Architectural
A108	BUILDING REMOVAL ELEVATIONS & REMOVAL WALL SECTIONS	Architectural
A109	BASEMENT LEVEL FLOOR PLAN	Architectural
A110	FIRST FLOOR PLAN	Architectural
A111	SECOND FLOOR PLAN	Architectural
A112	THIRD FLOOR PLAN	Architectural
A113	FOURTH FLOOR PLAN	Architectural
A114	FIFTH FLOOR PLAN	Architectural
A115	FIRST FLOOR REFLECTED CEILING PLAN	Architectural
A116	FIFTH FLOOR REFLECTED CEILING PLAN	Architectural

A201	BUILDING ELEVATIONS	Architectural
A301	BUILDING AND WALL SECTIONS	Architectural
A302	WALL & FLOOR SECTIONS	Architectural
A401	ENLARGED STAIR PLANS (SHEET 1 OF 2)	Architectural
A402	ENLARGED STAIR PLANS (SHEET 2 OF 2)	Architectural
A403	STAIR SECTIONS	Architectural
A404	STAIR DETAILS 1	Architectural
A405	STAIR DETAILS 2	Architectural
A406	RAILING DETAILS	Architectural
A407	WALL DETAILS 1	Architectural
A408	WALL DETAILS 2	Architectural
A409	MISCELLANEOUS DETAILS	Architectural
A501	DOOR SCHEDULE AND ELEVATIONS	Architectural
A502	DOOR DETAILS 1	Architectural
A503	DOOR DETAILS 2	Architectural
A504	LOUVER SCHEDULE AND ELEVATIONS	Architectural
A505	LOUVER DETAILS 1	Architectural
A506	LOUVER DETAILS 2	Architectural
A507	CEILING & MISC. DETAILS	Architectural
A601	SIGN SCHEDULE AND DETAILS	Architectural
A602	FINISH SCHEDULE	Architectural
E101	GENERAL NOTES ELECTRICAL SYSTEMS	Electrical
E102	LEGENDS, SYMBOLS AND ABBREVIATIONS (SHEET 1 OF 3)	Electrical
E103	LEGENDS, SYMBOLS AND ABBREVIATIONS (SHEET 2 OF 3)	Electrical
E104	LEGENDS, SYMBOLS AND ABBREVIATIONS (SHEET 3 OF 3)	Electrical
E105	CAISSON #1 SUB EXISTING SINGLE LINE DIAGRAM	Electrical
E106	CAISSON #1 SUB SINGLE LINE DIAGRAM	Electrical
E107	CAISSON #1 SUBSTATION 27KV FEEDERS PARTIAL ONE-LINE DIAGRAM	Electrical
E108	CAISSON #1 SUBSTATION BUS DIFFERENTIAL PROTECTION	Electrical
E109	CAISSON #1 SUB CONTROL SCHEMATIC FOR FEEDER BREAKER 15SF4	Electrical

E110	CAISSON #1 SUB CONTROL SCHEMATIC FOR FEEDER BREAKER 15SF5	Electrical
E111	CAISSON #1 SUB CONTROL SCHEMATIC FOR FEEDER BREAKER 15SF6	Electrical
E112	CAISSON #1 SUB CONTROL BLOCK DIAGRAM	Electrical
E113	CAISSON #1 SUB EQUIPMENT LAYOUT	Electrical
E114	CAISSON #1 SUB CONDUIT ROUTING PLAN	Electrical
E115	CAISSON #1 SUB ELEVATION	Electrical
E116	CAISSON #1 SUB 26.4KV SWITCHGEAR PATH CONTROL PANEL	Electrical
E117	CAISSON #1 SUB 26.4KV SWITCHGEAR INTERCONNECTION DIAGRAM SHEET 1 OF 2	Electrical
E118	CAISSON #1 SUB 26.4KV SWITCHGEAR INTERCONNECTION DIAGRAM SHEET 2 OF 2	Electrical
E119	CAISSON #1 INTERFACE CABINET 1A AND 1B INTERCONNECTION DIAGRAM	Electrical
E120	ANNUNCIATOR WIRING DIAGRAM	Electrical
E121	CAISSON #1 SUB SITE PLAN	Electrical
E122	CAISSON #1 SUB CABLE SCHEDULE	Electrical
E123	WASHINGTON ST. SUB SINGLE LINE DIAGRAM AND PROTECTIVE RELAYING	Electrical
E124	WASHINGTON ST. SUB CONTROL SCHEMATIC FOR FDR BKR SF5	Electrical
E125	WASHINGTON ST. SUB CONTROL SCHEMATIC FOR FDR BKR SF3	Electrical
E126	WASHINGTON ST. SUB CONTROL SCHEMATIC FOR FDR BKR SF1	Electrical
E201	EXISTING SINGLE LINE DIAGRAM (SHEET 1 OF 3)	Electrical
E202	EXISTING SINGLE LINE DIAGRAM (SHEET 2 OF 3)	Electrical
E203	EXISTING SINGLE LINE DIAGRAM (SHEET 3 OF 3)	Electrical
E204	SINGLE LINE DIAGRAM (SHEET 1 OF 5)	Electrical
E205	SINGLE LINE DIAGRAM (SHEET 2 OF 5)	Electrical
E206	SINGLE LINE DIAGRAM (SHEET 3 OF 5)	Electrical
E207	SINGLE LINE DIAGRAM (SHEET 4 OF 5)	Electrical
E208	SINGLE LINE DIAGRAM (SHEET 5 OF 5)	Electrical
E209	KEY INTERLOCK SCHEME	Electrical
E210	KEY INTERLOCK DESCRIPTION	Electrical

E211	ELECTRICAL EQUIPMENT SPECIFICATIONS (SHEET 1 OF 2)	Electrical
E212	ELECTRICAL EQUIPMENT SPECIFICATIONS (SHEET 2 OF 2)	Electrical
E213	EXISTING SUBSTATION LAYOUT BASEMENT PLAN	Electrical
E214	EXISTING SUBSTATION LAYOUT FIRST FLOOR PLAN	Electrical
E215	EXISTING SUBSTATION LAYOUT SECOND FLOOR PLAN	Electrical
E216	EXISTING SUBSTATION LAYOUT THIRD FLOOR PLAN	Electrical
E217	EXISTING SUBSTATION LAYOUT FOURTH FLOOR PLAN	Electrical
E218	EXISTING SUBSTATION LAYOUT FIFTH FLOOR PLAN	Electrical
E219	EXISTING SUBSTATION LAYOUT ROOF PLAN	Electrical
E220	SUBSTATION EQUIPMENT REMOVALS BASEMENT PLAN	Electrical
E221	SUBSTATION EQUIPMENT REMOVALS FIRST FLOOR PLAN	Electrical
E222	SUBSTATION EQUIPMENT REMOVALS SECOND FLOOR PLAN	Electrical
E223	SUBSTATION EQUIPMENT REMOVALS THIRD FLOOR PLAN	Electrical
E224	SUBSTATION EQUIPMENT REMOVALS FOURTH FLOOR PLAN	Electrical
E225	SUBSTATION EQUIPMENT REMOVALS FIFTH FLOOR PLAN	Electrical
E226	SUBSTATION EQUIPMENT REMOVALS ROOF PLAN	Electrical
E227	SUBSTATION EQUIPMENT LAYOUT BASEMENT	Electrical
E228	SUBSTATION EQUIPMENT LAYOUT FIRST FLOOR	Electrical
E229	SUBSTATION EQUIPMENT LAYOUT SECOND FLOOR	Electrical
E230	SUBSTATION EQUIPMENT LAYOUT THIRD FLOOR	Electrical
E231	SUBSTATION EQUIPMENT LAYOUT FOURTH FLOOR	Electrical
E232	SUBSTATION EQUIPMENT LAYOUT FIFTH FLOOR	Electrical
E233	SUBSTATION EQUIPMENT LAYOUT ROOF	Electrical
E301	FIRE ALARM SYSTEM RISER DIAGRAM	Electrical

E302	FIRE ALARM SYSTEM BASEMENT FLOOR PLAN	Electrical
E303	FIRE ALARM SYSTEM FIRST FLOOR PLAN	Electrical
E304	FIRE ALARM SYSTEM SECOND FLOOR PLAN	Electrical
E305	FIRE ALARM SYSTEM THIRD FLOOR PLAN	Electrical
E306	FIRE ALARM SYSTEM FOURTH FLOOR PLAN	Electrical
E307	FIRE ALARM SYSTEM FIFTH FLOOR PLAN	Electrical
E308	FIRE ALARM SYSTEM ROOF PLAN	Electrical
E309	FIRE ALARM SYSTEM MISCELLANEOUS DETAILS	Electrical
E401	LIGHTING AND RECEPTACLE REMOVALS BASEMENT PLAN	Electrical
E402	LIGHTING AND RECEPTACLE REMOVALS FIRST FLOOR PLAN	Electrical
E403	LIGHTING AND RECEPTACLE REMOVALS SECOND FLOOR PLAN	Electrical
E404	LIGHTING AND RECEPTACLE REMOVALS THIRD FLOOR PLAN	Electrical
E405	LIGHTING AND RECEPTACLE REMOVALS FOURTH FLOOR PLAN	Electrical
E406	LIGHTING AND RECEPTACLE REMOVALS FIFTH FLOOR PLAN	Electrical
E407	LIGHTING AND RECEPTACLE REMOVALS ROOF PLAN	Electrical
E408	LIGHTING AND RECEPTACLE SYSTEM RISER DIAGRAM	Electrical
E409	LIGHTING AND RECEPTACLE SYSTEM BASEMENT PLAN	Electrical
E410	LIGHTING AND RECEPTACLE SYSTEM FIRST FLOOR PLAN	Electrical
E411	LIGHTING AND RECEPTACLE SYSTEM SECOND FLOOR PLAN	Electrical
E412	LIGHTING AND RECEPTACLE SYSTEM THIRD FLOOR PLAN	Electrical
E413	LIGHTING AND RECEPTACLE SYSTEM FOURTH FLOOR PLAN	Electrical
E414	LIGHTING AND RECEPTACLE SYSTEM FIFTH FLOOR PLAN	Electrical
E415	LIGHTING AND RECEPTACLE SYSTEM ROOF PLAN	Electrical
E416	LIGHTING AND RECEPTACLE SYSTEM MISCELLANEOUS DETAILS	Electrical

E417	HVAC POWER BLOCK DIAGRAM	Electrical
E418	HVAC POWER BASEMENT PLAN	Electrical
E419	HVAC POWER FIRST FLOOR PLAN	Electrical
E420	HVAC POWER SECOND FLOOR PLAN	Electrical
E421	HVAC POWER THIRD FLOOR PLAN	Electrical
E422	HVAC POWER FOURTH FLOOR PLAN	Electrical
E423	HVAC POWER FIFTH FLOOR PLAN	Electrical
E424	HVAC POWER ROOF PLAN	Electrical
E501	GROUNDING SYSTEM BLOCK DIAGRAM	Electrical
E502	GROUNDING SYSTEM BASEMENT PLAN	Electrical
E503	GROUNDING SYSTEM FIRST FLOOR PLAN	Electrical
E504	GROUNDING SYSTEM SECOND FLOOR PLAN	Electrical
E505	GROUNDING SYSTEM THIRD FLOOR PLAN	Electrical
E506	GROUNDING SYSTEM FOURTH FLOOR PLAN	Electrical
E507	GROUNDING SYSTEM FIFTH FLOOR PLAN	Electrical
E508	GROUNDING SYSTEM ROOF PLAN	Electrical
E509	GROUNDING SYSTEM MISCELLANEOUS DETAILS	Electrical
E510	STORED ENERGY DEVICE PLAN AND ELEVATION	Electrical
E511	STORED ENERGY DEVICE SCHEMATIC DIAGRAM	Electrical
E512	STORED ENERGY DEVICE SECTION AND DETAILS	Electrical
E513	STORED ENERGY CAPACITOR BANK CONNECTIONS	Electrical

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E612	BLUE LIGHT & INTERTRIP I/O CABINET (INTERNAL VIEW)	Electrical
E613	AC SWITCHGEAR AND MISCELLANEOUS I/O CABINET (INTERNAL VIEW)	Electrical
E614	INTERFACE TERMINAL CABINET (INTERNAL VIEW)	Electrical
E615	4160V AND 480V EQUIPMENT I/O CABINET (INTERNAL VIEW)	Electrical
E618	TYPICAL RECTIFIER UNIT I/O EQUIPMENT BACK PANEL	Electrical
E620	TYPICAL PLC CABINET	Electrical
E621	TYPICAL PLC CABINET (INTERNAL VIEW)	Electrical
E622	PLC INTERCONNECTIONS	Electrical
E623	TYPICAL CHANNEL BANK EQUIPMENT	Electrical
E624	COMMUNICATIONS DISTRIBUTION BLOCK DIAGRAM	Electrical
E625	TRACKSIDE BREAKER EMERGENCY CONTROL PANEL LAYOUT	Electrical
E626	TRACKSIDE BARRIER EMERGENCY CONTROL PANEL CONSOLE DETAILS	Electrical
E627	VENTILATION FAN CONTROL PANEL LAYOUT	Electrical
E628	VENTILATION FAN CONTROL PANEL CONSOLE DETAILS	Electrical
E629	MASTER TERMINATION CABINET DETAILS (SHEET 1 OF 2)	Electrical
E630	MASTER TERMINATION CABINET DETAILS (SHEET 2 OF 2)	Electrical
E631	EXISTING DUCTBANK SECTION AND CABLE SCHEDULE	Electrical
E632	EXISTING BASEMENT DETAILS	Electrical
E633	EXISTING FIRST FLOOR DETAILS	Electrical
E634	EXISTING SECOND FLOOR DETAILS (SHEET 1 OF 2)	Electrical
E635	EXISTING SECOND FLOOR DETAILS (SHEET 2 OF 2)	Electrical

E636	EXISTING CONDUIT AND CABLE SCHEDULE (SHEET 1 OF 2)	Electrical
E637	EXISTING CONDUIT AND CABLE SCHEDULE (SHEET 2 OF 2)	Electrical
E638	DUCTBANK PLAN AND SECTIONS	Electrical
E639	BASEMENT DETAILS (SHEET 1 OF 4)	Electrical
E640	BASEMENT DETAILS (SHEET 2 OF 4)	Electrical
E641	BASEMENT DETAILS (SHEET 3 OF 4)	Electrical
E642	BASEMENT DETAILS (SHEET 4 OF 4)	Electrical
E643	POSITIVE BUS AND CABLE TRAY DETAILS (SHEET 1 OF 4)	Electrical
E644	POSITIVE BUS AND CABLE TRAY DETAILS (SHEET 2 OF 4)	Electrical
E645	POSITIVE BUS AND CABLE TRAY DETAILS (SHEET 3 OF 4)	Electrical
E646	POSITIVE BUS AND CABLE TRAY DETAILS (SHEET 4 OF 4)	Electrical
E647	TYPICAL NEGATIVE BUS INSTALLATION DETAILS DETAILS & CONDUIT/CABLE SUPPORT STRUCTURE	Electrical
E648	MISCELLANEOUS BUS DETAILS	Electrical
E649	TUNNELS A AND B CABLE INSTALLATION PLAN	Electrical
E650	TYPICAL TRAY AND TRAY SUPPORT DETAILS	Electrical
E701	TYPICAL MEDIUM VOLTAGE SWITCHGEAR DETAILS	Electrical
E702	TYPICAL AUXILIARY TRANSFORMER DETAILS	Electrical
E703	AUXILIARY TRANSFORMER RELAY CABINET DETAILS	Electrical
E704	TYPICAL RECTIFIER TRANSFORMER DETAILS	Electrical
E705	TYPICAL RECTIFIER AND RECTIFIER CONTROL PANEL DETAILS	Electrical
E706	TYPICAL DC SWITCHGEAR DETAILS	Electrical
E707	DC SWITCHGEAR LOCAL PUSHBUTTON CONTROL PANEL (SHEET 1 OF 2)	Electrical
E708	DC SWITCHGEAR LOCAL PUSHBUTTON CONTROL PANEL (SHEET 2 OF 2)	Electrical
E709	TYPICAL RECTIFIER CONTROL CIRCUIT	Electrical
E710	TYPICAL RECTIFIER AND DC SWITCHGEAR HIGH RESISTANCE GROUND CIRCUIT	Electrical

E711	TYPICAL DC MAIN BREAKER CONTROL CIRCUIT	Electrical
E712	TYPICAL DC FEEDER BREAKER CONTROL CIRCUIT	Electrical
E713	TYPICAL DC TIE BREAKER CONTROL CIRCUIT	Electrical
E714	TYPICAL TRACKSIDE BREAKER CONTROL CIRCUIT	Electrical
E715	TYPICAL ELECTROLYSIS BREAKER CONTROL CIRCUIT AND DETAILS (SHEET 1 OF 2)	Electrical
E716	TYPICAL ELECTROLYSIS BREAKER CONTROL CIRCUIT AND DETAILS (SHEET 2 OF 2)	Electrical
E719	TYPICAL BLUE LIGHT AND INTERTRIP CIRCUITRY	Electrical
E801	EXISTING DC PANELBOARD SCHEDULES	Electrical
E802	EXISTING AC PANELBOARD SCHEDULES (SHEET 1 OF 2)	Electrical
E803	EXISTING AC PANELBOARD SCHEDULES (SHEET 2 OF 2)	Electrical
E804	STATION BATTERY ROOM LAYOUT	Electrical
E805	125VDC STATION BATTERY SYSTEM	Electrical
E806	DC PANELBOARD SCHEDULES	Electrical
E807	AC PANELBOARD SCHEDULES (SHEET 1 OF 2)	Electrical
E808	AC PANELBOARD SCHEDULES (SHEET 2 OF 2)	Electrical
E809	CONDUIT AND CABLE SCHEDULE (SHEET 1 OF 5)	Electrical
E810	CONDUIT AND CABLE SCHEDULE (SHEET 2 OF 5)	Electrical
E811	CONDUIT AND CABLE SCHEDULE (SHEET 3 OF 5)	Electrical
E812	CONDUIT AND CABLE SCHEDULE (SHEET 4 OF 5)	Electrical
E813	CONDUIT AND CABLE SCHEDULE (SHEET 5 OF 5)	Electrical
E814	TEMPORARY CONDUIT AND CABLE SCHEDULE	Electrical
E815	SUBSTATION EQUIPMENT ROUTING PLAN AC SWITCHGEAR FIRST FLOOR	Electrical
E816	SUBSTATION EQUIPMENT ROUTING PLAN FOURTH AND FIFTH FLOOR	Electrical
E901	CONSTRUCTION STAGING NOTES AND SEQUENCES (SHEET 1 OF 2)	Electrical
E902	CONSTRUCTION STAGING NOTES AND SEQUENCES (SHEET 2 OF 2)	Electrical
E903	CONSTRUCTION STAGING (STAGE I) SINGLE LINE DIAGRAM	Electrical

E904	CONSTRUCTION STAGING (STAGE II) SINGLE LINE DIAGRAM	Electrical
E905	CONSTRUCTION STAGING (STAGE III) SINGLE LINE DIAGRAM	Electrical
E906	CONSTRUCTION STAGING (STAGE IV) SINGLE LINE DIAGRAM	Electrical
E907	CONSTRUCTION STAGING (STAGE V) SINGLE LINE DIAGRAM	Electrical
E908	CONSTRUCTION STAGING (STAGE VI) SINGLE LINE DIAGRAM	Electrical
E909	CONSTRUCTION STAGING (STAGE VII) SINGLE LINE DIAGRAM	Electrical
E910	CONSTRUCTION STAGING (STAGE VIII) SINGLE LINE DIAGRAM	Electrical
E911	CONSTRUCTION STAGING (STAGE I) CAISSON SUBSTATION SECOND FLOOR	Electrical
E912	CONSTRUCTION STAGING (STAGE II) BASEMENT	Electrical
E913	CONSTRUCTION STAGING (STAGE II) FIRST FLOOR PLAN	Electrical
E914	CONSTRUCTION STAGING (STAGE II) SECOND FLOOR PLAN	Electrical
E915	CONSTRUCTION STAGING (STAGE II) THIRD FLOOR PLAN	Electrical
E916	CONSTRUCTION STAGING (STAGE II) FOURTH FLOOR PLAN	Electrical
E917	CONSTRUCTION STAGING (STAGE II) FIFTH FLOOR PLAN	Electrical
E918	CONSTRUCTION STAGING (STAGE II) ROOF	Electrical
E919	CONSTRUCTION STAGING (STAGE III) BASEMENT	Electrical
E920	CONSTRUCTION STAGING (STAGE III) FIRST FLOOR PLAN	Electrical
E921	CONSTRUCTION STAGING (STAGE III) SECOND FLOOR PLAN	Electrical
E922	CONSTRUCTION STAGING (STAGE III) THIRD FLOOR PLAN	Electrical
E923	CONSTRUCTION STAGING (STAGE III) FOURTH FLOOR PLAN	Electrical
E924	CONSTRUCTION STAGING (STAGE III) FIFTH FLOOR PLAN	Electrical
E925	CONSTRUCTION STAGING (STAGE III) ROOF	Electrical

E926	CONSTRUCTION STAGING (STAGE IV) BASEMENT	Electrical
E927	CONSTRUCTION STAGING (STAGE IV) FIRST FLOOR PLAN	Electrical
E928	CONSTRUCTION STAGING (STAGE IV) SECOND FLOOR PLAN	Electrical
E929	CONSTRUCTION STAGING (STAGE IV) THIRD FLOOR PLAN	Electrical
E930	CONSTRUCTION STAGING (STAGE IV) FOURTH FLOOR PLAN	Electrical
E931	CONSTRUCTION STAGING (STAGE IV) FIFTH FLOOR PLAN	Electrical
E932	CONSTRUCTION STAGING (STAGE IV) ROOF	Electrical
E933	CONSTRUCTION STAGING (STAGE V) BASEMENT	Electrical
E934	CONSTRUCTION STAGING (STAGE V) FIRST FLOOR PLAN	Electrical
E935	CONSTRUCTION STAGING (STAGE V) SECOND FLOOR PLAN	Electrical
E936	CONSTRUCTION STAGING (STAGE V) THIRD FLOOR PLAN	Electrical
E937	CONSTRUCTION STAGING (STAGE V) FOURTH FLOOR PLAN	Electrical
E938	CONSTRUCTION STAGING (STAGE V) FIFTH FLOOR PLAN	Electrical
E939	CONSTRUCTION STAGING (STAGE V) ROOF	Electrical
E940	CONSTRUCTION STAGING (STAGE VI) BASEMENT	Electrical
E941	CONSTRUCTION STAGING (STAGE VI) FIRST FLOOR PLAN	Electrical
E942	CONSTRUCTION STAGING (STAGE VI) SECOND FLOOR PLAN	Electrical
E943	CONSTRUCTION STAGING (STAGE VI) THIRD FLOOR PLAN	Electrical
E944	CONSTRUCTION STAGING (STAGE VI) FOURTH FLOOR PLAN	Electrical
E945	CONSTRUCTION STAGING (STAGE VI) FIFTH FLOOR PLAN	Electrical
E946	CONSTRUCTION STAGING (STAGE VI) ROOF	Electrical
E947	CONSTRUCTION STAGING (STAGE VII) BASEMENT	Electrical
E948	CONSTRUCTION STAGING (STAGE VII) FIRST FLOOR PLAN	Electrical

E949	CONSTRUCTION STAGING (STAGE VII) SECOND FLOOR PLAN	Electrical
E950	CONSTRUCTION STAGING (STAGE VII) THIRD FLOOR PLAN	Electrical
E951	CONSTRUCTION STAGING (STAGE VII) FOURTH FLOOR PLAN	Electrical
E952	CONSTRUCTION STAGING (STAGE VII) FIFTH FLOOR PLAN	Electrical
E953	CONSTRUCTION STAGING (STAGE VII) ROOF	Electrical
E954	CONSTRUCTION STAGING (STAGE VIII) BASEMENT	Electrical
E955	CONSTRUCTION STAGING (STAGE VIII) FIRST FLOOR PLAN	Electrical
E956	CONSTRUCTION STAGING (STAGE VIII) SECOND FLOOR PLAN	Electrical
E957	CONSTRUCTION STAGING (STAGE VIII) THIRD FLOOR PLAN	Electrical
E958	CONSTRUCTION STAGING (STAGE VIII) FOURTH FLOOR PLAN	Electrical
E959	CONSTRUCTION STAGING (STAGE VIII) FIFTH FLOOR PLAN	Electrical
E960	CONSTRUCTION STAGING (STAGE VIII) ROOF	Electrical
ES101	LENEL ACCESS CONTROL SYSTEM LEGEND AND NOTES	Electrical
ES102	EXISTING LENEL ACCESS CONTROL SYSTEM BLOCK DIAGRAM	Electrical
ES103	LENEL ACCESS CONTROL SYSTEM BLOCK DIAGRAM	Electrical
ES104	EXISTING LENEL ACCESS CONTROL SYSTEM LAYOUTS	Electrical
ES105	LENEL ACCESS CONTROL SYSTEM LAYOUTS	Electrical
ES106	LENEL ACCESS CONTROL SYSTEM DETAILS	Electrical
N001	ASBESTOS ABATEMENT GENERAL NOTES, STAGING AND LEGEND	Environmental
N002	CONFINED SPACE GENERAL NOTES	Environmental
N003	ASBESTOS ABATEMENT EXISTING BASEMENT FLOOR PLAN	Environmental
N004	ASBESTOS ABATEMENT EXISTING FIRST FLOOR PLAN	Environmental
N005	ASBESTOS ABATEMENT EXISTING SECOND FLOOR PLAN	Environmental

N006	ASBESTOS ABATEMENT EXISTING THIRD FLOOR PLAN	Environmental
N007	ASBESTOS ABATEMENT EXISTING FOURTH FLOOR PLAN	Environmental
N008	ASBESTOS ABATEMENT EXISTING FIFTH FLOOR PLAN	Environmental
N009	ASBESTOS ABATEMENT EXISTING ROOF PLAN	Environmental
N010	ASBESTOS ABATEMENT DETAILS SHEET 1 OF 3	Environmental
N011	ASBESTOS ABATEMENT DETAILS SHEET 2 OF 3	Environmental
N012	ASBESTOS ABATEMENT DETAILS SHEET 3 OF 3	Environmental
FP001	NOTES, SYMBOLS, ABBREVIATIONS AND RISER DIAGRAM	Fire Protection
FP002	FIRST AND SECOND FLOOR REMOVAL PLANS CARBON DIOXIDE SYSTEM	Fire Protection
FP003	FIRST FLOOR PLAN CLEAN AGENT SYSTEM	Fire Protection
M001	GENERAL NOTES, SYMBOLS AND ABBREVIATIONS	Mechanical
M002	BASEMENT LEVEL REMOVAL PLAN	Mechanical
M003	FIRST FLOOR REMOVAL PLAN	Mechanical
M004	SECOND FLOOR REMOVAL PLAN	Mechanical
M005	THIRD FLOOR REMOVAL PLAN	Mechanical
M006	FOURTH FLOOR REMOVAL PLAN	Mechanical
M007	FIFTH FLOOR REMOVAL PLAN	Mechanical
M008	ROOF REMOVAL PLAN	Mechanical
M009	BASEMENT LEVEL FLOOR PLAN	Mechanical
M010	FIRST FLOOR PLAN	Mechanical
M011	SECOND FLOOR PLAN	Mechanical
M012	THIRD FLOOR PLAN	Mechanical
M013	FOURTH FLOOR PLAN	Mechanical
M014	FIFTH FLOOR PLAN	Mechanical
M015	ROOF PLAN	Mechanical
M016	SECTIONS	Mechanical
M017	AIR FLOW RISER DIAGRAMS	Mechanical
M018	INSTRUMENTATION AND CONTROLS SYMBOLS, NOTES AND LEGENDS	Mechanical
M019	INSTRUMENTATION AND CONTROL DIAGRAM SHEET 1	Mechanical

M020	INSTRUMENTATION AND CONTROL DIAGRAM SHEET 2	Mechanical
M021	INSTRUMENTATION AND CONTROL DIAGRAM SHEET 3	Mechanical
M022	INSTRUMENTATION AND CONTROL DIAGRAM SHEET 4	Mechanical
M023	INSTRUMENTATION SEQUENCE OF OPERATION	Mechanical
M024	INSTRUMENTATION CONTROL PANEL LAYOUT	Mechanical
M025	MISCELLANEOUS DETAILS SHEET 1	Mechanical
M026	MISCELLANEOUS DETAILS SHEET 2	Mechanical
M027	EQUIPMENT SCHEDULES	Mechanical
P001	NOTES, SYMBOLS, ABBREVIATION AND SCHEDULES	Mechanical
P002	SECOND FLOOR REMOVAL PLAN	Mechanical
P003	FOURTH FLOOR REMOVAL PLAN	Mechanical
P004	FIRST FLOOR PIPING PLAN AND RISER DIAGRAMS	Mechanical
P005	SECOND FLOOR PIPING PLAN AND SANITARY RISER DIAGRAMS	Mechanical
P006	FOURTH FLOOR PIPING PLAN AND RISER DIAGRAMS	Mechanical
S001	STRUCTURAL GENERAL NOTES AND LEGEND	Structural
S002	BASEMENT REMOVAL PLAN	Structural
S003	BASEMENT PLAN	Structural
S004	FIRST FLOOR STRUCTURAL FRAMING PLAN	Structural
S005	SECOND FLOOR STRUCTURAL FRAMING PLAN STAGE 1	Structural
S006	SECOND FLOOR STRUCTURAL FRAMING PLAN STAGE 2	Structural
S007	SECOND FLOOR STRUCTURAL FRAMING PLAN STAGE 3	Structural
S008	SECOND FLOOR STRUCTURAL FRAMING PLAN STAGE 4	Structural
S009	SECOND FLOOR STRUCTURAL FRAMING PLAN STAGE 5 AND STAGE 6 AND 3RD FLOOR PARTIAL PLAN	Structural
S010	FOURTH FLOOR STRUCTURAL FRAMING PLAN	Structural
S011	FIFTH FLOOR STRUCTURAL FRAMING PLAN	Structural
S012	TYPICAL DETAILS (SHEET 1 OF 2)	Structural

S013	TYPICAL DETAILS (SHEET 2 OF 2)	Structural
S014	MISCELLANEOUS SECTIONS AND DETAILS (SHEET 1 OF 3)	Structural
S015	MISCELLANEOUS SECTIONS AND DETAILS (SHEET 2 OF 3)	Structural
S016	MISCELLANEOUS SECTIONS AND DETAILS (SHEET 3 OF 3)	Structural
S017	REMOVABLE FLOOR PLATE	Structural
S018	EXISTING SECOND FLOOR PLAN	Structural
S019	EXISTING SECOND FLOOR SECTIONS	Structural
S020	TYPICAL SECTIONS AND DETAILS	Structural

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.

77. 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 clause, 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 PATH shall become the property of PATH. PATH 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.

78. 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 PATH 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.

79. 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".

All items provided in this contract that use dates in the recording, storing or processing of information shall use such dates correctly at all times including using such dates correctly in the recording, storing or processing of information after January 1, 2000 (Year 2000 Compliant).

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.

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.

In various paragraphs of these Specifications, references may be made 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 bids upon the present Contract.

All inventions, ideas, designs and methods contained in the Specifications and Contract Drawings in which PATH has or may acquire patent, copyright or other property rights are hereby expressly reserved for the exclusive use of PATH. 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 PATH and must not be produced or copied in whole or in part or used for furnishing information to others without the written consent of PATH, 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, PATH 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 PATH. Promptly upon request by PATH, the Contractor shall furnish or obtain from the appropriate person a form of license satisfactory to PATH, but as between the Contractor and PATH the license herein provided for shall nevertheless arise for the benefit of PATH 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 PATH to its successors, immediate or otherwise, in the operation or ownership of any real or personal property now or hereafter owned or operated by PATH, 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 PATH 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 PATH use, in accordance with the preceding two paragraphs of this numbered clause, 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 PATH 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 PATH. If PATH 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 PATH against patent, copyright or other intellectual property right claims, PATH 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 PATH or to take such steps as may be necessary to ensure compliance by PATH with such injunction, all to the satisfaction of PATH and all without cost or expense to PATH.

80. 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.

81. 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 PATH and may be rejected at any time by the Engineer if incorrect, improper or otherwise unsatisfactory in his opinion.

82. 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 PATH 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.

83. 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 PATH 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.

84. 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".

85. ACCIDENTS AND FIRST AID PROVISIONS

The Contractor shall promptly report in writing to the Engineer and to PATH 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 PATH.

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 PATH, giving full details of the claim.

86. 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.

87. 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.

88. 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 clause. 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 Section 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 clause 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 Section 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 clause. 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 clause. 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 clause. 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 clause 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 clause; 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 clause, 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.
- c. Contract number and title.
- d. 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.
- e. Number, type, make, year of manufacture, manufacturer and serial number.
- f. Engine type, make, horsepower rating, year of manufacture, and serial number.
- g. Approximate fuel consumption rate per shift.
- h. Anticipated function, duration of use, and days and hours of operation.
- i. Technical explanation of safety hazard, mechanical constraint, warranty, limited availability, or functionality issues cited as basis for waiver.
- j. 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.
- k. 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.
- l. 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.

89. 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, nor shall such memorandum be deemed to be a substitute for the daily log required by the Section(s) of the Specifications pertaining to asbestos removal.

90. LAWS AND ORDINANCES

In order to effectuate the policy of PATH, 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 PATH, 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 permits, licenses, or any variance in his own name without first obtaining the approval of PATH.

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.

PATH has applied/will apply for the following permit(s) in connection with this Contract in its own name:

The Contractor shall comply with all provisions of the said permit(s).

91. IDENTIFICATION

No person will be permitted on or about the construction site without a pass, permit or identification badge approved by the Engineer. The Contractor shall provide such passes, permits or identification badges for his employees, subcontractors and materialmen whenever necessary. Identification badges shall be worn in a conspicuous and clearly visible position by all employees of the Contractor whenever they are working at the construction site.

All persons entering the "Work Area" of asbestos removal shall, in addition to the above, conform to the requirements concerning entry into the "Work Area" contained in the Section(s) of the Specifications pertaining to asbestos removal.

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. PATH 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 PATH and not as a substitute for rights which PATH 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 PATH by any manufacturer shall be deemed to be a limitation upon any rights which PATH 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 - NEW YORK

With respect to the performance of Work in the State of New York:

During the performance of Work at the construction site, the use by the Contractor or his subcontractors of power operated cranes and derricks for hoisting and/or rigging purposes; or for construction, alteration, demolition, excavation and maintenance purposes, including highways or sewers; or for the installation of piles; or for the hoisting or lowering of any article on the outside of any building or structure shall be subject to the approval of the Engineer in accordance with this Section.

- A. Determinations will be made in writing by the Engineer on whether cranes and other such equipment meeting certain criteria shall be exempt from all or part of the requirements herein. Such determinations shall in no way relieve the Contractor from conformance with all applicable requirements of this Section and governing codes including the possession of a valid operator's license subject to verification by the Engineer.
- 1.) The following equipment will be considered for full exemption, which means exempt from B., C., D., E., F., G., H. and I. below:
 - a. Excavating or earth-moving equipment, except cranes used with clamshells.
 - b. Augurs, churn-drills, and other drilling equipment not used for the hoisting of any objects.
 - c. Mobile cranes, including jibs and any other extensions to the boom, exceeding 50 feet but not exceeding 135 feet in length, and with a manufacturer's rated capacity of 3 tons or less used exclusively as a man-basket.
 - d. Hoisting machines permanently mounted on the bed of material delivery trucks that are used exclusively for the loading and unloading of such trucks, provided that the length of boom does not exceed the length of the truck bed by more than 5 feet, and any material transported thereon shall not be raised more than 2 feet in the unloading process.
 - e. Cranes and derricks with a manufacturer's rated capacity of less than 1 ton.
 - f. Mechanics trucks with a hoisting device used in activities associated with the maintenance and repair of construction related equipment.
 - g. Articulating boom cranes that do not have an integral hoisting mechanism and that are used exclusively for the loading and unloading of trucks or trailers, provided that the length of boom does not exceed 135 feet, and that any material transported thereon shall not be raised more than 100 feet in the unloading process.
 - 2.) The following equipment will be considered for Partial Exemption – I, which means exempt from B.4.), C.2.), C.4.) and D. below:
 - a. Cranes with less than 160 feet combined boom/jib length to be used for a period not exceeding 24 hours, operated entirely within Authority property and at a location at least one boom/jib length away from all Authority property.
 - b. Service cranes and clamshells with a boom length of 110 feet or less, to be operated entirely within Authority property and at a location that does not require the moving of any load over a roadway or sidewalk.
 - c. Pile drivers or clamshells operated entirely within Authority property with a soil bearing pressure not exceeding 500 pounds per square foot.
 - d. Mobile cranes, including jibs and any other extensions to the boom, not exceeding 50 feet in length and with a manufacturer's rated capacity of 3 tons or less.
 - 3.) The following equipment will be considered for Partial Exemption – II, which means exempt from B., C. 2.), C. 3.), C. 4.), D., F., G. and I. below:

- a. Articulating/knuckle boom cranes used to hold, support or stabilize material to facilitate construction activity.
 - b. Cranes with a manufacturer's rated capacity of 1 ton or more.
- B. For each crane or derrick not considered fully exempt by the Engineer, submit the following forms to the Engineer prior to delivery of the crane or derrick to the construction site: (See F. below for all forms)
- 1.) A copy of a current and valid Form CD-2, entitled "Crane/Derrick/Mobile Work Platform – Approval and Operation Application/Certificate", Revised 08/15/05, as issued by the New York City Department of Buildings - Cranes & Derricks Division, hereinafter called "NYCDOB-C&D". Form CD-2 shall bear the approval stamp of NYCDOB-C&D as a "Temporary Certificate of Approval/Temporary Certificate of Operation," and shall include an expiration date, a legible CD Number, and an authorized signature from a representative of NYCDOB-C&D. In the event that such approved Form CD-2 is not available, the Contractor shall ensure that the owner of the crane or derrick files a Form CD-2 directly with NYCDOB-C&D. Submit to the Engineer proof of the filing, a copy of the completed Form CD-2, and an "acceptable to operate" inspection report issued by NYCDOB-C&D.
 - 2.) A fully executed Form CD-11, entitled "Equipment Owner Identification Form", Revised 12/03, as issued by NYCDOB-C&D.
 - 3.) A fully executed Form CD-16, Statement of Notification to Community Boards.
 - 4.) A fully executed Form CD-4, entitled "Crane/Derrick/Mobile Work Platform – On-Site Inspection Application/Certificate", Revised 12/03, as issued by NYCDOB-C&D. Form CD-4 shall be accompanied by drawings and calculations, all signed and sealed by a Professional Engineer licensed in the state of New York. The drawings and calculations shall clearly indicate the following:
 - a. Location of each crane or derrick.
 - b. All pertinent features of the site.
 - c. Supporting platforms and structures.
 - d. Swing and reach of each crane or derrick.
 - 5.) If the crane or derrick location is within two hundred feet (200') of an NYC subway line or facility, approval from New York City Transit ("NYCTA") is required prior to the placement, assembly, or erection of the crane or derrick. In such cases, a Certificate of On-Site Inspection cannot be issued without NYCTA written approval.
- Upon the review and acceptance in writing by the Engineer of all of the above submissions, the crane or derrick will be permitted to enter the construction site. Coordinate all such deliveries with the Engineer.
- C. Upon delivery to the construction site for cranes or derricks considered for Full Exemption or Partial Exemption – I or Partial Exemption – II by the Engineer, submit the following to the Engineer in accordance with A. above. For all other cranes or derricks, submit all of the following to the Engineer:

- 1.) Names, classifications, and license numbers of each crane or derrick operator and the master, tower, or climber crane rigger.
- 2.) For cranes or derricks to be operated solely on Authority property, file Form CD-8, entitled "Technical Report – Statement of Responsibility", Revised 12/03, as issued by the NYCDOB-C&D. Form CD-8 shall be completed in its entirety with the exception of Box #5B, and signed and sealed by a Professional Engineer licensed in the state of New York in Box #5A.

Upon review and acceptance by the Engineer of all submitted drawings and associated documentation specified above, the Contractor will be permitted to place and/or assemble the crane or derrick at the construction site, with the exception of tower or climber cranes. For tower or climber cranes, additional submittals and inspections shall be required as specified in 4.) below.

- 3.) For cranes or derricks to be operated on other than Authority property, file all forms, drawings and associated documentation directly with NYCDOB-C&D. Upon the submission to the Engineer of a current and valid "Certificate of On-Site Inspection" as issued by NYCDOB-C&D, will the Contractor be permitted to assemble or erect the crane or derrick at the construction site.
- 4.) For tower or climber cranes, in addition to the documentation in B. and C. above, submit the following to the Engineer:
 - a. A fully executed Form CD-7, entitled "Notification of Erecting or Dismantling of Climber or Tower Crane", Revised 07/07. Form CD-7 shall be accompanied by a copy of the license of each master or tower rigger designated to supervise the erection of the crane and all associated documentation required to ensure compliance with the manufacturer's recommendations. Form CD-7 shall also be accompanied by signed and sealed drawings by a Professional Engineer licensed in the state of New York for the erection, jumping, climbing and dismantling of the tower or climber crane. Documentation and drawings shall include the following:
 - (i) Serial number identification of equipment to be used for all rigging and lifting operations including all machines to be used for erection or dismantling.
 - (ii) Detailed listing of assemblies and components required for erection and dismantling of rigging and lifting equipment, including but not limited to lifting frame, climbing hydraulic cylinders, upper basket, lower basket, outriggers, communication system, tie-downs, dogs, horn, lights and weathervane.
 - (iii) Location of rigging and lifting equipment, assist cranes, sidewalk sheds, surrounding buildings, protection for their roofs and pick-up points, loads, and radius of swing of all loads. In addition, submit to the Engineer the safe load from the crane manufacturer's approved load radius chart for lift radius.

- (iv) Weight list certified by the crane manufacturer listing all assemblies and components to be lifted. All components shall be clearly marked with their weight painted on the assembly, or stamped on metal tags attached to the assembly. In lieu of an equipment manufacturer's certification, submit documentation signed and sealed by a Professional Engineer licensed in the state of New York certifying the weight list and indicating how such weights were determined.
 - (v) Locations of the centers of gravity for all asymmetrical components.
 - (vi) Sequence of operation detailing erection, jumping, climbing and dismantling, along with the rigging materials to be used in such operations.
 - (vii) Written certification by a Professional Engineer licensed in the state of New York that all safety devices on each crane to be used in the erection, jumping, climbing and dismantling operations have been calibrated in accordance with the crane manufacturer's recommendations.
 - (viii) Names, license numbers (as applicable) and contact information for each licensed rigger, rigger foreman, site safety manager, crane safety coordinator and entity performing the erection, jumping, climbing, and/or dismantling Work.
 - (ix) Load test procedure signed and sealed by a Professional Engineer licensed in the state of New York identifying the weights to be used and the load moment and line pull testing to be conducted in accordance with b. below.
- b. A load test shall be conducted on each tower or climbing crane by a Professional Engineer licensed in the state of New York in accordance with the load test procedure submitted under (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. REQUIREMENTS FOR CRANES AND DERRICKS - NEW JERSEY

With respect to the performance of Work in the State of New Jersey:

During the performance of Work at the construction site, the use by the Contractor or his subcontractors of power-operated equipment that can hoist, lower and horizontally move a suspended load as specified in Federal Register Part II, Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1926 Cranes and Derricks in Construction; Final Rule (OSHA), shall be subject to the approval of the Engineer in accordance with this Section.

- A. General requirements
 - 1.) Cranes shall be operated by certified and licensed crane operators. A certified and licensed crane operator shall receive and maintain the following:
 - a. Certificate from the National Commission for the Certification of Crane Operators (NCCCO), or other crane operator certification program found by the New Jersey Department of Labor Crane Operators License Advisory Board to offer an equivalent testing and certification program.
 - b. Crane license issued by the Office of Safety Compliance, certified in one of the following:
 - (i) "Lattice boom truck crane" or "LBT" shall mean a crane consisting of a superstructure mounted on an automotive truck as a base and a means of travel.
 - (ii) "Lattice boom crawler crane" or "LBC" shall mean a crane consisting of a superstructure mounted on a base with crawler treads as a means of travel.
 - (iii) "Small telescoping boom crane" or "TSS" shall mean a crane with extendable and retractable boom mounted on an automotive truck as a base and a means of travel and with a manufacturer's load rating of less than 17.5 tons.

- (iv) "Large telescoping boom crane" or "TLL" shall mean a crane with extendable and retractable boom mounted on an automotive truck as a base and a means of travel and with a manufacturer's load rating of 17.5 tons or more.
 - c. Medical certificate that meets the requirements of the American Society of Mechanical Engineers Safety Standard B30.5-2007.
 - 2.) Determinations will be made in writing by the Engineer on whether cranes and other such equipment meeting OSHA 1926.1400 Scope section (c) entitled "Exclusions" shall be exempt from the requirements herein. Such determinations shall in no way relieve the Contractor from conformance with all applicable requirements of this Section and governing codes.
- B. For each crane, submit the following to the Engineer prior to delivery of the crane to the construction site:
- 1.) Equipment Owner Identification and Equipment User Identification.
 - 2.) Drawings clearly indicating location of each crane or derrick, all pertinent features of the site, and supporting platforms and structures.
 - 3.) Name of competent person as outlined in Federal Register Part II, Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1926 Cranes and Derricks in Construction: Final Rule (OSHA).
 - 4.) Monthly and annual crane inspection reports. Attached to such records of inspection shall be a written designation naming the competent person identified in B. 3.) above, signed by the owner or lessee of the crane.
 - 5.) High wind (50 MPH and over) emergency plan.
 - 6.) Name of qualified person as defined in Federal Register Part II, Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1926 Cranes and Derricks in Construction; Final Rule (OSHA). Any OSHA requirement requesting certification by a Professional Engineer shall be fulfilled by a Professional Engineer licensed to practice in the State of New Jersey.

Upon the review and acceptance in writing by the Engineer of all of the above submissions, the Contractor will be permitted to deliver, place and/or assemble the crane at the construction site. Coordinate all such deliveries, placements and/or assemblies with the Engineer.

- C. Requirements for cranes upon delivery to the construction site:
- 1.) Submit a valid certificate of competence to operate a crane and classifications for the operator to the Engineer.
 - 2.) Submit rigger's qualifications to the Engineer.
- D. Requirements for inspection and operation of cranes at the construction site:
- 1.) Crane ropes shall be inspected on a daily and monthly basis and copies of the monthly inspection reports shall be stored in the crane cab.

- 2.) Should the monthly or yearly inspection expire while the crane or derrick is located at the construction site, the Contractor shall ensure that the owner of the crane or derrick performs the monthly and /or annual inspection. Submit proof of the inspection to the Engineer.
- 3.) Pre-lift meetings shall be held in accordance with Federal Register Part II, Department of Labor, Occupational Safety and Health Administration, 29 CFR Part 1926 Cranes and Derricks in Construction; Final Rule (OSHA). Submit pre-lift meeting minutes to the Engineer.
- E. The estimated review time for all crane and derrick submissions to the Engineer is five (5) business days. If the Contractor has not received any reply by the fourth day of the review, contact the Engineer.
- F. If any governing agency issues a letter of deficiency to the Authority or stop work order to the Contractor while the crane or derrick is located at the construction site, the Contractor shall cooperate fully with the governing agency to ensure that all acceptable corrective actions will be taken immediately. Keep the Engineer advised during the performance of all remedial Work.
- G. Cranes or derricks performing an emergency use pursuant to an order or direction issued by the Engineer shall be exempt from the submission requirements herein except for the requirements specified in B. 4.) and C. 1.) above.

102. 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.

Heat is available at the construction site for the Contractor's use without charge subject to such conditions and precautions upon its use as may be imposed by the Engineer. PATH will pay the cost for fuel consumed by use of the existing system(s). Provide connections to existing facilities, and extend as required to maintain environmental conditions to facilitate progress of the Work and to protect materials and finishes from damage due to temperature and humidity. Supplement with temporary heating units, if required. Such temporary units, if used, shall be vented self-contained units with individual space thermostatic control, shall be UL tested and approved for the fuel being consumed, shall be installed in accordance with ANSI A10.10 "Safety Requirements for Temporary and Portable Space Heating Devices and Equipment Used in the Construction Industry" and be approved by the Engineer. Use of gasoline burning space heaters, open flame, or salamander type heating units is prohibited. The Contractor shall pay all costs of installation, maintenance, operation, removal and for fuel consumed for supplemental temporary heating units.

Electricity is available at the construction site for the Contractor's use, subject to such conditions and precautions upon its use as may be imposed by the Engineer. PATH will pay the cost of power used. Provide connections to existing facilities and size to provide service required for small tools and lighting. Install circuit and branch wiring with ground-fault protection, with area distribution boxes for plug-in connection of construction-type power cords. The Contractor shall pay all costs of installation, maintenance, operation and removal of temporary service connections.

Water for construction purposes is available at the construction site, subject to such conditions and precautions upon its use as may be imposed by the Engineer. PATH will pay the cost for water used. Provide connections to existing facilities, and extend with branch piping, taps and hoses as required. Protect piping and fittings against freezing. The Contractor shall pay all costs of installation, maintenance, operation and removal for temporary service connections.

103. TEMPORARY SANITARY FACILITIES

PATH will permit use of existing toilet facilities at the construction site at the locations(s) shown on the Contract Drawings, or if not shown, as designated by the Engineer. The Contractor shall supply all disposable materials and clean and maintain such facilities in a manner acceptable to the Engineer.

104. ASBESTOS COST SUMMARY SUBMITTAL

Upon satisfactory completion of asbestos removal Work under this Contract, submit a Summary of Asbestos Removal and Disposal Costs on the form bound herewith, with all spaces filled in without exception. Such summary shall include costs associated with the Work computed in accordance with the stipulations of the clauses contained in CHAPTER II of the Form of Contract.

For purposes of completing such Summary of Asbestos Removal and Disposal Costs, the specific locations of asbestos removal and disposal are:

1. See Contract Drawings N001 through N012

**THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY
SUMMARY OF ASBESTOS REMOVAL AND DISPOSAL COSTS
(FOR COMPLETED WORK)**

CONTRACTOR _____ CONTRACT NO. PAT-624.154
 DATE _____
 FACILITY TITLE: PATH _____
 SPECIFIC LOCATION OF REMOVAL _____

ITEM DESCRIPTION	ASBESTOS CONTAINING MATERIALS ²⁵		
	Sprayed-on ²⁶	Pipe and Boiler Insulation ²⁷	Miscellaneous ²⁸
Removal ²⁹			
Encapsulation ³⁰			
Enclosures ³¹			
Insurance ³²			
Replacement of Removed ACM ³³			
Clean up ³⁴			
On-site Monitoring of Abatement ³⁵			
Disposal of ACM ³⁶			
Purchase of Capital Equipment ³⁷			
Purchase of Protective Equipment ³⁸			
TOTALS:			

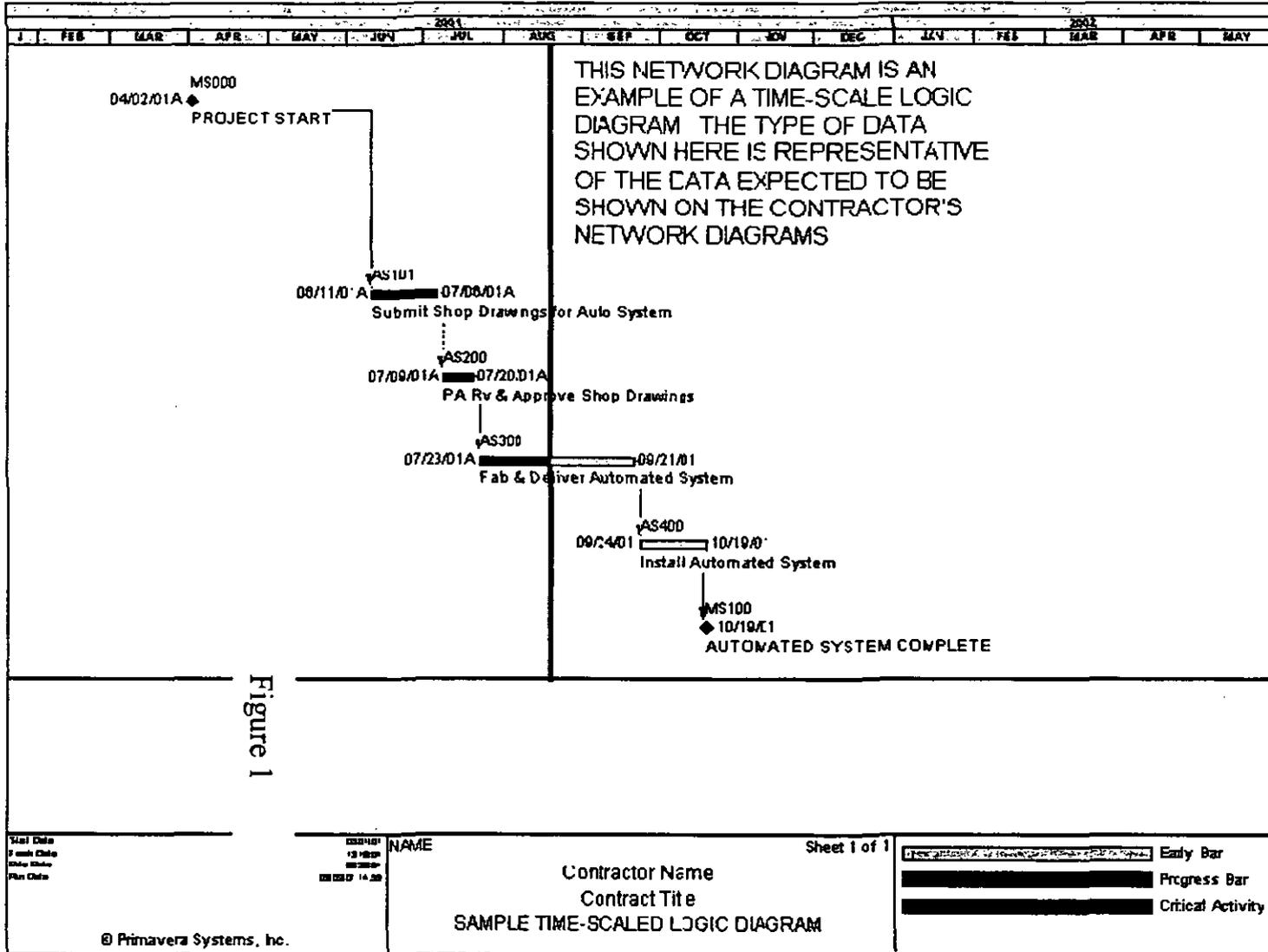
- ²⁵ Where a particular type of asbestos containing material (ACM) is not present in the specific removal location described above, cross out ACM description and fill in NA (Not Applicable) for the associated description items.
- ²⁶ Sprayed-on and trowelled-on fireproofing, acoustical plasters, simulated acoustical plasters, textures and other ACM such as those found on ceiling systems, fireproofing systems and structural steel.
- ²⁷ Insulation or treatment on pipes, fittings, elbows, boilers, breachings, ducts, tanks or other mechanical equipment.
- ²⁸ Specify as to type of material, i.e.; surface treatments such as floor and ceiling tiles, roofing materials, refractory insulation and structural insulation, electrical cable, asbestos cloth, "Transite" board, exterior siding/shingles, tape, roll board, brake shoes, or other asbestos containing items.
- ²⁹ Include actual labor costs for removal of asbestos containing material.
- ³⁰ Include actual labor costs for encapsulation of asbestos containing material.
- ³¹ Include actual labor costs for enclosure of asbestos containing material.
- ³² Include all premiums directly related to Work of this Contract only.
- ³³ Include actual labor costs for re-insulating, re-wrapping with substitute material and actual material cost.
- ³⁴ Include actual labor costs for, e.g., HEPA vacuuming, assembly of discarded materials and abated asbestos at Work site and preparation of materials for disposal.
- ³⁵ Include actual costs of air monitoring and analysis.
- ³⁶ Include actual costs for hauling and disposal in accordance with applicable Specification Sections.
- ³⁷ Include actual costs for purchase of capital equipment, e.g., negative air pumps and tools, if directly related to this Contract.
- ³⁸ Include actual costs for purchase of protective equipment, e.g., "Tyvek" suits, masks, HEPA filters, amended water, and plastic sheeting if directly related to this Contract.

105. PROGRESS SCHEDULE

A. Schedule Requirements

- 1.) The Contractor shall, at his own expense, prepare, maintain and update detailed electronic progress schedules for the Engineer's review and approval. All submittals required herein shall be in the form and content stipulated in this Section. Each progress schedule shall bear the signature of the Contractor's authorized representative. The progress schedules/graphics required by this Contract shall be produced using the latest version of Oracle – Primavera P6 scheduling software.
- 2.) The schedule shall be prepared by a scheduler who is an employee of the Contractor with 3 (three) years minimum experience in the development and updating of Critical Path Method schedule networks for projects of a complexity comparable to this Contract, or by an outside entity with similar experience specializing in project controls. The Contractor's senior management personnel shall actively participate in the development and updating of the schedule.
- 3.) Progress schedules shall be sufficiently detailed to accurately depict all the Work and milestones (including acquisition of any required permits, design progress, procurement of subcontractors, key submittals and approvals, materials procurement and construction activities performed by the Contractor and his subcontractors) and shall graphically represent the logical sequence and duration of activities, all in accordance with the requirements of the Contract. The information provided in progress schedules shall also include, but not be limited to, the interdependencies between the Contractors' Activities and all other Activities required for the successful completion of the Contract, e.g., those to be performed by utility companies or by other entities. All Milestone dates specified in the Contract shall be represented in the schedule by Milestone activities that are logically interrelated to the Work that must be accomplished in order to achieve the Milestone.
- 4.) All activities, except the Contract Start Milestone and Contract Completion Milestone shall be linked to predecessor(s) and successor(s).
- 5.) The Contractor's schedule shall incorporate the Activity Code Structure shown in Attachment A, and such other coding as may be required by the Engineer.
- 6.) The Contractor shall load construction activities with budget information and shall identify the cost to perform Work for each construction and management activity. The sum of the costs assigned to all activities shall be equal to the Contract value. No activity costs shall be assigned to the preparation and review of submittals and materials fabrication or procurement.
- 7.) To assist the Contractor in preparing its progress schedule, a sample Network Diagram is shown in Figure 1. The sample is intended merely as an example of a format for the Contractor's guidance. The types of data shown are the types of data expected to be shown on the Contractor's Network Diagram. However, the information presented in the sample Network Diagram shall not be misinterpreted as either representing a plan for the Contractor's Network Diagram or a depiction of the level of detail which will be required in such diagram.

- 8.) The submittal of Progress Schedules under this Section shall not be deemed to be a substitute for the reporting requirements of the Section of Division 1 entitled "Daily Progress, Equipment and Labor Reports".



B. Schedule Terminology

Schedule terminology used in this Contract shall have the meaning described below:

- 1.) **Activity:** A discrete item of Work with a Duration that can be clearly defined; a synonym for task. Unless otherwise permitted in writing by the Engineer, an activity's duration shall be not more than 14 calendar days or 10 working days except for non-construction activities, such as procurement cycles, material delivery, soil consolidation, etc. Each activity (task) description shall clearly identify the Work to be performed. No two or more activities in the schedule shall have exactly the same description.
- 2.) **Activity Codes:** Activity Codes allow each activity to be grouped into specific classifications such as area, responsibility, phase, system, or location. The codes consist of specific values and descriptive titles that are entered into the data dictionary of the scheduling software. Activities shall be assigned specific Activity Codes as appropriate.
- 3.) **Alternative Solutions:** Analyses of various options for dealing with encountered or anticipated Contract problems. Alternative solutions shall be developed to assist in determining the best method(s) of preventing or correcting any impediments to the progress of the Work. Alternative Solutions analysis shall indicate impacts on scheduling and resources.
- 4.) **Analysis Report:** A report that displays the impacts of all variances reported in the Current Progress Schedule. The Analysis Report focuses attention on the impacts of variances between planned and actual performance, so as to support an assessment of such impacts. The Analysis Report shall include Alternative Solutions.
- 5.) **Bar Chart:** A schedule display designed to complement the Network Diagram. The Bar Chart is a traditional Gantt chart to which the Early Start Dates, Early Finish Dates, Late Start Dates, Late Finish Dates and Critical Path have been added.
- 6.) **Calendar:** A calendar defines when Work on an activity can occur (i.e. Mon – Fri for a standard Work week). Activities shall be assigned to a calendar that represents the planned Work days. The calendar shall incorporate the Authority holidays listed below. The use of multiple calendars will be permitted.

New Year's Day
Martin Luther King, Jr. Day
Presidents' Day
Memorial Day
Independence Day
Labor Day

Columbus Day
Veterans Day
Thanksgiving Day
Day After Thanksgiving
Christmas Day

- 7.) **Constraint:** A constraint is a restriction imposed on the start or finish of an activity or the Contract. An example of the use of constraints is the imposition of a "finish no later than" constraint³⁹ on the Contract Completion Milestone that is equal to the Contract completion date. This constraint facilitates the identification of activities that control or do not support the completion date. Constraints shall be limited to start and finish constraints on milestone activities that represent critical Contract dates, unless otherwise approved by the Engineer in writing.
- 8.) **Critical Path:** The longest path through the network in estimated total elapsed time from the start of the first Activity through the completion of the last Activity. The Critical Path consists of a series of Activities which must be completed on their scheduled completion dates in order for the Contract to be completed on schedule.
- 9.) **Current Progress Schedule:** The most recent progress schedule which has been approved by the Engineer. The Original Baseline Schedule shall be referred to as "Revision 0". Each time a different Current Progress Schedule is accepted by the Engineer, the revision number shall be increased by 1 and the old schedule shall be electronically archived so as to permit an audit trail.
- 10.) **Duration:** The estimated and/or actual length of time required to fully perform a specific Activity. The Duration for construction activities shall be expressed in Work days.
- 11.) **Early Finish Date:** The date upon which an Activity can be completed if it is begun on the Early Start Date.
- 12.) **Early Start Date:** The earliest date upon which an Activity can begin.
- 13.) **Hammock:** A hammock activity summarizing the early and late dates of a set of activities is used for reporting durations of groups of important activities. An activity shall be designated as a hammock by selecting Hammock as the activity type in the Primavera activity form.
- 14.) **Lag:** The interval between the completion of a Predecessor Activity and the start of a Successor Activity. For example, ten days of positive Lag will cause the Successor Activity to begin ten days after the Predecessor Activity has been completed. Negative Lag will cause the Activities to overlap. The amount of Lag between each Activity shall be clearly represented on the Network Diagram.
- 15.) **Late Finish Date:** The latest date by which an Activity shall be completed if the succeeding Activity is to be started on schedule.
- 16.) **Late Start Date:** The latest date by which an Activity shall be started to allow completion by the Late Finish Date.
- 17.) **Milestone:** A significant point in the performance of the Work. A milestone has no Duration, and represents the start of a portion of the Work or the completion of a portion of the Work. A milestone may also represent either the beginning or the completion of a task or action being performed by entities other than the Contractor (e.g., obtaining a permit, notification to proceed with certain Work, etc.).

³⁹ A late finish or "finish no later than" constraint limits the latest time an activity can complete

- 18.) **Negative Float:** The amount of time that the planned completion date of an Activity is later than its required (Late Finish) date. An Activity with Negative Float must be completed ahead of schedule if the Work is to be completed on time. Negative Float usually indicates the need for corrective and/or preventive action to complete the Work on schedule.
- 19.) **Network Diagram:** A logic diagram prepared according to the Precedence Diagram Method, which displays each Activity required for the performance of the Contract in the sequence in which it is to be performed with appropriate logic ties between activities displayed.
- 20.) **Original Baseline Schedule:** The detailed progress schedule first approved by the Engineer as specified herein. All performance of Work will be measured against the Original Baseline Schedule.
- 21.) **Precedence Diagram Method (PDM):** A particular type of graphic representation of all Activities and Constraints. The Activities are represented by nodes; the Constraints are represented by lines between nodes. A sample PDM Network Diagram is shown in Figure 1 of this Section.
- 22.) **Predecessor Activity:** The partial or full completion of an Activity which is a prerequisite to commencement of another Activity.
- 23.) **Relationship:** A logic tie between two activities representing restrictions on the start or completion of the subsequent activity. Relationships may cause either positive or negative lag. The four basic types of relationships are finish to start, start to start, finish to finish and start to finish.
- 24.) **Successor Activity:** An Activity which cannot be started or completed without the prior partial or full completion of a Predecessor Activity.
- 25.) **Total Float:** The amount of time by which an Activity or series of Activities may be delayed without affecting the date of completion of the Work. Total Float is not for exclusive use or benefit of either the Contractor or the Authority but shall be used for the benefit of the Work in such manner as the Engineer may in his discretion decide. Use of float suppression and manipulation techniques, such as preferential sequencing, lag logic restraints, inflated activity duration and/or constrained dates, other than as may be required by the Contract, shall be cause for rejection of the Original Baseline Schedule and any subsequent schedule revisions and updates.

C. Schedule Submittal, Review & Approval Process

1.) Baseline Schedule

- a. Within forty five (45) calendar days of the acceptance of the Contractor's Proposal, the Contractor shall submit a proposed Baseline Schedule containing the Contractor's projected plan and schedule to complete all Work required by the Contract within the time(s) for completion required by the Contract. A schedule showing time(s) for completion later than those required by the Contract will not be accepted.

- b. The Engineer will review the Baseline Schedule and return it to the Contractor with comments, or accept it as the Original Baseline Schedule, within fifteen (15) calendar days. The Contractor shall participate in any meetings called to resolve issues with the schedule.
- c. If it is not accepted, the Contractor shall revise the Baseline Schedule in accordance with the Engineer's comments and resubmit it for the Engineer's approval within fifteen (15) calendar days of the receipt by the Contractor of the Engineer's comments. Until such time as acceptance of the Baseline Schedule by the Engineer, the Contractor shall continue to resubmit the Baseline Schedule as directed by the Engineer within the same time frame and in the same format as the initial resubmission.
- d. After the approval of the Original Baseline Schedule, no changes shall be made therein without the written approval of the Engineer. No other act or omission on the part of the Engineer shall be deemed to constitute such approval. The Contractor shall not be entitled to any damages by reason of the failure of the Engineer to give timely approval or comments on any progress schedule submitted hereunder.

2.) Progress Schedule Updates

- a. The Contractor shall submit to the Engineer not less frequently than once a month, on a date specified by the Engineer, an updated Current Progress Schedule. The Engineer may require that the Contractor also include scheduling updates with his monthly payment request. Schedule updates shall status the actual performance and progress of the Work and depict any changes. Schedule updates where early start or early finish of any activity is positioned on the data line but not actualized will not be approved.
- b. If directed by the Engineer, within seven (7) calendar days after receipt by the Engineer of a updated progress schedule, the Contractor shall meet with the Engineer for the purpose of reviewing and obtaining the Engineer's approval of it.
- c. The Engineer may require the Contractor to furnish a revised update which shall include any other information he may request to assist him in evaluating the Contractor's progress, including but not limited to manpower loading charts and equipment schedules; "what-if" analysis performed in a copy of the current progress schedule, etc.
- d. In the event that the Engineer requests the Contractor to revise the updated schedule submitted, and/or to submit such additional information, the Contractor shall make the requested revisions and/or submit the updated schedule to the Engineer for approval along with the additional information requested within seven (7) calendar days of the Engineer's request.

D. Schedule Reporting Requirements

- 1.) The Original Baseline Schedule submittal shall include the following:
 - a. One PDF printout file and one Primavera file submitted electronically.
 - b. Six copies of the following output reports:

- c.
 - (i) A Schedule narrative in writing that provides a general description of the Contractor's approach to meeting the Contract goals and the Critical Path.
 - (ii) Explanation for any constrained dates.
 - (iii) A time-scale logic diagram in PDM format containing all activities displaying Activity ID, Activity Description, Calendar, original and remaining durations, percent complete, Early Dates and Total Float, and sorted by:
 - (a.) Early Start, Total Float
 - (b.) Total Float, Early Start (Critical Path report)
 - d. Supporting data showing all activities with their associated cost, budgets or estimates.
 - e. The Contractor shall electronically archive all accepted schedules.
- 2.) In addition to the reports required for the Baseline Schedule submittal, all Progress Schedule Update Reports shall include the following:
- a. A narrative comparing the current Dates to the respective Milestone Dates, describing the physical progress during the current report period, explaining plans for continuing the Work during the next report period and describing and explaining changes in crewing and construction equipment. The narrative shall also explain changes in Activity durations, logic ties and Activity Values and the reason why the changes were made.
 - b. Whenever there is any delay or negative float prediction in the schedule, the Contractor shall submit an alternative solutions report that describes the delay, explains when it started and finished or is expected to finish and the basis for those dates and lists the affected schedule activities by activity ID, and he shall present reasons for the delay. Any revisions to durations or the logical sequence of Activities made to reflect these delays shall be explained. The report shall include proposed schedule recovery efforts such as multiple shifts or overtime to mitigate any potential delay to the overall Contract completion date, or request an extension of time, as appropriate.
 - c. Critical Path Analysis.
 - d. An Analysis Report indicating Activities and/or Milestones which are behind schedule by at least 30 calendar days (commonly evidenced by Negative Float).
 - e. A report that compares the Current Progress Schedule update with the Original Baseline Schedule and prior month's accepted schedule update and lists all changes made to the schedule.

E. General Schedule Provisions

- 1.) Should the Contractor fail to comply with any provision of this Section, The Engineer shall have the right in his discretion to withhold out of any payment (final or otherwise and even though such payment has already been certified as due) such sums as he deems necessary or desirable, all as more fully provided in the clause of the Form of Contract entitled "Withholding of Payments".

- 2.) Neither the acceptance, review or approval of any progress schedule or other data submitted by the Contractor pursuant to this Section, nor any other action on the part of the Engineer under this Section shall in any way be deemed to be a representation by the Engineer that the Contractor may or will be permitted to follow a particular schedule or sequence of operations or that by following any such schedule or sequence he may or will complete the Work by the time(s) required by the Contract or by any other time(s). Nor shall the approval of any progress schedule or other such data relieve the Contractor of his obligation to complete the Contract by the time(s) required in the Contract, even though the schedule may be inconsistent with such completion.
- 3.) Any approval under this Section shall be construed merely to mean that the Engineer knew of no good reason at that time to object thereto. No acceptance, review or approval or any other action under this Section shall limit, affect or impair the Contractor's obligation to perform all Work by time(s) required by the Contract and in accordance with all other provisions of the Contract.
- 4.) The performance of the Work by the time(s) required in the Contract, after taking into account extensions to which the Contractor may be entitled under the clause of the Form of Contract entitled "Extensions of Time", may require the Contractor to perform the Work using overtime labor, additional shifts or additional plant and equipment and/or other measures at no additional cost to the Authority. The Contractor shall anticipate, avoid and mitigate the effects of all delays.
- 5.) The Engineer shall have the right at any time when in his judgment the Work is not proceeding in accordance with the approved progress schedule or at any time when it is likely that the Work might not be completed by the time(s) required in the Form of 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 necessary or required to assure the completion within the time(s) shown in the accepted schedule.
- 6.) No action on the part of the Contractor pursuant to this Section shall be construed as a request by him for an extension of the time(s) for completion required by the Contract. A request for an extension of time shall be deemed made only if it complies with the requirements of the clause of the Form of Contract entitled "Extensions of Time". No extension of the time(s) for completion shall be inferred because of any action, omission to act, or statement on behalf of the Engineer pursuant to this Section. Extension of time, if any, shall be granted only pursuant to the clause of the Form of Contract entitled "Extensions of Time".
- 7.) The Contractor acknowledges and agrees that he is not entitled to an extension of time for impacts that do not extend the contractual end date of the Contract.

ATTACHMENT A

MANDATORY ACTIVITY CODE STRUCTURE

- 1.) Responsibility (Authority, Contractor)
- 2.) Area (building, floor or area)
- 3.) Trade/CSI code (concrete, steel, etc as required)
- 4.) Location (3rd Fl, etc)
- 5.) Phase of Work, if applicable
- 6.) Change Order work, if applicable
- 7.) Other, as required by the Engineer

PRIMAVERA PROJECT PLANNER

Date 01/02/0 -----ACTIVITY CODES DICTIONARY----- Page 1

NAME - Project Title

CODE	VALUE	TITLE	SEQUENCE
------	-------	-------	----------

Activity Codes:

RESP	Responsibility		
	AI	Architect/Engineer	
	C	Contractor	
	O	Port Authority	
AREA	Area		
	G	General Area	1
	CTL	Air Traffic Control Tower	2
MILE	Milestone		
CSI	Trade/CSI Code		
	03000	Concrete	
	04000	Masonry	
	07000	Thermal & Moisture Protection	
	15000	Mechanical	
	16000	Electrical	
LOCN	Location		
PHAS	Phase		
	D	Design	1
	P	Procurement	2
	C	Construction	3
CO	Change Order Wor		
OTH	As Req'd by Engr		

106. 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 PATH 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.

107. PERMIT AND REQUIREMENTS FOR CONFINED SPACES ENTRY

Notify the Engineer one week prior to commencement of operations within locations designated as Permit Required Confined Spaces on the Contract Drawings and/or Specifications and obtain from the Engineer Form PA 3745C entitled "The Port Authority of NY & NJ - Contractor Permit Required Confined Space Notification". Execute such form and submit it to the Engineer along with two copies of the Contractor's Confined Space Entry Program, at least forty-eight hours prior to commencing operations within the Permit Required Confined Spaces.

Unless otherwise approved by the Engineer, all operations shall be performed in accordance with the conditions forming a part of said permit. The Authority will issue this permit to the Contractor without payment of a fee. Each such permit shall be valid for the duration stated in the permit and shall be returned to the Engineer upon completion of operations or at the expiration of permit validity. A copy of Form PA 3745C is appended to this numbered Section.

THE PORT AUTHORITY OF NY & NJ

FACILITY: _____

CONTRACTOR PERMIT REQUIRED CONFINED SPACE NOTIFICATION

Hand print in ink. (See instructions)

Requested By:		Company Name/Telephone Number:	
Print Name	Signature	Contract Number	
Exact Location of Confined Space:			
Purpose of Entry:			
Prepared By:		Date:	
Chief Maintenance Supervisor/Designee (CMS/D)			
Print Name		Signature	
In accordance with 29 CFR 1910.146 (c) (8) (i) the issuance of this form explicitly states that the ensuing work involves entry into a Permit-Required Confined Space. Entry into this space is allowed only through compliance with the OSHA standard Permit-Required Confined Spaces, 29 CFR 1910.146.			

A copy of this form shall be given or faxed (with verification of receipt) to the Police desk and/or Communications desk, and the local PAPD Tour Commander to alert personnel of work being performed in a PRCS:

PRE-ENTRY CHECKLIST					
	YES	N/A		YES	N/A
Contractor informed of the elements, including the hazards identified that make the space permit required	<input type="checkbox"/>	<input type="checkbox"/>	Contractor personnel and Port Authority personnel will be working in or near permit spaces requiring joint entry operations	<input type="checkbox"/>	<input type="checkbox"/>
Contractor informed of precautions or procedures implemented for the protection of employees.	<input type="checkbox"/>	<input type="checkbox"/>	Contractor has obtained available information regarding permit space hazards and entry operations	<input type="checkbox"/>	<input type="checkbox"/>

IN THE EVENT OF AN EMERGENCY CONTACT:	
(COMPLETED BY CHIEF MAINTENANCE SUPERVISOR/DESIGNEE)	
1. Your name and company name. 2. Location, including cross streets. 3. Phone number from which you are calling. 4. This is a confined space operations. You need a rescue service.	5. Number of victims; conditions of victims if known. 6. Type of entry (manhole, door, etc.). 7. Any known conditions in the space (gas readings, flooding)

I UNDERSTAND THE ABOVE INFORMATION AND WILL ADHERE TO ALL RULES AND REGULATIONS MANDATED BY THE OSHA STANDARD FOR PERMIT REQUIRED CONFINED SPACES.

Print Full Name/Title Contractor Representative	Signature/Contract Number	Date
THE CONTRACTOR IS OBLIGED TO INFORM THE PORT AUTHORITY OF ANY HAZARD CONFRONTED OR CREATED IN THE PERMIT SPACE BY USING THE SPACE BELOW.		

Distribution: Copy 1. Completed PA 3745C and completed Contractor's Permit to Risk Management, PATC 43.

Copy 2. Retained by Facility CSM/D.

THE PORT AUTHORITY OF NY & NJ

PERMIT REQUIRED CONFINED SPACE RULES

1. No work shall be performed in any designated Permit Required Confined Space (PRCS) without acknowledgement by the Chief Maintenance Supervisor or his/her designee.
2. Contractors must complete the reverse side of this notification document and ensure that all contract personnel or subcontractor personnel are equipped and trained in accordance with OSHA 29 CFR 1910.146
3. Contractors will ensure monitoring is performed prior to entry into a PRCS. A copy of the contractors confined space entry permit shall be prominently posted outside or above the work site for the duration of the job.
4. Contractors are reminded that should the nature of the work being performed in the permit required confined space change or if all the employees working change during the performance of the task described on the contractor's permit, a new revised notification document and contractor's permit is necessary.

CONTRACTORS SAFETY PRECAUTIONS AND REQUIREMENTS

1. The contractor must provide a copy of its Confined Space Entry Program that meets or exceeds OSHA confined space entry requirements to the Facility Manager or the Chief Maintenance Supervisor and/or the Resident Engineer Office Construction Inspectors prior to the commencement of work. The contractor is responsible for furnishing all necessary equipment including monitoring devices, and the required Confined Space Entry Permit required under 29 CFR 1910.146. The contractor's Permit Required Confined Space Entry Permit is to be posted in a conspicuous manner prior to entering the Port Authority Permit Required Confined Space (PRCS).
2. The contractor must assure that all safety precautions and requirements are implemented prior to the commencement of work inside the PRCS. Examples of these safety precautions and requirements are appropriate site protection, air monitoring prior to and while inside the permit space, appropriate ventilation equipment is utilized, electrical and mechanical systems have been de-energized and locked/tagged out and all other appropriate personal protective equipment (PPE) is furnished and utilized by contract personnel.
3. The contractor is responsible for making notifications to the Port Authority High Tension System Operator to coordinate activities if necessary.
4. Neither this notification document nor any act or omission of the Port Authority shall be construed to impair the obligations of any person under or in connection with any agreement or contract with the Port Authority or in connection with the work done.
5. The contractor shall not do or permit to be done any act or thing which will invalidate or conflict with any insurance policy covering any area which the Contractor enters upon, and the Contractor shall promptly observe, comply with and execute the provisions of any and all present and future rules, regulations, orders, and directions of the New York Board of Fire Underwriters, New York Fire Insurance Exchange, or if the work area is located in New Jersey, the National Board of Fire Underwriters, the Fire Insurance Rating

Organization of New Jersey, or of any other board or organization exercising or which may exercise, similar functions which may pertain or apply to the operations of the Contractor hereunder.

6. The contractor fully understands that certain areas owned or leased to the Port Authority are in turn leased or licensed to third parties. In the event that the contractor's work requires access to any of these areas arrangements must be made with the Port Authority property representative at the facility.
7. The contractor shall observe and obey (and compel its officers, members, employees, agents subcontractors, and other persons doing business with it to observe and obey the present and future "Rules and Regulations" of the Port Authority, and all Federal, State, County and Municipal rules, regulations and guidelines and laws.
8. Work being performed in PRCS is subject to immediate suspension by the Port Authority upon oral or written notice if, in the opinion of the Port Authority Resident Engineer's Office staff or Safety Inspectors/Engineers, such action is deemed justifiable to protect life or property.
9. Upon completion of work or when shift ends, the contractor shall return their cancelled entry permit to a Port Authority Representative.

108. PATH OPERATIONS AND CONDITIONS

A. Construction Site Conditions:

- 1.) Schedule and perform the Work in the sequence shown on the Contract Drawings, if any, in such a manner as not to delay, endanger, or interfere with PATH operations. To the extent feasible the scheduled sequence, if any, and the times of the Contractor's operations, once approved, will be adhered to and operations of PATH and others will be scheduled to cause the least interference with the Contractor's operations. However, should the Engineer deem that any portion of the area in which the Contractor is working is required by PATH, the Contractor will be required to suspend operations and remove personnel, and obstructing plant, equipment and materials from such areas, within 1/2 hour of notice to suspend operations and stand by, if necessary, until directed by the Engineer to resume operations in such areas.
- 2.) Should the Contractor be specifically directed to suspend operations as provided in A.1 above, and if solely because of such direction and not due to fault of the Contractor, 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 the Contractor suspend or cancel scheduled work previously approved at PATH's monthly track access coordination meetings on less than 24 hours written notice, compensation to the Contractor will be adjusted as provided under section paragraph entitled "Coordination Rescheduling or Cancellation" herein. Should the Contractor suspend or cancel scheduled work previously approved at PATH's monthly track access coordination meetings by written notice at least 24 hours prior to the start of work, compensation to the Contractor will not be adjusted. In either case, an extension of time of completion will not be considered.
- 3.) To enable the Contractor to plan Work of the Contract, and to enable PATH to plan train service operations, maintenance operations, and operations of others, prepare and submit for approval in accordance with "Coordination" hereof, a weekly schedule of operations for Work of the Contract.
- 4.) 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.
- 5.) Take all precautions necessary for protection of persons and property during dust or fragment generating operations, concrete mixing or placing, painting or other operations, which may stain, soil or damage property, or injure persons. Provide and erect waterproof, fire-resistant, UL labeled tarpaulins with flame spread rating of 15 or less or other protective enclosures as approved by the Engineer.
- 6.) The Contractor, employees of the Contractor, subcontractors, materialmen or other persons over whom the Contractor has control (herein after in this Section "Contractors' Personnel") shall conform to the following:

- a. Do not park any vehicles, including construction vehicles, company vehicles or personal vehicles within any area of PATH property without prior approval of the Engineer, and no representation is made that parking, if approved, will be available throughout the Work of the Contract.
 - b. Do not enter upon PATH right-of-way unless PATH flaggers assigned to the Contractor are present.
 - c. Do not enter upon PATH right-of-way or platforms unless Engineer is present.
 - d. Do not permit material, equipment or other objects to lie within or project into the PATH right-of-way.
 - e. Provide sound suppression devices on gasoline and diesel powered construction equipment and pneumatic tools as required to maintain noise exposure below the limits specified in the Code of Federal Regulations (CFR) 29 CFR 1926 Occupational Safety and Health Regulations for Construction (OSHA). Maintain such sound suppression devices in proper operating condition throughout the time of their use, make adjustments, and repair as required to maintain noise within exposure levels stipulated in 29 CFR 1926.52, Table D-2.
 - f. Do not store combustible products or flammable materials at areas of Work.
- 7.) Restrict smoking to areas designated by the Engineer for this purpose.
 - 8.) At all times while performing Work, require workers to wear reflective safety vests, hard hats and boots with non-slip type soles. Reflective safety vests shall have a visible reflective surface of not less than 100 square inches on front and back.
 - 9.) Do not burn or bury debris of any type on PATH property, or wash waste materials down sewers or into waterways.
 - 10.) In the event of damage to or disruption of existing construction, structure, systems or equipment the Contractor shall repair, replace or reinstall such construction, structure, and/or systems to the satisfaction of the Engineer. Should the Contractor fail to perform such repair or replacement, PATH reserves the right to perform such Work and deduct from the Contractor's compensation an amount representing the cost of such Work, as determined by the Engineer.
 - 11.) In addition to the requirements of the Section of Division 1 GENERAL PROVISIONS entitled "Safety Provisions", provide and maintain at areas of Work, two "Pyrene 95-P20M" extinguishers as manufactured by RC Industries, Inc., Linden, N.J., or approved equal UL rated 20A-80BC 20 pound dry chemical multi-purpose fire extinguishers.

B. Construction Site Conditions in Tunnels and Stations:

- 1.) The use of propane heaters and gasoline or diesel powered construction equipment within tunnels or at underground stations is prohibited.
- 2.) Use of liquids having a flashpoint below 73 degrees F and boiling point below 100 degrees F is prohibited, unless specifically approved by the Engineer.

- 3.) Provide and operate air-moving equipment when fume-generating operations are in progress. During such operations provide air monitoring and test for toxicity (PPM), oxygen deficiency and combustible gas (% LEL).
- 4.) Work will be permitted in only one tunnel at any one time unless otherwise shown on the Contract Drawings or specifically approved by the Engineer.

C. Access to Areas of Work:

- 1.) Work of this Contract is at areas that are accessible by road. Transportation for personnel, material and equipment delivery, and debris removal shall be via road transportation provided by the Contractor.

D. Material and Equipment Delivery and Removal:

- 1.) Delivery and removal of material and equipment by road shall be during the work hours and shall be as approved by the Engineer and/or by the NYCDOT or other NY City agencies as necessary. Transporting material and equipment large or small in and out of the substation via delivery truck shall be coordinated with the Engineer two (2) weeks prior to scheduled delivery to minimize interference to the local traffic and neighboring community. ~~Contractor shall coordinate with the NY City agencies for permits, approvals necessary for street or lane closure.~~ *Contractor shall coordinate with the NY City agencies to acquire necessary permits, approvals required for street closure or lane closure or any work during construction.*
- 2.) For Work at areas that are not accessible by road, deliver material and equipment via truck to the PATH C or D Yard near the intersection of Academy Street and Mill Road, Jersey City, New Jersey.
- 3.) Due to the limited space available at the PATH C or D Yard, operations, during performance of this Contract, shall comply with the following:
 - a. Limit deliveries to such material and equipment that will be promptly loaded on PATH work train for transportation, or can be confined within the "Area Available for Contractor's Use" at C or D Yard, if any.
 - b. Confine loading or unloading operations within the "Area Available for Contractor's Use", if any, except that for material and equipment delivered via truck to C or D Yard, the Contractor will also be permitted to use, for off-loading only, the loading platform of the PATH Stores Building. Such loading platform use shall be subject to availability of space and PATH does not guarantee the availability of the loading platform.
 - c. Promptly unload and remove materials or debris returned to C or D Yard via PATH rail transportation.

E. Hours of Work:

- 1.) Perform Work of the Contract only during the following time periods. Do not perform Work outside of such time periods, or on a legal holiday of the state(s) in which Work is being performed. All hours of work shall be as approved by the Engineer two (2) weeks in advance.
 - a. Between the hours of 8AM to 4PM, Monday through Friday:
 - (i) Delivery and unloading of material or equipment at PATH C or D Yard.

(ii) Loading and unloading of material or equipment, and unloading of debris from PATH work train at C or D Yard. (Additional hours during which materials and equipment may be loaded and unloaded at PATH C or D Yard are set forth in subparagraph (b) below.)

b. Between the hours of 1AM to 5AM, Monday through Friday, between the hours of 1AM to 7AM, Saturday, and between the hours of 2:30AM to 7:30AM Sunday:

(i) Loading or unloading of Contractor's employees, subcontractors, material or other personnel over whom the Contractor has control to or from PATH work train at PATH C or D Yard.

(ii) Work at area of Work that requires crossing or obstruction of tracks, is within 4 feet of right-of-way, or in any way interferes with or interrupts PATH train operations.

(iii) Work in Tunnels and Stations

c. Work inside the substation building:

(i) Between the hours of 8AM to 5PM, Monday through ^{Friday} ~~Friday~~, and between the hours of 8AM to 4PM, Saturday and Sunday

2.) PATH rail transportation, if any, will transport from C or D Yard to areas of Work and back to C or D Yard commencing at approximately 1:00 A.M. each day on which the Contractor has arranged for such transportation. Arrival times at the areas of Work will vary, depending upon the designated locations, PATH operations and operations of others. Transportation from areas of Work to C or D Yard will commence sufficiently in advance to permit arrival at C or D Yard by approximately 5:00 A.M., Monday through Friday, and approximately, 7:00 A.M., Saturday and Sunday. Arrival time at C or D Yard will vary depending upon locations of areas of Work, PATH operations and operations of others.

3.) Work of the Contract is to be performed on an operating railroad, therefore, PATH does not guarantee that PATH rail transportation will be available precisely at the beginning and end of each specified time period. Arrival times of PATH rail transportation will vary as stipulated herein.

F. PATH Rail Transportation:

1.) If required, PATH will furnish a work train at C or D Yard and operate it subject to the following conditions upon its use:

a. The availability of work trains is limited. Generally, only one work train may be available for Contractor's use at a time. PATH will operate at no cost to the Contractor a maximum of 25 work train tours of 6 hours each. The work train will include an enclosed car for transporting Contractor's personnel and one flatcar, for transporting material and equipment or removed debris.

Work trains requested by the Contractor in excess of the 25 provided at no cost by PATH pursuant to the above will be provided as available at a cost to the Contractor of \$1500 per work train that consists of 6-hour tour.

- b. Each flatcar loading area is approximately 35 feet long and 7.5 feet wide with a maximum 20 ton load capacity. The maximum height of load is limited to the motorman's line-of-sight or 4 feet whichever is less. All loaded material and equipment shall be secured in place and shall be subject to PATH inspection and approval.
 - c. The work train flatcar may remain at the areas of Work as a storage platform for the Contractor's material and equipment for the approved scheduled time of use at such areas of Work.
 - d. Unless otherwise specifically permitted by the Engineer, return flatcar to PATH at the end of each day for which approval for use was granted.
 - e. Remove material, equipment or debris and broom clean work train flatcars at the end of each time of approved use.
 - f. During inclement weather, the contractor is responsible for preparing the designated work area on the flatcars that includes snow/ice removal.
- 2.) Under no circumstances will the Contractor be permitted to use PATH passenger trains for transporting material or equipment of any kind in connection with performance of the Work.
 - 3.) The Contractor's personnel shall not use PATH passenger trains for transportation in connection with performance of the Work, unless specifically approved in advance by the Engineer and such use, if granted, shall be subject to the limitations and conditions imposed by the Engineer for such transportation.
 - 4.) Requests for PATH rail transportation will be monitored by the Engineer. Should the Engineer determine that flatcars are not required for a Contractor operation, flatcars will not be furnished with the PATH work train.
 - 5.) Make arrangements for PATH Rail Transportation in accordance with "Coordination" hereof.
 - 6.) In the event of damage to any work train component by the Contractor, PATH will deduct from the Contractor's compensation an amount representing the cost of required repairs or replacements as determined by the Engineer.

G. PATH Flagger Service:

- 1.) PATH will provide flaggers without charge to the Contractor and their use is required for the following operations in connection with performance of the Work:
 - a. Work within or closer than 4 feet to the right-of way.
 - b. Work that requires crossing or obstruction of tracks.
 - c. Use of PATH rail transportation or Contractor's rail transportation
 - d. Work that in any way interferes with or interrupts PATH train service operations

- e. Work, which, in the sole discretion of the Engineer, requires flaggers for safety purposes.
- 2.) Make arrangements for PATH flagger service in accordance with paragraph entitled "Coordination" herein.

H. Station Closings:

- 1.) During station closings as herein before stipulated, the following conditions shall apply:
 - a. During the time when any station is closed, train movements will nevertheless continue through the station unless the Contractor has obtained specific approval for shut-off of traction power in accordance with "Traction Power and Existing Utilities" hereof.
 - ~~b. Only one station may be closed at any time.~~
 - c. At Exchange Place station, only one platform and its adjacent track may be closed at any one time.
 - d. A station closing will require Contractor operations to continue 24 hours per day, seven days a week, except holidays, so that the time for closing of a station is kept to a minimum.
 - e. Limit Work at closed stations that require crossing or obstruction of tracks, shut-off of traction power, or will interfere with or interrupt PATH trains service operations to the time periods stipulated in "Hours of Work" hereof.
- 2.) Make arrangements for closing of stations in accordance with paragraph entitled "Coordination" herein.

I. Traction Power and Existing Utilities:

- 1.) The Contractor's attention is called to the fact that there will be high voltage electric lines and rails for PATH traction power at or adjacent to the areas of Work and no representation is made that such lines and rails will be de-energized during performance of the Work of the Contract. The Contractor shall take all necessary precautions to protect his personnel and others affected by his operations from injury from such high voltage electric lines and rails. Such lines and rails will remain energized for PATH operations except where shut-off is approved by the Engineer.
- 2.) Maintain operation of existing utility services such as compressed air, water, sewers, electricity, ventilation or fire protection and PATH surveillance cameras, signal and communication systems during performance of Work of the Contract, except as absolutely necessary for cutoff, cutover or other change of the affected systems, as approved by the Engineer. Coordinate with the Engineer prior to interrupting or otherwise affecting any operating system, utility or service.
- 3.) Shut-off and turn-on of traction power or existing utility, signal or communication service will be performed by PATH without cost to the Contractor.
- 4.) If required for Work of the Contract, the Contractor shall use its own compressed air system during construction.

"only one station/platform may be closed at any time."

- 5.) Notify the Engineer of such shut-off or turn-on requirements in accordance with "Coordination" hereof.

J. Coordination:

- 1.) The progress schedule required under the Section of Division 1 GENERAL PROVISIONS entitled "Progress Schedule and Analysis of Bid" shall contain, but not be limited to, the following items:
 - a. Description of operations, location of Work in tunnels, and station closings, if any
 - b. Start and completion dates of each operation
 - c. Dates of material and equipment delivery to C or D Yard
 - d. Dates and times of Work that:
 - (i) Require closing of PATH stations or tunnels
 - (ii) Require crossing or obstruction of tracks
 - (iii) Is within or closer than 4 feet to right-of-way
 - (iv) Interferes with or interrupts PATH train service operations
 - (v) Require the shut-off or turn-on of the traction power or existing utility, signal or communication service.
- 2.) On a monthly basis (by the 15th of the month preceding the planned work), submit written notification to the Engineer of the following
 - a. Planned work for the coming month, including a detailed scope of the planned work and its specific location on the PATH system and any projected utility shutdowns.
 - b. A listing of any Contractor conditions that the work may entail, such as the need for continuous work in one location, any inter-relationship between the work or other parties, etc.
 - c. General description of the services required of PATH, including work and flat cars, flagger services, power-rail shut-offs, etc.
 - d. An update of the overall schedule for delivery of the Contract work identifying any changes and/or updates since the prior month, and noting the progress of actual work versus that planned in the baseline schedule.
- 3.) On a weekly basis, submit written notification to the Engineer not later than 9:00 AM Monday of the week preceding each day that the following services are required for the work previously approved at PATH's monthly track-access coordination meeting:
 - a. PATH rail transportation service.
 - b. Services of PATH pilot for Contractor's rail transportation.
 - c. PATH flagger services or other protection services.

- 4.) Written notification shall include, but not be limited to, the following items:
 - a. For PATH rail transportation service:
 - (i) The dates and locations of areas of Work
 - (ii) Whether or not flatcar will be required to remain in position as storage platform at areas of Work; and if so, locations of such areas
 - (iii) Number of Contractor's personnel to be transported
 - b. For PATH flagger services:
 - (i) The dates, times and locations of area of Work
 - (ii) Description of operations to be performed at areas of Work
- 5.) For closing of PATH stations as herein before specified, submit written request no later than 21 days preceding the date on which closing is requested. Written request shall include the dates, times, durations of closing and locations of stations to be closed; and whether or not shut-off of traction power is required at the closed stations.
- 6.) Where shut-off services of PATH traction power or other utility or services are permitted, notify the Engineer not less than a month prior to the anticipated need for such services. Each notification shall be written and shall include:
 - a. The dates, times and locations of areas of Work involved.
 - b. Description of what utility or service shut-off or turn on is required.
 - c. Duration of shut-off times.
- K. Coordination Rescheduling or Cancellation:
 - 1.) When the Contractor obtains approval under "Coordination" hereof for the use of PATH services, Work in PATH tunnels, or the closing of a PATH station for a particular day or days, and should the Contractor thereafter require a rescheduling or cancellation of such services for the approved days, submit written notification of such rescheduling or cancellation to the Engineer not less than 48 hours in advance of each day for which approval was given. Failure by the Contractor to provide such notification of rescheduling or cancellation shall result in deduction by PATH of the following amounts from the Contractor's compensation:
 - a. For PATH rail transportation \$1500 for each prior approved 6-hour tour or part thereof.
 - b. For PATH flagger services: \$50 per flag person for each prior approved hour or part thereof.
 - c. For PATH station closing: \$2000 per day.
- L. Frangible Mock-ups:

- 1.) Not less than two weeks prior to erection or installation of permanent construction, temporary construction, scaffolding, platforms or other construction aids within PATH tunnels or at locations above or adjacent to the right-of-way, construct frangible mock-up which duplicates edge and end profiles of such proposed erection or installation. The mock-up shall be structurally adequate to resist without displacement the positive and negative wind loads imposed by passing PATH train operations but not cause damage to or create a hazard for PATH trains in the event that such end and edge profiles obstruct required PATH railway clearances.
- 2.) When directed by the Engineer, dismantle mock-up and remove from PATH property.

M. PATH On-Track Safety Program

PATH requires that all Contractor personnel who may enter the track area at any time be certified by successfully completing the "PATH ON-TRACK SAFETY PROGRAM", in compliance with the Rules and Regulations set forth in Federal Railroad Administration (FRA) Regulation 49 CFR Part 214, Subpart C, entitled "RAILROAD WORKER PROTECTION". Contractor personnel not certified under this program will not be permitted to enter the PATH track area. On a monthly basis, PATH will provide a four-hour certification class at no cost to the Contractor, which includes a certification test for supervisory staff representing the Contractor. The Contractor's supervisory staff will then be required to train and certify all additional Contractor personnel that may be performing Work of the Contract. A letter certifying that the listed Contractor personnel have been trained on the "PATH ON-TRACK SAFETY PROGRAM" and, that they fully understand and will comply with all requirements of FRA rules, shall be filed with PATH's Safety Supervisor at One PATH Plaza, Jersey City, NJ 07306, Sixth floor, within 48 hours of such training. Only the persons specified in such letter will be permitted to enter the track area. Safety is the highest priority to PATH. Failure by Contractor or its employee to adhere or comply with PATH Safety Program could lead to removal from PATH property.

- N.** 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 Work and shall take such precautions as will accomplish such end, without undue interference with the public or the operations of PATH.

109. CONSTRUCTION STAGING

See Contract Drawings E901 through E960.

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 02076

SELECTIVE DEMOLITION FOR INTERIORS

PART 1. GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected interior portions of a building and building closure.
 - 2. Repair procedures for selective demolition operations.

- B. Related Sections

The following Sections contain requirements that relate to this Section:

- 1. Division 6 Section "Rough Carpentry" for material and construction requirements for temporary enclosures.
- 2. Division 9 Section "Gypsum Drywall" for material and construction requirements for temporary enclosures.
- 3. Division 9 Section "Painting" for painting requirements for temporary enclosures.
- 4. Division 15 Sections for cutting, patching, or relocating mechanical items.
- 5. Division 16 Sections for cutting, patching, or relocating electrical items.

- C. Definitions

- 1. Remove

Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Authority's property.

- 2. Remove and Salvage

Items indicated to be removed and salvaged remain the Authority's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to the Authority's designated storage area.

- 3. Remove and Reinstall

Remove items shown on the Contract Drawings; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations shown on the Contract Drawings.

4. Existing to Remain

Protect construction shown on the Contract Drawings to remain against damage and soiling during selective demolition. When permitted by the Engineer, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

- D. Except for items or materials shown on the Contract Drawings to be reused, salvaged, reinstalled, or otherwise shown to remain property of the Authority, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

Resilient Floor Covering Institute

RCFI-WP Recommended Work Practices for the Removal of Resilient Floor Coverings

1.03 QUALITY ASSURANCE

- A. Demolition firm shall have successfully completed selective demolition Work similar to that shown on the Contract Drawings for the Work of this Contract.
- B. The Authority will occupy portions of the building immediately adjacent to selective demolition area. Conduct selective demolition so that the Authority's operations will not be disrupted. Provide not less than 72 hours' notice to the Engineer of activities that will affect the Authority's operations.
- C. Maintain access to existing corridors and other adjacent occupied or used facilities.
1. Do not close or obstruct corridors or other occupied or used facilities without written permission from the Authority.
- D. The Authority assumes no responsibility for actual condition of areas to be selectively demolished.
1. Conditions existing at time of inspection for bidding purposes will be maintained by the Authority as far as practical.
- E. Asbestos
- Asbestos may be present in the building to be selectively demolished. A report on the presence of asbestos, if any, is on file in the Engineer's office for review and use. Examine the report to become aware of locations where asbestos is present.
1. Asbestos abatement, if any, is specified elsewhere in the Contract Documents.
2. Do not disturb asbestos or any material suspected of containing asbestos except under the procedures specified elsewhere in the Contract Documents.
- F. Storage or sale of removed items or materials on-site will not be permitted.

G. Utility Service

Maintain existing utilities shown on the Contract Drawings to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection services during selective demolition operations.

H. Schedule selective demolition so as not to interfere with the Authority's, or its tenants' on-site operations.

1.04 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Where repairs are required by the Contract Drawings, use repair materials identical to existing materials.

1. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3. EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements shown on the Contract Drawings to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with the demolition Work shown on the Contract Drawings are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Engineer.

3.02 PREPARATION

- A. Do not proceed with selective demolition operations until chemicals, gases, explosives, acids, flammables, or other dangerous materials have been drained, purged, or otherwise removed, collected, and disposed of by others.

- B. Conduct demolition operations and remove debris to ensure minimum interference with corridors and other adjacent occupied and used facilities. Do not close or obstruct corridors or other adjacent occupied or used facilities without permission from the Authority.
- C. Conduct demolition operations to prevent injury to people and damage to adjacent facilities to remain. Ensure safe passage of people around selective demolition area.
 - 1. Erect temporary protection, such as railings, canopies, and covered passageways, where required by the Contract Drawings.
 - 2. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.
 - 3. Cover and protect furniture, furnishings, and equipment that have not been removed.
- D. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
 - 1. Construct dustproof partitions as shown on the Contract Drawings.
 - 2. Paint occupied side of partitions with paint system specified in Division 9 Section of the Specifications on painting.
 - 3. Maintain negative air pressure of not less than 2000 cfm in the selective demolition area, where required by Contract Drawings.
 - 4. Insulate partition to provide noise protection to occupied areas, when required by Contract Drawings.
 - 5. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 - 6. Weatherstrip openings.
- E. Provide and maintain interior shoring, bracing, or structural support to preserve stability and prevent movement of area to be selectively demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.

3.03 UTILITY SERVICES

- A. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by the Engineer. Provide temporary services during interruptions to existing utilities, as acceptable to the Engineer.
 - 1. Provide not less than 72 hours' notice to the Engineer if shutdown of service is required during changeover.
- B. Utility Requirements

Locate, identify, shut off, disconnect, and seal or cap off utility services serving space to be selectively demolished, as shown on the Contract Drawings.

 - 1. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.

2. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.

C. Utility Requirements

Refer to Division 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utility services. Do not start selective demolition until utility disconnecting and sealing have been completed and verified in writing.

3.04 POLLUTION CONTROLS

- A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
 1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.
- C. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure.
- D. Fully clean adjacent areas of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.05 SELECTIVE DEMOLITION

- A. Demolish and remove existing construction only to the extent required by new construction and as shown on the Contract Drawings. Use methods required to complete Work within limitations of governing regulations and as follows:
 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame cutting operations.
 4. Maintain adequate ventilation when using cutting torches.
 5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

6. Locate selective demolition equipment throughout the structure and remove debris and materials so as not to impose excessive loads, on supporting walls, floors, or framing.
 7. Dispose of demolished items and materials promptly. Onsite storage or sale of removed items is prohibited.
 8. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.
- B. Comply with the Authority's regulations for using and protecting elevators, stairs, loading docks, building entries, and other building facilities during selective demolition operations.
 - C. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.
 - D. Removal of Curtain Wall
 1. Remove curtain wall, including support framing and brackets, fasteners, glazing, and any appurtenances thereto. Coordinate removal of curtain wall inserts, if required for construction shown on the Contract Drawings.
 2. Coordinate removals of curtain wall with removals of concrete spandrels masonry walls, structural steel, roof copings, and floor slabs - as shown on Contract Documents.
 - E. Remove resilient floor coverings and adhesive according to recommendations of the Resilient Floor Covering Institute's (RFCI) "Recommended Work Practices for the Removal of Resilient Floor Coverings."
 - F. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

3.06 PATCHING AND REPAIRS

- A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.
- B. Where repairs to existing surfaces are required by the Contract Drawings, patch to produce surfaces suitable for new materials.
- C. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.
- D. Patch and repair floor and wall surfaces in the new space where demolished walls or partitions extend one finished area into another. Provide a flush and even surface of uniform color and appearance.
 1. Closely match texture and finish of existing adjacent surface.
 2. Patch with durable seams that are, as invisible as possible. Comply with specified tolerances.

3. Where patching smooth painted surfaces, extend final paint coat over entire unbroken surface containing the patch after the surface has received primer and second coat.
 4. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 5. Inspect and test patched areas to demonstrate integrity of the installation, where feasible.
- E. Patch, repair or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

A. General

Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning

Do not burn demolished material on-site.

C. Disposal

Transport demolished materials off the construction site and legally dispose of them.

3.08 CLEANING

- A. Sweep the construction site broom clean on completion of selective demolition operations.

END OF SECTION

SECTION 02076
SELECTIVE DEMOLITION FOR INTERIORS

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

- 02076G01 Schedule of selective demolition activities indicating the following:
1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 2. Interruption of utility services.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Use of elevator and stairs.
 5. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of the Authority's, building manager's, or other tenants' on-site operations.
 6. Coordination of the Authority's continuing occupancy of portions of existing space and of the Authority's partial occupancy of completed Work.
 7. Locations of temporary partitions and means of egress.
 8. Locations of temporary partitions and means of egress for other tenants affected by selective demolition operations.

Schedules

- 02076J01 Inventory of items to be removed and salvaged.
- 02076J02 Inventory of items to be removed by the Authority.

END OF APPENDIX "A"

DIVISION 2

SECTION 02081

ASBESTOS REMOVAL AND DISPOSAL FOR PORT AUTHORITY OF NEW YORK AND NEW JERSEY

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for removal and disposal of asbestos-containing materials and/or asbestos-contaminated objects from facilities owned and/or operated by the Port Authority of New York and New Jersey or The Port Authority Trans-Hudson Corporation (PATH), hereinafter called the "Authority" at facilities in the States of New York or New Jersey.
- B. This Section is organized as follows:
- Parts 1 through 4 represent the general portions of the specification. These sections are supplemented with Appendix "A" and "B".
- C. In accordance with Appendix "A", "B" and "C" herein, and the Contract Drawings, perform the following:
1. Prepare the "Work Area" and "Work Site" systems and objects, and remove systems and objects.
 2. Remove, package, transport and dispose of the type(s) of asbestos-containing materials and/or asbestos-contaminated objects from the "Work Area(s)".
 3. Decontaminate and seal surfaces in contact with asbestos-containing materials.
 4. If removed materials are to be replaced, new materials shall be approved non-asbestos materials.
 5. Re-establish "Work Area" and/or "Work Site" systems and objects.
- D. Transport asbestos-containing materials and/or asbestos contaminated objects in accordance with 1.04 A.2 herein.
- E. Dispose of asbestos-containing materials and/or asbestos contaminated objects at an approved landfill in accordance with 1.04 A.3.

1.02 REGULATORY COMPLIANCE

- A. Unless specifically directed otherwise by the Engineer, the Authority shall be sole entity to administer the regulatory compliance, the Work of this Section, and enforce the provisions herein.
- B. Notifications

1. The Authority will notify the U.S. EPA for Work of this Section in accordance with 40 CFR Part 61, Section 61.145 (a)(b), for asbestos-containing materials.
2. The Contractor shall make arrangements for, and ensure that, the entity performing the Work of this Section performs the following:
 - a. As directed by the Engineer, comply with the notification and re-notification requirements for the State in which Work is being performed and provide proof of notification and re-notification prior to starting or continuing with work.
3. The Contractor will be compensated for the cost of Work of 1.02 B.2 as stipulated in 4.01 herein.

C. In accordance with the requirements of the Section of Division 1 GENERAL PROVISIONS, Entitled "Laws and Ordinances," Work under this Section shall conform to the provisions of the following codes and regulations, except where otherwise noted herein or on the Contract Drawings. Where the requirements of this Section or the Contract Drawings and the following codes and regulations differ, the stricter requirements shall control. Where methods or procedures are specified, they shall constitute minimum measures and shall in no way relieve the contractor of sole responsibility for the means, methods, techniques, sequences, or safety measures in connection with the work.

1. For Work of this Section performed in New York State:
 - a. Part 56 of Title 12 of the Official Compilation of Codes, Rules and Regulations of the State of New York (NYCRR): (12 NYCRR, Part 56) – Industrial Code Rule 56.
 - b. Asbestos Safety Program Requirements, 6 NYCRR Chapter II Title, 10, Part 73.
 - c. 6 NYCRR, Part 364 - Waste Transporter Permits.
 - d. 6 NYCRR, Part 360 - Solid Waste Management Facilities (if transfer station/disposal site is in New York State).
 - e. Administrative Code of the City of New York:

Section 755 (2) – 6.3 – Transport, Storage and Disposal of Waste Containing Asbestos, and Section B32 – 267.0 et. SEQ. – Commercial Refuse Removal.
 - f. Asbestos Control Program (ACP), New York City: Sections 8181, Respirator Protection Requirements.
2. For Work of this Section performed in New York State and/or New Jersey:
 - a. 29 CFR (Code of Federal Regulations) Part 1926.1101, U.S. Occupational Safety and Health Administration (OSHA), Asbestos Standard for the Construction Industry.

- b. 29 CFR Part 1910.146, Subpart C, OSHA, Confined Space Entry.
- c. 29 CFR Part 1926, Subpart C, General Safety and Health Provisions. Sections: 20 through 28, 32, 50.
- d. 29 CFR 1926.35, Employee Emergency Action Plans.
- e. 29 CFR 1926.56, Subpart D, Illuminations.
- f. 29 CFR 1926.59, Hazard Communications.
- g. 29 CFR Part 1926 Subpart E, Personal Protective and Life Saving Equipment, Sections: 95, 96, 100, 101, 102, 103.
- h. 29 CFR Part 1926.150 – 155, OSHA, Fire Protection and Prevention.
- i. 29 CFR Part 1926 Subpart G, Signs, Signals and Barricades.
- j. 29 CFR Part 1926, Subpart K, Electrical.
- k. 29 CFR 1926 Subpart L, Scaffolding.
- l. 29 CFR 1926 Subpart X, Stairways and Ladders.
- m. 40 CFR Part 61, Subparts A and M, U.S. Environmental Protection Agency (EPA), National Emission Standards for Hazardous Air Pollutants (NESHAP) – Asbestos.
- n. 49 CFR Part 173, Section 216, U.S. Department of Transportation: Subpart E, Asbestos, Blue, Brown or White.
- o. 49 CFR Part 171, Section 216, U.S. Department of Transportation: Hazardous Material Regulations.
- p. National Fire Protection Association (NFPA), Standard 701, Small Scale Fire Test for Flame Resistant Textiles and Films.
- q. The American National Standard Institute (ANSI) Practices for Respiratory Protection ANSI 88.2-1980.

D. References in this Section to laws, codes, ordinances, regulations, standards or other Federal, state, municipal, local or departmental legal requirements shall be deemed to mean the latest version or revision thereof or successor thereto, notwithstanding any change in numbering, designation or titles in effect at the time of bid opening.

E. Unless specifically directed otherwise by the Engineer, the Authority will be the sole entity to monitor the project.

1.03 DEFINITIONS

A. Definitions and other terms used in this Section shall have the meanings set forth in 29 CFR 191-.1101; and for Work in New York State, as set forth in New York

City Asbestos Control Program (AC), New York City: Title 15 Chapter 1; Subchapter E Part 1, and 12 NYCRR Part 56: Subpart 56-1.4: and for Work in New Jersey, as set forth in N.J.A.C. 5:23-8.2: and the following:

- B. "Asbestos Safety Control Monitoring Firm" shall mean an environmental consulting firm certified by the State of New Jersey Department of Consumer Affairs as an Asbestos Safety Control Monitoring Firma and approved by the Authority, or the Authority itself for Work in New Jersey.
- C. "Airlock" shall mean a system for permitting entrance and exit to/from the work area while restricting air movement between a contaminated area and an uncontaminated area. It consists of two curtained doorways separated by a distance of at least three feet (New York State) or four feet (New Jersey) such that one passes through one doorway into the airlock allowing the doorway sheeting to overlap and close off the opening before proceeding through the second doorway thereby preventing flow-through contamination.
- D. "Asbestos" shall mean any naturally occurring hydrated mineral silicate separable into commercially usable fibers, including chrysotile (serpentine), amosite (cumingtonite-grunerite), crocidolite (Riebeckite), tremolite, anthophyllite, and actinolite.
- E. "Asbestos Abatement Permit Placard" shall mean a permit issued by the Authority authorizing the entity performing Work of this Section to commence with such Work.
- F. "Asbestos Disposal" shall mean the removal, packaging, transport, temporary storage and/or transfer and off-site disposal of asbestos, asbestos-containing materials, asbestos-containing waste materials and asbestos-contaminated objects for the "Work Area" to the final disposal site.
- G. "Authorized Person" shall mean a person provided by the Authority in accordance with U.S. EPA NESHAP, 40 CFR Part 61, Section 61.145 © (8) and 12 NYCRR, Part 56.
- H. "Authorized Visitor" shall mean the Engineer, persons authorized by the Engineer, and personnel of any regulatory agency, who have the proper authorization, certification and training for entry into the "Work Area".

- I. "Certified Project Designer" shall mean a U.S. EPA Asbestos Hazardous Emergency Response Act (AHERA) Certified Project Designer for Work in New Jersey, or a New York State Department of Labor Certified Project Designer for Work in New York State.
- J. Competent person means, in addition to the definition in 29 CFT 1926.32 and 29 CFR 1926.1101 (b), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32 (f).
- K. "Critical Barriers" shall mean "Work Area" containment used for openings equal to or less than thirty-two (32) square feet consisting of two (2) layers of 6-mil fire retardant polyethylene completely sealed, which shall remain in place through post-abatement air clearance of the "Work Area".
- L. "Dry" shall mean having no apparent wetness visually or tactually.
- M. "Emergency Exit" shall mean an area on the isolation barrier that may be broken for the immediate egress of people for the work area in case of an emergency.
- N. "Friable" shall mean that condition of crumbled, pulverized, powdered, crushed or exposed asbestos, which is capable of being, released into the air by hand pressure.
- O. "HEPA" filter shall mean High Efficiency Particulate Air Filter, Capable of trapping and retaining 99.97 percent of asbestos fibers greater than 0.3 microns (MM) equivalent aerodynamic diameter.
- P. "Initial Exposure Assessment", including "Negative Initial Exposure Assessment" are terms used in the OSHA construction standards. It means a required assessment by a "competent person" concerning the exposure potential of a specific asbestos job, or series of similar asbestos jobs. A "Negative Initial Exposure Assessment" is such an assessment in which it is concluded that employee exposures during the job are likely to be consistently below the Permissible Exposure Level (PEL). Assessments must be based on information and data, which are allowed pursuant to criteria in OSHA Standard 1926.1101.
- Q. "Isolation Barrier Partitions" shall mean "Work Area" containment for openings greater than thirty-two (32) square feet constructed of adequately sized sheathing for the state in which the work occurs and 2x4 inch wood studs with a U.L. designated rating of FR-S, or metal studs and completely sealed to prevent leakage, which shall remain in place through post-abatement air clearance of the "Work Area".
- R. "Site Security/Fire Watch" shall mean an employee of the entity performing Work of the Section, who shall at a minimum possess the appropriate, valid state certification as an asbestos handler, who shall be on the "Work Site" at all times during periods of non-Work of this Section to ensure "Work Area" containment integrity, continuous operation of negative air filtration devices, security of the "Work Area" and security of asbestos waste stored at the "Work Site". In addition, when the operation of the existing fire protection system is impaired, deactivated, or compromised, the "Site Security/Fire Watch" person shall, in addition to being familiar with responsibilities of maintaining "Work Area" integrity, be familiar with the emergency response plans and procedures, and the use of the fire extinguisher provided at the "Work Site" for Work of this Section.

- S. "Support Structure" shall mean any structure used to reach, inspect, or perform Work at an elevation above or below the ground.
- T. "Surface Barrier" shall mean the plasticizing of all vertical and horizontal surfaces within a Work Area with a minimum 6-mil polyethylene (plastic) fire retardant sheeting. Such applications shall conform to Section 56-8.1 (k) (5) for work in New York and Section 5:23-8.15(e)4 for work in New Jersey.
- U. "Waste Decontamination Enclosure System" shall mean an area consisting of a washroom, airlocks, and holding area, designated for the controlled transfer of materials and equipment.
- V. "Wet", "wetted", or "adequately wetted" shall mean moistened with a wetting agent (amended water) such that the material or surface is at a minimum, wet to the touch.
- W. "Work Area" shall mean the designated area within a "Work Site" where Work of this Section occurs which is isolated as required and to which access is restricted.
- X. "Work Site" shall mean the construction site location(s) where Work of this Section is being performed.

1.04 QUALITY ASSURANCE

A. QUALIFICATIONS:

1. The entity performing Work of this Section shall be approved by the Authority prior to the commencement of Work of this Section and shall:
 - a. Possess valid licenses, permits and certificates for the State in which the Work is to be performed.
 - b. Employ for Work of this Section "Certified Project Designers", asbestos abatement handlers, restricted handlers, supervisors and air compressor operators who possess valid certifications and licenses for the State in which the Work is to be performed.
 - c. Provide at the "Work Area" a "Competent Person" conforming to the requirements of 29 CFR 1926.32 (f), 1926.1101 (b), 40 CFR 61 Subpart M, and in addition, such person shall have at least three years of experience on asbestos abatement projects as an asbestos abatement supervisor in the State in which Work of this Section is being performed.
 - d. Provide a Certified Industrial Hygienist (CIH) with at least three years of applicable experience in asbestos abatement; and with a certification by the American Board of Industrial Hygiene.
 - e. Employ an environmental laboratory, approved by the Authority, that conforms to the Quality Control Procedures of 29 CFR 1926.1101 Appendix A, participates in a national

sampling testing scheme such as the Proficiency Analytical Testing Program (PAT) or the Asbestos Registry sponsored by the American Industrial Hygiene Association.

- f. All subcontractors shall be approved by the Engineer or shall submit subcontractor(s) qualifications with the bid for all proposed Subcontractor(s). Any proposed subcontractor(s) performing work under this specification shall have appropriate qualifications. Subcontractor qualifications submitted shall be in such form and number as may be required by the Authority.
2. The asbestos waste transporter providing transportation services for Work of this Section shall be approved by the Authority prior to the commencement of Work of this Section, and hold the appropriate transporter permits, licenses and certifications for each State in which asbestos transportation is to take place. Such transporter shall transport asbestos-containing material and/or asbestos-contaminated objects by licensed motor vehicle operators, in vehicles with valid motor vehicle registrations.
3. The landfill disposal site for the asbestos-containing materials and/or asbestos-contaminated objects shall be a site listed in Appendix "B" herein, or a facility with valid municipal, state, Federal permits (where applicable) and approved by the Authority prior to the commencement of Work at the "Work Area".

1.05 WORK AREA CONDITIONS

- A. The Authority will perform the following air monitoring and analysis, and will provide analytical results of such air monitoring to the entity performing Work of this Section:
 1. Baseline sample results collected within and adjacent to the "Work Area(s)" during normal occupancy conditions prior to the commencement of asbestos abatement activities.
 2. Pre-abatement (Area preparation) sample results collected within and adjacent to the "Work Areas" during asbestos abatement preparation activities (applicable to work performed in New York State only).
 3. Sample results taken outside the "Work Area(s)" during abatement activities.
 - a. If during the performance of abatement Work, area air sample results taken outside the "Work Area" exceed normal occupancy baseline levels or fiber concentrations in air at or in excess of 0.01 fibers per cubic centimeter (whichever is greater), the entity performing Work of this Section shall take the appropriate corrective action until acceptable levels are achieved, as determined solely by the Engineer.
 4. Post-abatement air

- B. The Entity performing Work of This Section shall:
1. Perform initial employee exposure air monitoring in accordance with 29 CFR 1926.1101 (f) (2).
 2. Perform full shift daily monitoring for a minimum of twenty (20%) percent of the workers performing a particular task within the "Work Area" each working shift in accordance with 29 CFR 1926.1101 (f) (3).
 3. Throughout Work of this Section, the CIH, or the CIH's authorized representative, shall review and sign all air monitoring reports prior to the release of the data to the Contractor. Based upon employee exposure monitoring and analysis of airborne fiber concentration levels, the CIH shall determine the required level of respiratory protection established in accordance with 29 CFR 1926.1101(h).
 - a. If based upon the results of employee exposure air monitoring the entity performing Work of this Section requests that monitoring be suspended in accordance with 29 CFR 1926.1101 (f) (4), the CIH shall determine if full shift monitoring accurately represented the airborne exposure to asbestos for the Work, and submit to the Engineer in writing for approval, a recommendation with reasons why monitoring may be suspended.
 - b. Verbally report results to employee exposure air monitoring analyses to the Engineer not more than twenty-four (24) hours after the collection of the sample, and post written laboratory results, signed by the CIH, or the CIH's authorized representative, in accordance with 3.01 E.3 herein within two (2) business days.
 4. For post-abatement air clearance sampling provide, install, maintain and operate aggressive forced air equipment, e.g., fans, leaf blowers, in accordance with the requirements of the State in which Work is being performed.
 5. Re-cleaning, if the "Work Area" fails the Post-abatement air clearance test on the first attempt, shall be performed by the entity performing Work of this Section at no additional cost to the Authority.
 6. Ensure that the "Competent Person" stipulated in 1.04 A.2.c attend all meetings related to Work of this Section.
 7. Perform Work in accordance with the Contract Documents.
- C. Unless otherwise stipulated in Appendix "A" to this Section or as shown on the Contract Drawings, utilities and services, such as water, gas, sewers, electricity, steam heating/cooling ventilation, elevators, fire protection systems, sprinklers and smoke detectors, passing through the "Work Area(s)" shall continue service to areas outside of the "Work Area(s)" where stipulated in Appendix "A: herein, or shown on the Contract Drawings shutdown and lock-out as necessary to perform Work of this Section. The Contractor shall provide that the entity performing Work of this Section shall coordinate with the Engineer prior to interrupting, re-routing or otherwise affecting any operating system, utility or service. The Authority will perform, and provided certification of utility and

service shutdown(s)), lockouts, and of required pressurization of ventilation duct systems. Notify the Engineer prior to the impairment or deactivation of the existing "Work Area" and/or "Work Site" fire protection system.

1.06 SUBMITTALS

For Submittal Requirements, see Appendix "A".

PART 2 - PRODUCTS

2.01 EQUIPMENT

- A. The entity performing Work of this Section shall provide, maintain, an/or use the following equipment as required:
1. Respirators selected by the CIH based upon airborne fiber concentrations determined in accordance with 1.05 B. herein.
 2. Daily employee exposure air monitoring equipment for not less than twenty percent (20%) of workers employed in each particular task per work shift in accordance with 1.05 B. herein.
 3. Protective clothing and equipment for personnel exposed to airborne concentrations of asbestos fibers, including but not limited to whole body disposable covering, gloves, head covering, foot covering, hard-hats and eye protection.
 4. The Contractor shall maintain stocked first aid kits in the clean room of the decontamination unit and in the work area including, but not limited to bandages, antiseptic wipes, burn cream, eye flushing solution, and tourniquet.
 5. Dedicated respirators and personal protective clothing and equipment for the Engineer, and maximum of three (3) for "Authorized Visitors".
 6. Twenty pound A-B-C multipurpose dry chemical fire extinguishers located in the clean and equipment rooms of the personnel and waste decontamination enclosure, emergency egress locations, and the "Work Area".
 7. Negative pressure air filtration equipment.
 8. Continuous chart recording manometers to measure differential air pressure.
 9. Forced air equipment, e.g., leaf blowers and fans, for use during post-abatement air clearance sampling.
 10. Fully enclosed and lockable waste dumpsters, trailers, or roll-offs, with the interior walls and floors lined with one (1) layer of 6-mil fire retardant polyethylene.
 11. Asbestos warning signs, leak-tight containers, and transportation labels conforming to 29 CFR 1926.1101(k), 40 CFR Part 61, Section 61.150(a), and 49 CFR Part 173, Section 173.216.

12. Spare containers and labels at the "Work Site", and on the waste transport vehicle for use in case of accidental loss or breakage.
13. HEPA vacuums, rubber or plastic dust pans, squeegees or non-metallic shovels with rounded edges, hand tools, OSHA approved ladders and scaffolds, and inclined chutes where required for Work at heights ten (10) feet or greater above the floor or adjacent ground surface.
14. When "Work Site" electricity is furnished from an existing electrical system, provide temporary electric and lighting from a panel outside of the "Work Area". Furnish and install a temporary electric panel equipped with ground fault circuit interrupters conforming to the National Electrical Code for work in New Jersey, and to the Electrical Code of the City of New York for Work in New York State. Temporary lighting level within the "Work Area" shall at a minimum conform to 29 CFT 1926.56, Illumination.
15. Battery operated emergency lighting within the "Work Area", personnel and waste decontamination enclosures, and emergency egress locations. Self-luminous emergency fire exit and directional signs identifying the path to, and location of, the personal and waste decontamination enclosures, and emergency egress locations.

2.02 MATERIALS

- A. The entity performing Work of this Section shall provide, maintain, and/or use the following materials as required for Work of this Section:
 1. Leak-tight containment waste bags of clear or colored plastic, at least 6-mil in thickness with approved warning and transportation labels.
 2. Commercially available glovebags of clear 6-mil polyethylene with approved asbestos warning labels.
 3. Surfactant, lock-down sealant, and encapsulating products which are recommended by the manufacturers for the specific type of asbestos being abated, and approved by the Engineer.
 4. Lumber having a U.L. rating of FR-S. Lumber for temporary support structure shall be U.L. rated FR-S.
 5. Minimum 6-mil polyethylene and reinforced polyethylene, with a fire retardant rating conforming to the requirements set forth by the NFPA Standard 701.
 6. Other materials such as water resistant duct tape, adhesives, caulking, nails, fasteners and hardware, as required to perform the Work of this Section.

PART 3 – EXECUTION

3.01 PRE-ASBESTOS REMOVAL MEETING AND WORK SITE PREPARATION

- A. Prior to the start of work of this Section at the "Work Site" and after the submission and approval of the information required under 1.04 A. and 1.06 A.,

1.06 B. and 1.06 C., the Engineer will schedule a pre-asbestos removal meeting. The agenda of the meeting may include, but is not limited to, the following:

1. Contractor's chain-of-command for Work of this Section.
2. Temporary utilities.
3. Safety, fire protection, and security procedures. The role and responsibilities of "Site Security/Fire Watch" person shall be outlined. Requests for ambulance, police or fire department assistance shall be coordinated through the facility's Police or Operations Desk.
4. Asbestos Waste Shipping Documents and disposal procedures.
5. Worker certifications, licenses, and permits.
6. Final report preparation which shall be submitted in accordance with 3.05 herein.

B. The following will be performed at the "Work Area" and "Work Site" by the Authority:

1. Post the U.S. EPA notification letter, and if applicable, all re-notifications.
2. Post the Authority "Asbestos Abatement Permit Placard".
3. Post bulk sampling results.
4. As required, isolate, shutdown, pressurize, de-energize and lockout those utilities and services listed in applicable appendices herein.
5. Inspect and evaluate waste container(s) upon arrival at the "Work Site". Damaged, improperly sealing or locking waste container(s) shall be rejected.
6. Place locks on all waste containers.
7. Field verify the efficiency of the negative air units utilizing velometers and/or manometers.

C. If Appendix "A" to this Section stipulates that a "Work Area" is a Confined Space as defined by 29 CFR 1926.21, the Contractor shall ensure that entity performing work of this Section shall be responsible for and shall take the appropriate safety measures stipulated therein.

D. The Engineer shall ensure that the entity performing Work of this Section notifies the building occupants who may be impacted by Work of this Section with a letter, prepared by the Authority, a minimum of ten (10) days prior to the start of Work.

1. The Contractor shall ensure that entity performing Work of this Section posts the "Notice of Abatement Project" signs, provided by the Authority, ten (10) days prior to the start of Work, posted at locations determined by the Engineer.

- E. The entity performing Work of Section shall post the following items on a notification board located at the entrance to the clean room of the personal decontaminant enclosure:
1. A copy of the Abatement Contractor's State license.
 2. Copies of the air sampling technician's, project monitor's, supervisor's, handler's and restricted handler's State certificates.
 3. OSHA air monitoring results (Within 72 hours of Sample Collection).
 4. Emergency first aid procedures and notification telephone numbers.
 5. If applicable, air compressor operator certificates of approval or fitness.
 6. Name of the Work Site "Competent Person", and a list of names of workers who are authorized to enter the "Work Area(s)".
 7. Chain-of-command and telephone numbers in accordance with 1.06 © herein.
 8. Copies of all required City and State asbestos transporter licenses, certificate, and permits.
 9. Signs as required by 29 CFR 1926.1101 (k) at all entrances to the "Work Area".
 10. "No Smoking" signs.
 11. A copy of this Specification Section and Appendices.
 12. A copy of approved applicable or project specific state variances pertinent to the project.
 13. Laboratory results of environmental air samples as defined in Section 1.05 B.3.b.
- F. The Contractor shall ensure that the following items shall be available at the "Work Area" and/or "Work Site" by the entity performing Work of this Section for inspection by the Authority or their duly appointed representative:
1. The Contract booklet and Contract Drawings and in addition, a copy of all approved submitted drawings and procedures.
 2. Copies of applicable City, State and Federal regulations.
 3. Material Safety Data Sheets.
 4. NESHAP asbestos generator shipping labels
 5. The record of all manometer recordings.

3.02 WORK AREA PREPARATION

- A. Work of this Section at the "Work Area" and/or "Work Site" shall not commence until all submittals are approved, and an "Asbestos Abatement Placard" has been issued by the Authority.
- B. Work at the "Work Area" shall proceed only when the "Competent Person" and Authority "Authorized Person" are present at the "Work Area".
- C. If the scheduled starting date cannot be met, the Contractor shall ensure that the entity performing Work of this Section request a start date change in writing to the Engineer at least seventy-two (72) hours before the initial notice start date. Schedule changes are subject to the approval of the Engineer. Regulatory re-notifications shall be performed in accordance with 1.02 B.1 and B.2.
 - 1. In the event of failure to commence with Work of this Section on the approved date without the consent of the Engineer to a start date change, the Contractor shall be responsible for the payment of all Authority administrative fees, including, but not limited to, preparation of and courier service for the hand delivery of the U.S. EPA re-notification letter.
- D. Submit staging procedures and shift schedules. Notify the Engineer in writing of any shift changes not less than forty-eight (48) hours in advance. Such shift changes shall be subject to the approval of the Engineer.
- E. The Contractor shall provide that the entity performing Work of this Section shall perform the following in accordance with Contract Drawings and Appendix "A" herein:
 - 1. After utility shutdown in accordance with 1.05 C., remove filters from the HVAC system, double bag, store and dispose of as asbestos-contaminated waste. Seal all openings in the HVAC and other utility systems within the "Work Area(s)."
 - 2. Prior to the construction of the decontamination enclosure(s), remove asbestos that may be disturbed by such installation utilizing an approved isolation tent removal procedure to remove a one foot wide strip at the locations where asbestos may be disturbed.
 - 3. Pre-clean the location where the decontamination enclosure(s) will be constructed using HEPA vacuuming an/or wet cleaning in accordance with Appendix "A" herein.
 - 4. Construct the decontamination enclosure(s) in accordance with the Contract Drawings, Appendix "A" herein, and approved Contractor submittals. Provide electric, water, and drainage to make the decontamination enclosure(s) and sanitary facility unit(s) operational.
 - 5. Pre-clean the "Work Area" using HEPA vacuuming and/or wet cleaning in accordance with Appendix "A" herein.
 - 6. Establish the "Isolation Barrier Partitions", "Critical Barriers", "Surface Barriers", or demarcate an area, and seal all openings. Stationary equipment within the "Work Area(s)" shall be enclosed, protected, and

ventilated, as required in accordance with the Contract Drawings and/or applicable appendices herein.

7. Pre-clean fixed objects within the "Work Area(s)" and enclose objects to remain in accordance with the Contract Drawings and Appendix "A" herein. Pre-clean movable items before removal from the "Work Area" in accordance with the Contract Drawings and Appendix "A" herein.
 8. Paint, or apply tape, in a fluorescent color at the fire extinguisher locations, door frame(s) of the personal and waste decontamination enclosures, emergency egress locations, kick-out panels and along wall bases showing direction towards the nearest exit.
 9. Install and continuously operate the negative air filtration system in accordance with the Contract Drawings and/or applicable appendices herein.
 10. Provide temporary lighting and power in accordance with 2.01 (A) and Appendix "A" herein.
- F. Notify the Engineer in writing that asbestos removal is ready to commence. No less than twenty-four (24) hours after such notification, a pre-removal inspection will be performed by the Engineer.
1. After a successful pre-removal inspection and approval of the Engineer, commence with asbestos removal.

3.03 ASBESTOS REMOVAL

- A. The Contractor shall provide that the "Competent Person" employed by the entity performing Work of this Section performs the following:
1. Ensures that workers are equipped with respiratory protection and personnel protective equipment in accordance with Section 1.05 B.3.
 2. Ensures that the negative air filtration system and manometers are maintained and continuously operated throughout "Work Area" preparation, asbestos removal, clean up, and post-abatement air clearance sampling in accordance with Appendix "A" and the Contract Drawings herein.
 3. Ensures that when removing asbestos identified as amosite in Appendix "A" herein, the procedures of 29 CFR 1926.1101, Appendix "F" – "Wetting Agents" are complied with.
 4. Ensures that "Site Security/Fire Watch" personnel to keep watch during non-work hours are utilized in accordance with Appendix "A" herein.
 5. Ensures that prior to asbestos removal, all asbestos-containing materials are adequately wetted as regulated by the state in which the work occurs and as specified by the manufacturer.

6. Ensures that the removal of the asbestos-containing material is in accordance with Appendix "A" herein, and the Contractor's approved submittals.
7. Ensures that debris and water does not remain or pond on the floor and/or temporary "Support Structures". Adequately wet down, remove, and bag material while wet, concurrently during removal operations utilizing HEPA vacuums, rubber or plastic dustpans, squeegees or plastic shovels for continuous water and debris removal.
8. Ensures that disposal of waste water from the "Work Area" is performed in accordance with Appendix "A" herein.
9. Ensures that a permanently bound entry log book for each "Work Area" is maintained and made available for the Engineer's inspection signed by all individuals who enter and leave the "Work Area(s)". The log shall identify the abatement contractor, the Authority contract and job number, and the respiratory protection used.
10. Ensures that the permanently bound daily log book for each "Work Area" is maintained with records of the Engineer's inspections and all findings, events, and required corrective action regarding, but not limited to daily inspections, integrity of the decontamination enclosure system(s), "Isolation Barrier Partitions", "Critical Barriers", "Surface Barriers", the negative air filtration system, and all "Work Area" cleanings.
11. Unless directed by the Engineer to do otherwise, ensures that the condition of the waste container is examined by the "Site Security/Fire Watch" person (or "Competent Person" in the event that a Site Security/Fire Watch Person is not required) at least once every twenty-four (24) hours during non-work periods, and that repairs of torn or missing signs on the waste container, or damage affecting the integrity of the waste container are performed or that replacement containers are provided.
12. Ensures that for Work in New York State, the cleaning and surface lock-down encapsulation procedures in Subpart 56-12.1(i) of Industrial Code 56 are complied with.
13. Ensures that for Work in New Jersey, the cleaning and surface lock-down encapsulation procedure in 5:23-8.15(h) of the Asbestos Hazard Abatement Sub code is complied with.
14. Whenever possible, gross removal, packaging and cleaning shall proceed generally from the top downward.
15. Ensures that gross removal, packaging and cleaning shall proceed from locations which are remote from the HEPA units toward the areas of the units.
16. Ensures that wire brushes are not used for asbestos removal.
17. Ensures that compressed air and high pressure water or steam are not used for asbestos removal.

3.04 DISPOSAL

- A. Notify the Engineer in writing at least twenty-four (24) hours in advance of any bag out operations or waste container removal.
- B. Remove asbestos waste from the "Work Site" only with the approval from the Engineer and an accompanying, properly signed Asbestos Waste Shipping Document issued by the Authority.
- C. Transport the waste consignment to the landfill designated in the Contractor's approved submittals, U.S. EPA notification letter, and indicated on the Asbestos Waste Shipping Document in accordance with 1.04 A.
- D. The collection, co-mingling and transport of generated Authority asbestos waste with the asbestos waste from other generator sources is prohibited. Temporary storage or secondary transfer of the asbestos waste before final disposal is prohibited unless otherwise approved in writing by the Engineer prior to the waste leaving the "Work Site".

3.05 FINAL REPORT

- A. This final report shall not be a substitute for the requirements of the Section of Division 1 entitled "Asbestos Cost Summary Submittal".
- B. Final payment will not be approved prior to the Contractor preparing, itemizing and submitting to the Engineer four (4) copies of a final report containing:
 - 1. A cover page identifying the entity performing Work of this Section with their phone number and business address, name of the "Competent Person", name and business address of the CIH and analytical laboratory, name and business address of the waste transporter, and name and business address of the landfill.
 - 2. Summarize the type(s) of material removed, quantity of material removed, description of containment and engineering controls, amount of waste generated and date(s) transported from facility.
 - 3. Daily project logs, entry logs, and if applicable, time and material sheets.
 - 4. Analytical results of employee exposure air monitoring performed during Work of this Section, and strip or disk chart recordings of differential air pressure to areas adjacent to the "Work Area(s)".
 - 5. Written certification of the amount of asbestos-containing waste removed and received by the secondary transfer storage facility and/or disposal site operator.
 - 6. Manometer recording logs. Manometer chart or tape shall include a date and time marker at least once per 24 hour period, and shall clearly indicate scale and zero.
 - 7. The name, title and signature of the person preparing the final report.

PART 4 – PAYMENT

4.01 NET COST WORK

The contractor will be reimbursed for the items listed below at the "Net Cost" for such Work. "Net Cost" as used herein (and in this Specification Section Only) shall be deemed to mean the actual cost in money, as approved by the Engineer in writing, in advance, expended by the Contractor or a sub-contractor approved by the Authority in fulfilling its obligations under this Contract.

- A. The cost of telephone charges and express mail delivery charges for notifications, re-notifications in accordance with 1.02 B herein. The costs for notification and re-notification are excluded in the event that their necessity is due to the Contractor's failure to commence abatement on the approved date.
- B. Fees for notification and re-notification required by the laws of the State in which Work is being performed, actually paid by the Contractor, not necessitated by the Contractor's failure to commence abatement on the approved date.

END OF SECTION

SECTION 02081

ASBESTOS REMOVAL AND DISPOSAL FOR PORT AUTHORITY OF NEW YORK AND NEW JERSEY

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

- 02081A01 Detailed site-specific drawings prepared and signed by a "Certified Project Designer" which shall include, but not be limited to Negative Air Unit Calculations.
- 02081A02 Detailed site-specific drawings prepared and signed by a "Certified Project Designer" which shall include, but not be limited to Engineering Controls (i.e.: work area enclosure; decontamination enclosure system layout and location; work area boundaries; etc.).
- 02081A03 Detailed site-specific drawings prepared and signed by a "Certified Project Designer" which shall include, but not be limited to "Emergency Egress" location(s).
- 02081A04 Detailed site-specific drawings prepared and signed by a "Certified Project Designer" which shall include, but not be limited to requirements for electric power, water supply and drainage.
- 02081A05 Detailed site-specific drawings prepared and signed by a "Certified Project Designer" which shall include, but not be limited to requirements for storage and staging location(s).
- 02081A06 Support Structures – Drawings, design details and calculations for temporary "Support Structure(s)", signed and sealed by a Professional Engineer (P.E.) licensed in the State in which the Work of this Section is to be performed. Following installation of "Support Structure(s)", submit P.E. signed inspection report verifying compliance with design.

Product Data

- 02081D01 List of all materials and equipment to be used for Work of this Section.
- 02081D02 Catalog cuts for all materials and equipment to be used for Work of this Section.
- 02081D03 Material Safety Data Sheets and a copy of the product labels for all chemicals to be used for Work of this Section.

Construction and Installation Procedures

02081-18

02081K09 Name of Asbestos Waste Transporter Contractor plans to utilize -- the entity providing transportation services shall be approved by the Authority prior to the commencement of Work of this Section. Provide documentation showing, for each State in which transportation is to occur, the following:

- a. Copies of Transporter's Permits, Licenses and/or Certificates as required by state agencies to operate.
- b. Name and title of Transporter's contact person.
- c. Business, mobile and pager telephone numbers.
- d. U.S. DOT statement of reportable accidents and reportable environmental incidents as per 49 CFR 171.15 and 171.16

02081K10 Name of landfill Contractor plans to utilize. Contractor shall obtain approval from the Authority for utilization of proposed facility prior to commencement of Work of this Section [refer to Appendix "C" herein]; and submit the following documentation for the proposed facility:

- a. Municipal, State and/or Federal permits and/or licenses required to operate.
- b. Name, title and telephone number of Landfill's contact person.

Quality Assurance-Quality Control

02081L01 Outline of Respiratory Protection Program for Employees conforming with current regulations - The outline shall bear the signature and approval of a CIH.

02081L02 Copies of notifications and re-notifications, prior to sending, in accordance with (1.02) (B) herein.

02081L03 Copies of project-specific variances obtained by the Contractor for Work of this Section.

Contact Information

02081P01 Project Specific Chain of Command -- Show on Chain of Command form(s) office, beeper, mobile and home telephone numbers of persons having the authority to dispatch personnel to the Project location and commit such persons to the tasks as directed by the Engineer. At a minimum include numbers for Project Supervisor, Competent Person and CIH.

Closeout Submittals

02081R01 Copies of the Final Report as stipulated (3.05) herein.

END OF APPENDIX "A"

02081-19

SECTION 02081

ASBETOS REMOVAL AND DISPOSAL FOR PORT AUTHORITY
OF NEW YORK AND NEW JERSEY

APPENDIX "B"

1.0 DESCRIPTION

This Section specifies removal of asbestos material from Christopher Street Sub-station # 1 (see Contract Drawings N001 thru N012). All materials are non-friable except for the basement cable wrap.

Floor	Location	Material Description
Basement	West Wall	Conduit Collars
	Center Hallway	Cable Wraps (Friable)
	Along Walls & Below Buss Bar in Vault Corridor	Isolation Boards & Blocks - Composite
	Center Hallway Ceiling	Isolation Boards - Cement
1 st	Structure & Sheath Drain Breakers	Isolation Boards - Composite & Cement
	S & C Switches	Fuse Holders
	Former Elevator Shaft	Flange Gaskets
2 nd	Former Elevator Shaft	Flange Gaskets
	650 V Switch Gear Truck Units	Isolation Boards - Composite & Cement
	650 V Switch Gear Cabinets	Fuse Holders, Isolation Boards - Composite & Arc Shields
3 rd	Former Elevator Shaft	Flange Gaskets
4 th	Fan Hatch Perimeter	White Cloth
	Former Elevator Shaft & Thru-out	Flange Gaskets
	Thru-out	Isolation Boards - Cement & Composite
5 th	Abandoned Electrical Room	Arc Boxes, Isolation Boards - Composite & Cement, Arc Chute & Coil Wraps
Roof	Roof Surface	Built-up Roofing
	Main Roof South Parapet Wall to Former Elevator Shaft	Mastic Waterproofing

2.0 ASBESTOS TYPE(S)

Test results of asbestos-containing material to be removed indicate that such material contains the following type(s) of asbestos:

Material Description	Asbestos Content
Conduit Collar	9-11% Chrysotile
Cable Wrap (Friable)	40-90% Chrysotile
Isolation Board - Composite	5.2 - 22% Chrysotile
Isolation Boards - Cement	19 - 25% Chrysotile
Fuse Holders	9.1% Chrysotile
Flange Gasket	5-6% Chrysotile
Arc Shield -Cement	19% Chrysotile
White Cloth	44-50% Chrysotile
Arc Box - Cement	14.3 Chrysotile
Arc Chute - Cement	19% Chrysotile
Coil Wrap	Assumed
Roofing	Assumed
Roofing Mastic	10-40% Chrysotile

3.0 ITEMS IN "WORK AREA" TO BE REMOVED

No items other than asbestos containing materials are to be removed within this scope of work.

4.0 ITEMS REMAINING IN "WORK AREA" TO BE PROTECTED

No items will require special protection within work areas beyond the requirement of work area isolation required by regulations.

5.0 UTILITIES FOR WORK OF THIS SECTION

A. HOT AND COLD WATER:

Cold (and hot) water are available at the "Work Site" without charge from the second (2nd) floor restrooms or as designated by the Engineer subject to such conditions and precautions upon its use as may be imposed by the Engineer. Provide connections to existing facilities, extend with piping, hoses and fittings as required. Completely remove temporary materials when their use is no longer required. In the event of asbestos contamination of temporary materials, clean and decontaminate by wet cleaning and/or HEPA vacuuming in the "Work Area", or dispose of as Asbestos-Containing Material (ACM) waste. Restore existing facilities to their original condition. Backflow protection shall be provided at all connections to the owners water supply system.

B. DRAINAGE:

Drainage is available at the "Work Site" without charge at the location(s) designated by the Engineer, subject to such conditions and precautions upon its use as stipulated in "Water Disposal Procedures" herein. Completely remove temporary materials, clean and decontaminate by wet cleaning and/or HEPA vacuuming in the "Work Area", or dispose of as ACM waste. Restore existing facilities to their original condition.

C. ELECTRICITY:

Electricity is available at the "Work Site" without charge at the location(s) designated by the Engineer, subject to such conditions and precautions upon its use as may be imposed by the Engineer. Connect to existing service, provide branch wiring and distribution boxes located to allow power and lighting by means of construction-type power cords with ground-fault interrupter(s). Completely remove temporary materials when their use is no longer required. In the event of asbestos contamination of temporary materials, clean and decontaminate by wet cleaning and/or HEPA vacuuming in the "Work Area", or dispose of as ACM waste. Restore existing facilities to their original condition. All electrical connections/disconnections shall be performed by a licensed electrician

6.0 SANITARY FACILITIES FOR WORK OF THIS SECTION

Sanitary facilities outside the "Work Area" are available at the "Work Site" without charge at the location(s) shown on the Contract Drawings, subject to such conditions and precautions upon their use as may be imposed by the Engineer. Maintain such facilities in a clean condition throughout Work of this Section.

7.0 UTILITIES AND SERVICES IN WORK AREA TO BE SHUT DOWN AND TO REMAIN IN SERVICE

Electrical equipment and cables that require abatement shall require electrical service shutdown on that electrical equipment or cabling during abatement activities. No electrical service shall remain in service during abatement.

8.0 "WORK SITE-SECURITY/FIRE WATCH"

Security/Fire Watch is not required.

9.0 "WORK AREA" PROCEDURES

Asbestos cable wrap removals are to be performed within commercially available glovebags within site constructed tent enclosures that comply with New York State Industrial Code Rule 56 and these design specifications and contract drawings N001 thru N0012.

Asbestos isolation boards and other non-friable asbestos electrical component removals that are fastened or affixed (secured) in any manner are to be performed within site constructed tent enclosures that comply with New York State Industrial Code Rule 56 and these design specifications and contract drawings N001 thru N0012.

Asbestos isolation boards and other non-friable asbestos electrical component removals that are not fastened or affixed (secured) in any manner ('loose') are to be collected, packaged and disposed of as an asbestos containing material by the asbestos abatement contractor utilizing proper personal protective equipment and wet methods (clean-up procedures).

10.0 "WATER DISPOSAL" PROCEDURES

Prior to disposal of waste water, filter through a new three stage filter system where the final stage is a 5.0 micron filter to remove asbestos fibers.

11.0 "SEALING ASBESTOS-CONTAINING CONTACT SURFACES - Not required.

12.0 REMOVAL OF "WORK AREA CONTAINMENT AND PROTECTION OF ITEMS
THAT REMAINED IN THE "WORK AREA"

Remove "Work Area" containment and discard as asbestos contaminated material.

13.0 RE-ESTABLISHMENT OF UTILITIES AND SERVICES - Not required.

END OF APPENDIX "B"

SECTION 02081

ASBESTOS REMOVAL AND DISPOSAL FOR PORT AUTHORITY
OF NEW YORK AND NEW JERSEY

APPENDIX "C"

1.0 ASBESTOS LANDFILL

Listed below are landfill disposal sites that are currently used, or have previously been used, by the Authority for disposal of asbestos-containing material and/or asbestos contaminated objects:

BRENT RUN LANDFILL
8427 Vienna Road
Montrose, Michigan 48457
810/639-3328

BROCTON RECYCLING FACILITY
Browning Ferris Industries (BFI)
190 Mulberry Street
Brocton, Massachusetts 02302
508/580-1151

CONESTGA LANDFILL or NEW MORGAN LANDFILL (BFI)
Mineview Drive
Morgantown, Pennsylvania 19543
610/286-6844

G.R.O.W.S. LANDFILL, INC
1543 Bordentown Road
Morrisville, Pennsylvania 19067
215/736-9400

GRAD CENTRAL SANITARY LANDFILL
1963 Pen Argyle Road
Pen Argyle, Pennsylvania 18072
610/863-6057

HACKENSACK MEADOWLANDS DEV. COMM. (HMDC)
(Use this facility only for Work performed in Hudson County New Jersey)
100 Baler Boulevard
North Arlington, New Jersey 07031
201/460-1700

HAM SANITARY LANDFILL
1 Bozzoo Road
Peterstown, West Virginia 24963
304/753-9470

M.C. ARNONI LANDFILL (USA South Hills Landfill)
3100 Hill Road
Library, Pennsylvania 15129
724/348-7013

MEADOWFILL CORPORATION
Dawson Drive
Bridgeport, West Virginia 26330
304/842-2784

OTTAWA COUNTY LANDFILL (BFI)
Route 358, 530N. Camp Road.
Port Clinton, Ohio 08110
609/635-2615

PENNSAUKEN SANITARY LANDFILL
8600 River Road
Pennsauken, New Jersey 08110
609/663-2772

R & A BENDER LANDFILL
3747 White Church Road
Chambersburgh, Pennsylvania 17201
717/264-4678

SOIL REMEDIATION INC.
6065 Arrell-Smith Road
Lowellville, Ohio 44436
330/536-6825

SOUTHERN ALLEGHENIES LANDFILL
843 Miller Picking Road
Davidsville, Pennsylvania 15928
814/479-2537

TULLYTOWN LANDFILL
200 Bordentown Road
Tullytown, Pennsylvania 19007
215/736-9400

WASTE MANAGEMENT OF NEW YORK, INC
123 Varick Avenue
Brooklyn, New York 11237
718/386-7900

WETZEL COUNTY SANITARY LANDFILL
Route 1
New Martinsville, West Virginia 26155
304/455-3800

110 CLEAN FILL DISPOSAL SITE
136 Spagnoli Road
Melville, New York 11704

END OF APPENDIX "C"

SIVISION 2

SECTION 02083

UNIVERSAL WASTE & PCB BALLAST MANAGEMENT
(HANDLING, TRANSPORT AND DISPOSAL OF FLUORESCENT / HIGH ENERGY LAMPS /
PCB LIGHTING BALLASTS / LEAD BATTERIES)

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section specifies the handling, segregation, packaging, labeling, transport, and disposal of Hazardous Substances and Universal Wastes generated by demolition activities. These wastes, classified by the EPA under the Hazardous Waste Management System (40 CFR Parts 260 through 279), require specialized handling, packaging, labeling, shipment, and ultimately recycling or disposal at an approved facility.
- B. This scope of work is limited to the removal and disposal of the following wastes:
- Fluorescent, high intensity lamps (e.g. metal halide), and mercury bulbs (thermostatic & contact switches). These components may or do contain mercury, lead and other heavy metals. All spent or discarded light bulbs (a.k.a. waste lamps) from this project shall be collected by the contractor, handled, transported, and recycled or disposed of in accordance with 40 CFR 273.13 & 273 requirements for universal waste concerning waste lamps;
 - Lead containing batteries, which will be collected for recycling; and
 - PCB Containing Ballasts.
- C. Visually inspect ALL components (including light fixture housings) scheduled for demolition, removal and disposal that have the potential to contain the aforementioned materials.
- D. Any PCB containing lighting ballasts that are leaking must be handled and transported as per all applicable federal, state and local codes, rules and regulations and must be disposed of as hazardous waste at a high-temperature incinerator.

1.02 CODES AND REGULATIONS

- A. General Applicability of Codes and Regulations: Except to the extent that more explicit or more stringent requirements are written directly into the Contract Documents, all applicable codes and regulations have the same force and effect (and are hereby made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies are bound herewith.
- B. Contractor Responsibility: Assume full responsibility and liability for compliance with all applicable Federal, State, and local regulations pertaining to hazardous waste management and disposal.
- C. Federal Requirements - Federal requirements which govern the management, hauling and disposal of hazardous waste include but are not limited to:
1. DOT: U.S. Department of Transportation, including, but not limited to:

02083-1

- a. Hazardous Substances
Title 49, Part 171 and 172 of the Code of Federal Regulations
 - b. Hazardous Materials Regulations
General Awareness and Training Requirements for Handlers, Loaders and Drivers
Titles 49, Parts 171-180 of the Code of Federal Regulations
 - c. Hazardous Materials Regulations
Editorial and Technical Revisions
Title 49, Parts 171-180 of the Code of Federal Regulations
2. EPA: U.S. Environmental Protection Agency (EPA), including but not limited to:
- a. Management of Hazardous Wastes, Resource Conservation and Recovery Act (RCRA)
Title 40, Parts 260-268 of the Code of Federal Regulations
3. OSHA: Occupational Safety and Health Administration including, but not limited to:
- a. OSHA General Industry Safety and Health Standards (29 CFR 1910) and OSHA Construction Industry Standards (29 CFR 1926)
- D. State Requirements: State requirements which govern the management, hauling and disposal of hazardous waste include but are not limited to:
- 1. New York State Department of Environmental Conservation (NYSDEC), Hazardous Waste; Title 6, NYCRR, Sections 364, 371, 372, and 373.
- E. Local Requirements: Abide by all local requirements which govern the management, hauling and disposal of hazardous waste.

1.03 SUBMITTALS

- A. Before Start of Work: Submit the following to the Engineer for review. Do not start work until these submittals are returned indicating that the submittal is approved.
- 1. Copy of state and local license for waste hauler.
 - 2. U.S. EPA Identification Number of waste hauler.
 - 3. Name and address of waste disposal facility where waste materials are to be disposed including:
 - a. Contact person and telephone number.
 - b. Copy of state license and permit.
 - c. Disposal facility permits.
 - 4. Specimen copy of Uniform Hazardous Waste Manifest form, or Bill of Lading as appropriate.
 - 5. Copy of EPA "Notice of Hazardous Waste activity" form.

6. Copy of forms required by state and local agencies.
7. Sample of disposal label to be used.
8. Type of personal protective equipment and work procedures to be used.
9. Work Plan explaining the personal protective equipment, methods and procedures utilized for fluorescent light bulb and ballast, and other environmental chemicals and materials handling and disposal. Work Plan will be reviewed by the Engineer prior to the commencement of work.

B. During Work:

Submit copies of all executed manifests and disposal site receipts to the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Disposal Bags: Furnish 0.15mm (6-mil) thick leak-tight polyethylene bags.
- B. DOT Hazardous Waste Disposal Drums: Furnish DOT 17-H Open-Top Drums (55 gallon) in accordance with DOT regulations title 49 CFR Parts 173, 178, and 179.
- C. DOT Hazardous Waste Labels: in accordance with DOT regulations Title 49 CFR Parts 173, 178, and 179.
- D. Fluorescent Lamp Disposal (Crusher) units, such as DexTrite Fluorescent® Lamp Disposal equipment, or equivalent. Such equipment must be capable of capturing fugitive mercury vapors during the bulb crushing process, as well as the fractured and broken waste products.
- E. HEPA and charcoal filter equipped mercury capture vacuum.
- F. Cardboard boxes and sleeves for packaging lamps that will be removed from the site intact or unbroken.

PART 3 EXECUTION

3.01 GENERAL

- A. Do not mix potentially hazardous waste streams. Where feasible, separate each type of waste from other types of hazardous wastes, from asbestos waste and from construction waste.
- B. Segregate, package, label, transport and dispose of Waste in accordance with DOT, EPA, State and Local regulations.
- C. Hammering or sudden impact methods for removing ballasts from light fixtures shall not be employed, as such methods may cause leakage in an otherwise non-leaking ballast.
- D. Throwing and tossing of ballasts into disposal drums shall not be done, as such activities may cause leakage in an otherwise non-leaking ballast.

- E. All removal and disposal activities will be periodically monitored by the Engineer for compliance.

3.02 MERCURY BULB / FLUORESCENT / HIGH-INTENSITY LIGHT BULB / LIGHTING BALLAST REMOVAL PROCEDURES

- A. During the light fixture removal stage during demolition, follow the following procedures (or equivalent alternate but protective measures):
1. Carefully remove fixtures and stack them in a designated portion of the work area.
 2. Designate an area where the fixtures can be disassembled and components removed and segregated (e.g., bulbs and ballasts). The area shall be remote from other demolition activities, and shall have adequate ventilation and lighting.
 3. The work area for fixture disassembly shall (at a minimum) have the floor lined with one layer of 6-mil fire-retardant polyethylene plastic to control accidental spills or breakage. The work area shall have a table or other solid work platform to facilitate disassembly of the fixtures, and the protective plastic sheeting shall cover the work table area drums/bulb crushing/bulb repackaging equipment.
 4. Carefully remove tubes from fixtures, and either crush them or repackage them for disposal.
- B. In the event a bulb breaks, utilize the mercury capture vacuum to remove all debris generated.
- C. Carefully remove ballasts and segregate for disposal in the following manner:
1. Ballasts labeled as "No-PCBs" shall be segregated and disposed of as conventional construction and demolition (C&D) waste;
 2. Non-leaking ballasts that are not specifically labeled as "No-PCB" containing shall be segregated and drummed for disposal as hazardous wastes. (Assume that all ballasts installed through 1979 contain PCBs). These ballasts may be destroyed by high temperature incineration, or land filled at a properly permitted facility.
 3. Leaking ballasts that are not specifically labeled as "No-PCBs" shall be segregated and drummed. Punctures or damage to these ballasts exposes an oily or tar-like substance. These oily and tar-like substances shall be treated as PCB contaminated. These ballasts, and all material they come into contact with, **MUST be incinerated** under TSCA; they cannot be landfilled.
- D. Follow waste containerizing and labeling procedures in Section 3.03 below.

3.03 HAZARDOUS WASTE PACKAGING AND LABELING

- A. SEGREGATE AND PACKAGE EACH WASTE TYPE as follows:
1. Package components in DOT 17-H Open-Top Drums with Polyethylene disposal Bag liners.
 2. Fill liner bags, then neck liner bags down into DOT 17-H Open-Top Drum and seal with duct tape.

02083-4

3. Install gasket on lid, apply lock ring, and seal.
 4. Apply Waste Label to drum side.
 5. Enter appropriate DOT Shipping Data, for example:
 - Mercury Waste - "Waste Mercury Thermostats" - RQ Hazardous Waste Solid, NOS, 9, NA3077, PG-III.
 6. Adjacent to each label, enter the date indicating when waste was first placed in each drum.
- B. Sealed and Labeled Containers: maintain all containers in a continuously sealed condition after they have been sealed.
1. Do not reopen sealed containers.
 2. Do not place additional waste in sealed containers.
- 3.04 TEMPORARY STORAGE: Partially filled containers of waste may be stored at the work site provided that:
- A. Each container is properly labeled when it is first placed in service;
 - B. Each container remains closed at all times except when compatible waste types are added.
 - C. When moved within the site, each container remains within the geographic boundaries of the facility without moving or crossing public access highways.
- 3.05 REMOVAL OF POTENTIALLY HAZARDOUS WASTES: Immediately seal waste containers as each container is filled. Remove waste containers from the work site within 45 days from start of accumulation.
- A. Transport filled containers from the work site to an approved disposal site or recycling center (refer to section 3.06).
 - B. Continuously maintain custody of all hazardous material generated at the work site including security, short-term storage, transportation and disposal, until custody is transferred to an approved disposal site or recycling center. Document continuous chain-of custody.
 - C. Do not remove, or cause to be removed, hazardous waste from the Authority's property without a legally executed Uniform Hazardous Waste manifest.
 - D. At completion of hauling and disposal of each load submit waste manifest; chain of custody form, and landfill receipt to the Engineer.
- 3.06 RECYCLING AND RECOVERY: Turn over waste which contains materials for which recovery and/or recycling is possible to an approved recycling center. Mercury switches and bulbs may be recycled.

END OF SECTION

02083-5

SECTION 02083
UNIVERSAL WASTE AND PCB BALLAST MANAGEMENT

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

- 02083B01 Catalog cuts for all equipment used in the performance of the Work.
- 02083B02 Catalog cuts for all Personal Protective Equipment including respirators and protective clothing.

Qualifications

- 02083K01 Names, addresses, qualifications, and contact persons for the proposed transporter(s) of hazardous waste, non-hazardous waste. Furnish evidence that each transporter has current registration approved by NYSDEC, and/ or DOT, as applicable.
- 02083K02 Name, address, telephone number and contact person for each waste disposal facility proposed for use in the Contract. Furnish evidence that each disposal facility has current registrations and permits for the operation of such facilities, or written approval from the state (and by the USEPA or other local agency, if applicable) in which it operates.

Record Documents

- 02083M02 Waste Handling Plan that addresses the proper handling and disposal of all waste as described in this Section, including a Site-specific Health and Safety Plan (HASP) that complies with OSHA and all applicable regulations. The HASP shall include the methods and procedures that will be followed. In addition, provide site-specific Scope of Work information.

- 02083M03 Contingency Procedures program to respond to fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water at the construction site. Include the following:
1. Emergency program describing arrangements agreed to by local police departments, fire departments, hospitals and state and local emergency response teams Include an evacuation plan for workers. Describe signals to be used to begin evacuation.
 2. List of names, addresses, and phone numbers of all persons qualified to act as emergency coordinators. Include a list of all emergency equipment at the construction site (fire extinguishers, spill control equipment, communications and alarm systems and decontamination equipment).
 3. Evacuation plan for workers. Describe signals to be used to begin evacuation.
- 02083M06 Copy of signed manifests for each load of waste material transported from the construction site. Furnish the manifest within one day of shipment
- 02083M07 Copy of executed waste manifest form signed by a responsible party of the disposal facility. Furnish the form within one day of receipt. If the copy is not received within 35 days from the date of shipment, contact the Engineer, and assist as directed, in efforts to locate the manifest, and in the completion of the EPA Exception Reports
- 02083M08 Certificate of final disposal for each manifest or certificate of recycling for recycled material. Provide the certification within one day of receipt
- 02083M09 Bills of Lading for the disposal of all non-hazardous municipal/construction waste within one week of the date of shipment

END OF APPENDIX "A"

DIVISION 2

SECTION 02084

DISPOSAL OF PCB LIQUID FILLED ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK – This Section specifies disposal of PCB liquid filled electrical equipment.

- A. Transformer fluids, upon testing, shall be disposed of as outlined in 1.04 Description, below.
- B. Size of transformer is labeled as 403 gallons.

1.02 REFERENCES

- A. 6 NYCRR, Parts 361, 364, 370, 371, 372, 373, and 376.
- B. 29 CFR, Part 1910.120.
- C. 40 CFR, Part 260, 261, 262, 263, 264, 265, 268, and 761.
- D. 40 CFR, Parts 171, 172, and 173.
- E. ANSI/IEEE Standard 799.

1.03 DEFINITIONS

- A. Definitions and Abbreviations:
 - 1. PCB: Polychlorinated Biphenyls.
 - 2. PPM: Parts per million.
 - 3. NYCRR: New York State Code, Rules, and Regulations.
 - 4. CFR: Code of Federal Regulations
 - 5. TSD Facility: Treatment, Storage, Disposal Facility
 - 6. Generator: Owner of Hazardous Material (PATH)

1.04 DESCRIPTION – This Section applies to:

- A. Existing electrical transformers that contain fluid with 500 or more ppm of PCBs, which identifies the fluid and the equipment as PCB and PCB articles under Federal and State regulations.
- B. Existing electrical equipment that contains fluid with 50 or more ppm but less than 500 of PCBs, which identifies the fluid and equipment as PCB contaminated under State and Federal regulations.

1.05 SUBMITTALS

- A. Quality Control Submittals:
 - 1. Detailed list of the codes, rules and regulations which govern the Work. This list must cite specific title, chapter, and section of the citation.

2. Detailed plan for notifying proper local, state and federal authorities of any incident required to be reported that occurs during the handling and transportation of PCB liquid filled electrical equipment.
3. Detailed plan for containment and cleanup of any PCB spill that occurs during the handling and transportation of the PCB liquid.
4. Listing of licenses or permits issued by government agencies authorizing the handling of PCB products by the service company, transporter and operator of the TSD Facility.
5. Resume for each person handling PCB products at the Site. Include:
 - a. Hazardous materials training.
 - b. Licenses, permits or certificates authorizing the handling of PCB Products.
 - c. Number of years performing similar hazardous materials work.
 - d. Three recent job locations performing similar work.
6. Detailed step by step procedure indicating how the Work is to be accomplished. Procedure shall also include information for off-site Work, such as:
 - a. Method of disposal.
 - b. Owner and operator of the TSD Facility.
 - c. Location of the TSD Facility.
 - d. Method of transporting to the TSD Facility.
 - e. Name and Address of the Transporter, if different from the service company.
7. Service Company Data:
 - a. Name, address and telephone number.
 - b. Brochure explaining services offered.
 - c. Experience directly applicable to the required services.
 - d. Type and listing of equipment proposed to be used for the Work.
 - e. Licenses, permits, or certificates authorizing the handling of PCB products
8. Transporter Company Data:
 - a. Name, address and telephone number.
 - b. Brochure explaining services offered.
 - c. Experience directly applicable to the required services.
 - d. Type and listing of equipment proposed to be used for the Work.
 - e. Licenses, permits, or certificates authorizing the handling of PCB products.
9. Treatment, Storage, Disposal Facility Data:
 - a. Name, address and telephone number.
 - b. Brochure explaining services offered.
 - c. Experience directly applicable to the required services.

- d. Type and listing of equipment proposed to be used for the Work.
- e. Licenses, permits, or certificates authorizing the handling of PCB products.

B. Contact Closeout Submittals:

- 1. Generator's Copies of Hazardous waste Manifest and other Documents: Deliver the generator's copies to the Director's representative for delivery to appropriate facility personnel.

1.06 QUALITY ASSURANCE

- A. Service Company: Have this Work performed by a qualified company specifically permitted by the U.S. Environmental Protection Agency, Region 2, to operate as commercially operated PCB smelting or incineration disposal company.

1.07 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Comply with applicable governmental agency codes, rules, and Regulations for handling PCB fluids and articles.

PART 2 PRODUCTS

2.01 MATERIALS FOR USE DURING DISPOSAL PROCEDURE

- A. Furnish the required drums, containers, and other materials which meet applicable governmental agency codes, rules and regulations.

PART 3 EXECUTION

3.01 PERFORMANCE

- A. Remove and thermally destroy by smelting and incineration the specified PCB fluids and articles in accordance with applicable governmental agency codes, rules, and regulations. No PCB fluids or articles shall be disposed of as or as part of landfill.

END OF SECTION

SECTION 02084
DISPOSAL OF PCB LIQUID FILLED ELECTRICAL EQUIPMENT

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

- 02084B01 Catalog cuts for all equipment used in the performance of the Work.
- 02084B02 Catalog cuts for all Personal Protective Equipment including respirators and protective clothing.

Qualifications

- 02084K01 Qualifications, experience, training, and certification information for the contractor.
- 02084K02 Qualifications, experience, training, and certification information for the subcontractors.
- 02084K06 Qualifications, experience, training, and certification information of each person handling PCBs..
- 02084K07 Names, addresses, qualifications, and contact persons for the proposed transporter(s) of PCB transformer. Transporter has current registration approved by NYSDEC, and/ or DOT, as applicable.
- 02084K08 Name, address, telephone number and contact person for each waste disposal facility proposed for use in the Contract. Furnish evidence that each disposal facility has current registrations and permits for the operation of such facilities, or written approval from the state (and by the USEPA or other local agency, if applicable) in which it operates.

Record Documents

- 02084M01 Site-specific Health and Safety Plan (HASP) that complies with 29 CFR 1926 "Safety and Health Regulations for Construction" signed by a Certified Industrial Hygienist. In addition, provide site-specific Scope of Work information such as method of removal, work location(s), duration of work, crew size, login procedures, key personnel, competent person(s), the location of the WCP during the project. Said WCP shall include at least the following:
1. Exposure Assessment program for site exposure assessments. Include details of personal monitoring and note specific tasks. Identify personnel performing sampling. Provide certifications of laboratory conducting sampling analysis. If historical data is to be used, provide to Engineer for evaluation.
 2. Respiratory Protection program written in compliance with 29 CFR 1926.103, if applicable. Address the selection, use, maintenance and inspection of respirators, and qualifications for respirator users. Include copies of fit test records
- 02084M02 Waste Handling Plan that addresses the proper handling and disposal of all waste as described in 3.03 of this Section
- 02084M03 Contingency Procedures program to respond to fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water at the construction site. Include the following:
1. Emergency program describing arrangements agreed to by local police departments, fire departments, hospitals and state and local emergency response teams Include an evacuation plan for workers. Describe signals to be used to begin evacuation.
 2. List of names, addresses, and phone numbers of all persons qualified to act as emergency coordinators. Include a list of all emergency equipment at the construction site (fire extinguishers, spill control equipment, communications and alarm systems and decontamination equipment).
 3. Evacuation plan for workers. Describe signals to be used to begin evacuation.
 4. Evidence that a copy of the plan has been submitted to all local police departments, fire departments, hospitals, and State and local emergency r
- 02084M06 Copy of signed manifests for each load of waste material transported from the construction site. Furnish the manifest within one day of shipment
- 02084M07 Copy of executed waste manifest form signed by a responsible party of the disposal facility. Furnish the form within one day of receipt. If the copy is not received within 35 days from the date of shipment, contact the Engineer, and assist as directed, in efforts to locate the manifest, and in the completion of the EPA Exception Reports
- 02084M08 Certificate of final disposal for each manifest or certificate of recycling for recycled material. Provide the certification within one day of receipt
- 02084M09 Bills of Lading for the disposal of all non-hazardous municipal/construction waste within one week of the date of shipment

02084M11 Clean-up Letter presenting the results of the inspections conducted to verify the final cleanliness of the construction site, surrounding property, waterways, equipment, buildings, and structures

Contact Information

02084P01 Project Specific Chain of Command -- Show on Chain of Command form(s) office, beeper, mobile and home telephone numbers of persons having the authority to dispatch personnel to the Project location and commit such persons to the tasks as directed by the Engineer. At a minimum include numbers for Project Supervisor, Competent Person and CIH.

Closeout Submittals

02084R01 Copies of the Final Report.

END OF APPENDIX "A"

DIVISION 2

SECTION 02094

WORKER AND ENVIRONMENTAL PROTECTION FOR LEAD PAINT REMOVAL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies requirements for:

1. The installation and use of containment systems for the removal of paint coatings containing lead and other toxic metals in accordance with the Society for Protective Coatings (SSPC) Technology Guide 6 and associated containment tables A, C, P and W.
2. Worker and Environmental Compliance Plans for the protection of workers, the public, and the environment from exposure to harmful levels of lead that may be present in the paint being removed.
3. Ensuring that all waste is collected, handled, stored, transported, and disposed of off in accordance with applicable regulations.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section.

A. Code of Federal Regulations (CFR)

- | | | |
|----|-----------------|---|
| 1. | 29 CFR 1910.120 | Hazardous Waste Operations and
Emergency Response |
| 2. | 29 CFR 1910.134 | Respiratory Protection |
| 3. | 29 CFR 1926 | Occupational Safety and Health
Regulations for Construction |
| 4. | 29 CFR 1926.51 | Sanitation |
| 5. | 29 CFR 1926.62 | Lead |
| 6. | 40 CFR 50 | National Primary and Secondary Ambient
Air Quality Standards |
| 7. | 40 CFR 261-264 | Hazardous Waste Standards |

- 8. 40 CFR 265.13 General Waste Analysis
- 9. 40 CFR 268 Land Disposal Restrictions
- 10. 49 CFR 171-179 Transportation Regulations

B. New York Code of Rules and Regulations (NYCRR)

- 1. Title 6, Chapter III, 364-373 Hazardous Waste Management Regulations

C. Society for Protective Coatings (SSPC)

- 1. SSPC Guide 6 Guide for Containing Debris Generated During Paint Removal Operations
- 2. SSPC Guide 7 Guide for Disposal of Lead-Contaminated Surface Preparation Debris

REGULATORY REQUIREMENTS

D. Comply with the requirements of all applicable Federal, State, and City laws, codes, and regulations, including, but not limited to the regulations of the:

- 1. United States Environmental Protection Agency (USEPA);
- 2. Occupational Safety and Health Administration (OSHA);
- 3. New York State Department of Environmental Conservation (NYSDEC);
- 4. New York State Department of Health (NYSDOH); and
- 5. New York State Department of Labor (NYSDOL).

E. Comply with all applicable regulations even if the regulation is not specifically referenced herein. If a Federal, State, or City regulation is more restrictive than the requirements of this Section, follow the more restrictive requirements.

1.03 QUALIFICATIONS AND EXPERIENCE

A. Laboratory Qualifications/Occupational Physician

- 1. Verify that the analytical laboratories performing metals analysis on air, water, soil and solid waste, are accredited by The American Industrial Hygiene Association (AIHA), and has successfully participated (previous 12 months at a minimum) in the AIHA ELPAT program and PAT program.
- 2. Verify that the laboratory conducting the worker blood analyses is approved by OSHA, and NYSDOH, as applicable.
- 3. Verify the certifications of the Occupational Physician.

B. Competent Person/Supervisor. Employ one who:

1. Has a minimum of two years industrial painting field experience, with a minimum of ninety days field supervisory or management experience in paint removal projects;
2. Has proof of completion of 29 CFR 1926.62 Lead in Construction training.
3. Has proof of 29 CFR 1910.120 (initial or refresher) HAZWOP Supervisor training within the last 12 months;
4. For work in New York, has proof of completion of Society for Protective Coatings (SSPC) Competent Person for Deleading of Industrial Structures (SSPC C-3) course or equivalent. Certification must be maintained throughout the duration of the Contract.

C. Workers. Confirm that:

1. All workers have proof of completion of 29 CFR 1926.62 Lead in Construction training.

1.04 SUBMITTALS

See Appendix A.

PART 2 - PRODUCTS

2.01 PERSONAL PROTECTIVE MATERIALS AND MONITORING EQUIPMENT

A. Monitoring and Testing Equipment

1. Supply the instrumentation needed for monitoring worker and area exposures.
2. Supply all equipment needed for the operation of all instrumentation and monitors (e.g., generators, batteries, power cords, fuel, etc.).

B. Personal Protective Equipment and Hygiene Facilities

1. Provide all personal protective equipment (PPE) needed for Contractor's workers and for up to four Engineering representatives at each shift.
2. Repair or replace PPE as required to ensure that it continues to provide its intended purpose.

C. Containment Materials

1. Supply all equipment and materials needed to contain debris in accordance with the provisions of this Section. This may include ground covers, rigging, scaffolding, planking, containment materials, dust collection and ventilation equipment and HEPA vacuums.

PART 3 - EXECUTION

3.01 WORKER PROTECTION CRITERIA FOR LEAD

- A. Competent Person - Have daily inspections of the work area performed by a competent person.
- B. Written Compliance Program (WCP) – Prepare a WCP in accordance with 29 CFR 1926.62 (e)(2)(i). Maintain a copy of the WCP at the construction site for review by all employees and interested parties.
- C. Engineering and Work Practice Controls – Implement engineering and work practice controls, including administrative controls, to reduce and maintain employee exposure to lead below the Permissible Exposure Limits (PEL) (50 micrograms per cubic meter of air as an eight-hour time weighted average)
- D. Exposure Monitoring/Initial Assessment – Collect representative personal air samples in accordance with 29 CFR 1926.62 (d)(1)(iii). Protect workers during initial exposure assessment in accordance with 29 CFR 1926.62 (d)(2)(i). If historical data will be used in accordance with 29 CFR 1926.62 (d)(3)(iii), submit prior to start of work for evaluation by the Engineer.
- E. Respiratory Protection- Implement a Respiratory Protection Program in accordance with 29 CFR 1910.134. Proper selection, use, maintenance and inspection of respirators is required. Provide medical clearance and fit tests for respirator users.
- F. Protective Clothing and Equipment - Provide clean protective clothing and equipment in accordance with 29 CFR 1926.62 (g) and ensure they are used by all employees whose exposures exceed the PEL. Provide closed containers for items to be cleaned, such as work shoes and facemasks. If the clothing is disposable, label the containers as clothing contaminated with lead, if applicable. Apply hazardous waste labels as appropriate after testing.
- G. Housekeeping – In accordance with 29 CFR 1926.62 (h), clean accumulations of dust or debris containing lead daily and conduct all cleaning with HEPA (High Efficiency Particulate Air)-filtered vacuums. Containerize the debris for proper disposal. Bags and containers should be appropriately labeled as lead-containing waste.
- H. Personal Hygiene Facilities and Equipment/Decontamination Zone – In accordance with 29 CFR 1926.62 (i), provide clean change areas, showers, lavatory, eating facilities, and hand washing facilities as necessary for workers who may be exposed to lead at or above the OSHA PEL.

- I. Medical Surveillance and Medical Removal Protection – In accordance with 29 CFR 1926.62 (j) and (k), perform initial and periodic blood sampling and analysis for lead and zinc protoporphyrin (ZPP) when an employee is exposed to lead at or above the OSHA Action Level of 30 ug/m³. Provide the Engineer with blood analysis results.
- J. Employee Training and Information - In accordance with 29 CFR 1926.62 (l), provide initial and annual refresher site specific training for all employees who may be exposed to lead at or above the OSHA Action Level.
- K. Signs and Restricted Zones - In accordance with 29 CFR 1926.62 (m), establish restricted zones around areas or activities that might generate airborne emissions of lead in excess of the OSHA Action Level and post caution signs around each restricted zone.
- L. Record keeping - In accordance with 29 CFR 1926.62 (n), retain all records related to training, medical examinations, blood analysis, exposure monitoring, respirator fit testing, inspections by a competent person, and other related documentation.
- M. Visible Assessments - Conduct daily assessments of visible emissions and releases to the air, soil, water, and sediment, as applicable. Undertake all necessary corrective action to control emissions.

3.02 AMBIENT AIR MONITORING FOR LEAD

- A. High Volume Ambient Air Monitoring :
 - 1. The Engineer will undertake high volume ambient air monitoring during paint removal and clean-up activities to confirm that emissions do not exceed the EPA National Primary and Secondary Ambient Air Quality Standards (NAAQS), or specific New York or New Jersey regulations.
 - 2. Total suspended particulate (TSP-lead) will be analyzed in accordance with 40 CFR 50 Appendix G.
 - 3. The number and location of monitors will be determined by the Engineer, taking into consideration proximity to homes, businesses, and the general surroundings. Monitor siting and operation will be performed in accordance with the guidance provided in Methods A1 and A2 of SSPC publication 95-06, Project Design.
 - 4. The Contractor will be advised if such monitoring will be performed and will be provided with verbal background and ongoing results. Written results will be provided if requested by the Contractor.
 - 5. Take the following corrective action when air monitoring results exceed the following:

- a. If the emissions of 1 day of monitoring exceed $4.5 \mu\text{g}/\text{m}^3$ (8 hour period), assess all field data for that day and take appropriate corrective action to control emissions.
 - b. If the emissions of 2 consecutive days of monitoring exceed $4.5 \mu\text{g}/\text{m}^3$ (8 hour period), suspend dust producing operations (e.g., paint removal and/or clean-up) and implement appropriate corrective action to control emissions.
 - c. If the emissions on any one day exceed $13.5 \mu\text{g}/\text{m}^3$ (8 hour period), suspend dust producing operations (e.g., paint removal and/or clean-up) and implement appropriate corrective action to control emissions.
6. Regardless of the ambient air monitoring results, ensure at all times that no visible emissions occur

3.03 ON-SITE MANAGEMENT, TRANSPORTATION, AND DISPOSAL OF PAINT DEBRIS, WASTEWATER, AND ANY OTHER WASTE GENERATED FROM THE WORK.

A. General

1. Contractor is responsible for the collection, handling, storage, transportation and disposal of all hazardous wastes generated from this Work. PATH will provide the EPA identification number for lead waste disposal for permitting purposes.
2. The Contractor is responsible for the collection, handling, ~~transportation~~, and disposal of all solvent wastes generated from this Work. The Contractor must acquire his own EPA identification number for the disposal of solvent wastes.
3. The Contractor is responsible for the collection, handling, transportation, and disposal of all non-hazardous municipal/construction waste and waste water generated from this Work.
4. Recover all waste products generated during the paint removal Work, including but not limited to rags, tape, disposable coveralls, filters, and sediments.
5. Store waste only at location designated by the Engineer. Transport the waste to the designated storage area at the end of each working day, at a minimum.
6. Hazardous waste generation reports and fees/taxes imposed by the States shall be handled and paid for by the Contractor.

B. Items provided by the Contractor

1. Hazardous Waste - Furnish DOT-approved containers of the appropriate size and type for the hazardous waste generated, including but not limited to, paint chips, protective clothing, and the interior lining of the containment. Use containers that are resistant to rust and corrosion, (painted if constructed of steel), that have tight fitting lids or covers, and which are water resistant and leak proof.
2. Municipal/Construction Waste - Furnish all containers for non-hazardous municipal/construction waste. Use containers that are free of loose debris when brought to the construction site.
3. Spent Solvents - Furnish all DOT-approved containers for spent solvents. Do not mix spent solvents with paint debris, water or other lead contaminated waste.

C. Waste Sampling, Testing, And Classification

1. Sampling: Collect and have analyzed representative samples of each waste stream generated by the Work. Collect the samples under the observation of the Engineer.
2. Testing
 - a) Solid Waste: Direct the laboratory to test the solid waste in accordance with 40 CFR 261, Appendix II, Method 1311, Toxicity Characteristic Leaching Procedure (TCLP), to determine if it is hazardous. (Equal to or greater than 5 mg/L)
 - b) Waste water - test the waste water for Total metals (As, Cd, Cr, Cu, Pb, Hg, Mo, Ni, Zn), hexavalent chromium, pH, suspended solids, oil and grease, BOD, temperature, total cyanide, TPH, and other analytical parameters required for disposal characterization or by the disposal facility.
3. Laboratory Report
 - a) Include the following minimum information in each report : Identity of the RCRA listed waste streams and identity of the waste stream(s) analyzed, the number of samples collected and tested, dates of sampling and testing, laboratory test procedures utilized, the names and signatures of the individuals collecting the samples and analyzing the laboratory tests, interpretation of the test results, and final determination.
 - b) Include copies of the chain-of-custody forms in the documentation of hazardous waste and non-hazardous waste streams.

D. Waste Handling, Packaging, And Storage

1. Comply with 40 CFR 262 for the on-site handling, packaging, and storage of all waste generated by the Work.
2. All paint debris shall be vacuumed and collected in DOT-approved 55-gallon drums at the end of each Work period. Paint debris shall include paint chips and dust and shall not include any other construction debris, trash or chemical solvents. All disposable protective clothing and interior lining of the containment system shall be collected in DOT-approved drums at the end of each Work period.
3. At the Work areas, store waste in locations designated by the Engineer. Do not place hazardous waste on unprotected grounds (e.g. cover the ground with impervious tarping). Locate in a secure area with signs around the perimeter, and shield adequately to prevent dispersion of the waste by wind or water.
4. Properly transport all non-hazardous waste municipal/construction waste from the Work areas to the designated storage area. Verify that the waste is completely covered during transportation.
5. Maintain all drums in good operating condition with all lids and closing mechanisms intact and operational to prevent escape of debris by winds, spilling of contents, or access by unauthorized personnel.
6. Store non-hazardous waste separately from hazardous waste. Do not mix hazardous waste with non-hazardous waste. Do not mix different types of hazardous waste unless specifically approved by the Engineer.
7. Verify that all waste is transported to the appropriate recycling or disposal facility within 60 days after waste is first placed into the container.
8. Train all personnel in the proper handling of hazardous waste at the Work site in accordance with 29 CFR 1910.120, including the procedures to follow in the event of a release or spill, required notifications, and methods of clean-up. Maintain all training records on-site.

E. Labeling of Containers

1. Immediately label all containers of waste and paint debris to identify the contents. Label containers of paint debris as "LEAD PAINT WASTE, CONTAINS LEAD". Include the Contract Number and locations. Provide similar labels on containers of other waste, wastewater and debris.
2. After the TCLP test results are received, or after determination of hazardous waste status based on RCRA list at 40 CFR 261, Subpart D,

immediately apply hazardous waste labels, if the waste tests hazardous. Label each container of hazardous waste in accordance with 40 CFR 262, and 49 CFR 171-179.

F. Waste Transportation and Disposal (with the Exception of Waste Water)

1. Hazardous Waste

- a) Prepare the hazardous waste manifest for each shipment and provide to the Engineer for review and signature.
- b) Arrange for the transportation of all hazardous waste by a licensed transporter in accordance with 40 CFR 263, 49 CFR 171-179, and 6 NYCRR 364.
- c) Hazardous Paint Waste (TCLP results which indicate that lead concentrations or equal to or greater than 5 mg/L) shall be treated and stabilized to TCLP levels below 0.75 mg/L prior to disposal.
- d) Submit to the Engineer a certification for each manifested shipment that the waste was accepted by the recycling or disposal facility and was properly treated and disposed of. Comply with all of the manifesting, certification, and reporting requirements for hazardous waste in accordance with 40 CFR 262, 40 CFR 268, and 6 NYCRR 372, including certificates of final disposal for each shipment.

2. Non-Hazardous, Municipal, and Construction Waste

- a) Properly transport, and dispose of all non-hazardous, municipal and construction waste.
- b) Verify that waste is completely covered during transport.
- c) If lead or hazardous substances were detected during the laboratory testing, notify the disposal facility that such metals or materials are present in the waste.
- d) For non-hazardous lead waste with TCLP results which indicate lead concentrations between 1 mg/L and 5 mg/L, the waste shall be treated and stabilized to TCLP levels below 0.75 mg/L prior to disposal.
- e) Comply with additional City and local regulations as applicable.

G. Waste Water Handling And Disposal

1. Furnish containers for the collection and retention of all waste water including but not limited to the water used for steam cleaning, hygiene purposes, decontamination and cleanup activities. Filter visible paint

chips and particulate from the waste water prior to placing it into the containers. Make disposal arrangement with the local publicly owned treatment works (POTW), sanitation company, or other appropriate permitted facility.

- H. Cleaning of Haul Routes - Clean waste transportation haul routes upon completion of operation at end of each hauling.

END OF SECTION

SECTION 02094
WORKER AND ENVIRONMENTAL PROTECTION FOR LEAD-CONTA

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

- 02094B01 Catalog cuts for all equipment used in the performance of the Work.
- 02094B02 Catalog cuts for all Personal Protective Equipment including respirators and protective clothing.
- 02094B03 Catalog cuts for decon unit and wash station

Qualifications

- 02094K01 Qualifications, experience, training, and certification information for the contractor as stated in 1.04 of this Section.
- 02094K02 Qualifications, experience, training, and certification information for the subcontractors as stated in 1.04 of this Section.
- 02094K03 Qualifications, experience, training, and certification information for the laboratories as stated in 1.04 of this Section
- 02094K04 Qualifications, experience, training, and certification information for the physician as stated in 1.04 of this Section.
- 02094K05 Qualifications, experience, training, and certification information for the competent person/supervisor, as stated in 1.04 of this Section
- 02094K06 Qualifications, experience, training, and certification information for the workers, as stated in 1.04 of this Section.
- 02094K07 Names, addresses, qualifications, and contact persons for the proposed transporter(s) of hazardous waste, non-hazardous waste, and waste water. Furnish evidence that each transporter has current registration approved by NYSDEC, and/ or DOT, as applicable.

- 02094K08 Name, address, telephone number and contact person for each waste disposal facility proposed for use in the Contract. Furnish evidence that each disposal facility has current registrations and permits for the operation of such facilities, or written approval
- 02094K09 Certifications for laboratory conducting blood work, and copies of blood lead and ZPP testing for workers
- 02094K10 Certifications for laboratory conducting blood work, and copies of blood lead and ZPP testing for competent person(s).

Quality Assurance-Quality Control

- 02094L01 Written Engineering and Work Practice Controls program describing method of lead removal, air monitoring, containment/collection systems, equipment, and safety.

Record Documents

- 02094M01 Site-specific Health and Safety Plan (HASP) that complies with 29 CFR 1926 "Safety and Health Regulations for Construction" signed by a Certified Industrial Hygienist. A site-specific Written Compliance Program (WCP) shall be part of the submitted HASP
- 02094M02 Waste Handling Plan that addresses the proper handling and disposal of all waste as described in 3.03 of this Section
- 02094M03 Contingency Procedures program to respond to fires, explosions, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water at the construction site. Include the following:
 1. Emergency plan
- 02094M04 Complete analytical package of TCLP test results of waste samples within 4 weeks after sample collection
- 02094M05 Complete analytical package of waste water test results of waste sample collection within 4 weeks after sample collection
- 02094M06 Copy of signed manifests for each load of waste material transported from the construction site. Furnish the manifest within one day of shipment
- 02094M07 Copy of executed waste manifest form signed by a responsible party of the disposal facility. Furnish the form within one day of receipt. If the copy is not received within 35 days from the date of shipment, contact the Engineer, and assist as directed, in
- 02094M08 Certificate of final disposal for each manifest or certificate of recycling for recycled material. Provide the certification within one day of receipt

02094M09 Bills of Lading for the disposal of all non-hazardous municipal/construction waste within one week of the date of shipment

02094M10 Written documentation of the receipt of disposal of all waste water within one week of the date of shipment

02094M11 Clean-up Letter presenting the results of the inspections conducted to verify the final cleanliness of the construction site, surrounding property, waterways, equipment, buildings, and structures

Contact Information

02094P01 Project Specific Chain of Command -- Show on Chain of Command form(s) office, beeper, mobile and home telephone numbers of persons having the authority to dispatch personnel to the Project location and commit such persons to the tasks as directed by the E

Closeout Submittals

02094R01 Copies of the Final Report as stipulated in Section 02081(3.05) herein.

END OF APPENDIX "A"

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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:

	<u>American Concrete Institute (ACI)</u>
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
	<u>American Society for Testing and Materials (ASTM)</u>
ASTM D 1751	Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types)
	<u>National Forest Products Association (NFPA)</u>
	<u>National Design Specifications for Wood Construction</u>
	<u>West Coast Lumber Inspection Bureau</u>
	<u>American Plywood Association (APA)</u>
	<u>Douglas Fir Plywood Association (DFPA)</u>

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

- 03100A02 Provide a layout of all embedded items, including electrical and telephone conduit and plumbing and drainage pipes, at least 15 days prior to concrete placement.

END OF APPENDIX "A"

03100 - 8

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
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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 D1.4.

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 2.01A.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

SUBMITTALS

APPENDIX "A"

The following items shall be submitted to the Engineer, except as otherwise noted.

A. Shop Drawings

1. As per Division 1, "Shop Drawings, Catalog Cuts and Samples".
2. Details 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.
3. All proposed changes to the size, spacing or arrangement of the reinforcing steel shown on the Contract Drawings shall be clearly flagged as such on the shop drawings.

B. Catalog Cuts, Material Certification and Test Results

1. As per Division 1, "Shop Drawings, Catalog Cuts and Samples".
2. Catalog cuts for chairs, spacers, hangers and mechanical splices.
3. Certification from the applicator of epoxy that the epoxy-coated reinforcing bars meet the requirements of ASTM A 775 (AASHTO M284).
4. Test results and certification from the galvanizer that the weight, application and testing of zinc coating conforms with specifications and ASTM A 767.
5. Certified mill test reports for all concrete reinforcement.

C. Samples

1. As per Division 1, "Shop Drawings, Catalog Cuts and Samples".
2. Mechanical Splice Hardware.
3. Material used to repair coating.

D. Design Computations

1. 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"

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

Manufacturer Test Reports

03200F01 Certified mill test reports for all concrete reinforcement.

END OF APPENDIX "A"

03200.-5

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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.
<u>ASTM International (ASTM)</u>	
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/ft²/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/ft²/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 m²/kg.
 - 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:

Sieve Size % Passing	For Pavement 10 Inches or Greater in Thickness		For Pavement Less Than 10 Inches in Thickness	
	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 1 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	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 subplot 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, \bar{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.

<u>Performance Parameters</u>	<u>Minimum PWL</u>
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, \bar{X} , by calculating the average of all Sublot test values.
4. Find the Lot sample standard deviation, S_N , by using the following formula:

$$S_N = \sqrt{\frac{d_1^2 + d_2^2 + d_3^2 + \dots + d_n^2}{n - 1}}$$

Where:

S_N = standard deviation of the Sublot test values

d_1, d_2, \dots = deviation from the individual Sublot test values

X_1, X_2, \dots from the Average value, \bar{X} , that is,

$$d_1 = (X_1 - \bar{X}), d_2 = (X_2 - \bar{X}), \dots, d_n = (X_n - \bar{X})$$

n = number of Sublots

5. Find the Lower Quality Index, Q_L , by subtracting the Lower Quality Limit, LQL, from the Average value, \bar{X} , and dividing the result by S_N .

$$Q_L = \frac{\bar{X} - LQL}{S_N}$$

6. Find the Upper Quality Index, Q_U , by subtracting the Average value, \bar{X} , from the Upper Quality Limit, UQL, and dividing the result by S_N .

$$Q_U = \frac{UQL - \bar{X}}{S_N}$$

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

<u>Percent Within Limits (PWL)</u>	<u>Compressive Strength Pay Factor</u>
98 - 100	0.02 (PWL-100) +0.06
95 - 97	0.0
55 - 94	(PWL-95)/100
0 - 54	-0.50
<u>Percent Within Limits (PWL)</u>	<u>Permeability & Bond Strength Pay Factor</u>
91 - 100	0.006 (PWL - 90)
80 - 90	0.0
55 - 79	0.00017PWL ² - 0.0105PWL - 0.30
0 - 54	-0.50
<u>Percent Within Limits (PWL)</u>	<u>Flexural Strength Pay Factor</u>
95 - 100	(PWL-95/100)+.01
55 - 94	(PWL-95)/100
0 - 54	-0.50
<u>Percent Within Limits (PWL)</u>	<u>Pavement Thickness Pay Factor</u>
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.

<u>Category</u>	<u>Base Prices for Adjustments to Contract Compensation</u> <u>Per Cubic Yd</u>
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 1/2 inch 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)

<u>PWL</u>	<u>n=3</u>	<u>n=4</u>	<u>n=5</u>	<u>n=6</u>	<u>n=7</u>	<u>n=8</u>
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:

- A. List of materials for Work of this Section.
- B. Shop Drawings of forms and test pour details at least 15 calendar days before the test.
 - 1. Proposed number, location and details of contraction, control, expansion and construction joints at least 15 days prior to concrete placement.
- C. Catalog Cuts, Material Certification and Test Results
 - 1. At least 35 calendar days prior to concrete placement, the following:
 - a. Name and address of proposed concrete supplier, type of plant, documentation of State Certification for plant and ready mix trucks, AASHTO Accreditation certification for the independent testing laboratory and certification for an on-site individual in a supervisory capacity from one of the programs specified in 3.03 A.
 - b. 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, arrange for an independent testing laboratory to verify that Very High Early Strength Cement meets compressive strength, absolute drying shrinkage and setting time requirements specified in 2.02 B at the testing frequency specified therein.
 - c. Brand names and chemical compositions of form oil or release agents, evaporation retardant and liquid membrane curing compounds. For Architectural Concrete include this information also for forms, form liners and pigments.
 - d. Certification of compatibility and five-year performance record for liquid membrane forming curing compound, when used under conditions specified in 3.04 C, and the requirements of 2.02 R.2.
 - e. Test data and field use history for corrosion inhibitor admixtures (when specified on the Contract Drawings) as per 2.02 O.4:
 - (1) Manufacturer's test method to determine the concentration of the active component of the inhibitor.
 - (2) Procedures for the production of concrete mixes containing a corrosion inhibitor for the range of concrete temperatures from 50 deg F to 90 deg F and a procedure for the placement of concrete when a retarder is being used.

- f. Certification that admixtures conform to the requirements of 2.02 M submitted with Appendix "B" "Concrete Materials and Mix Proportion Data". Include dosing and re-dosing charts, which shall demonstrate the effects of concrete temperatures from 50 deg F and 90 deg F.
- g. A chemical analysis report of the percent by weight of silica fume solids by an approved independent testing laboratory when a wet slurry type of silica fume is being used.
- h. Source of expansion and/or contraction joints.
- i. Type, number and method of application of concrete vibrators.

D. Samples

- 1. Concrete ingredients for trial batches including cement, stone, sand, fly ash, slag, silica fume, metakaolin, admixtures, corrosion inhibitor, fibers, latex, pigment and anti-washout agent. Furnish these to the Engineer in whatever quantities he may require at least 35 days prior to concrete placement. This applies to all mixes, including changes to an approved mix.
- 2. At the request of the Engineer, submit cement, fly ash, slag and/or silica fume samples to check the Mill Certification at any time in accordance with 3.05 C.
- 3. For architectural concrete, provide two (2) sample panels (12" x 12" x 2" minimum size) for each mix for approval of color and texture. Provide catalog cuts for forms, form liners and form oil or release agents.

E. Construction Procedures and Quality Control Documents and Plans

- 1. At least 35 calendar days prior to concrete placement, the following:
 - a. Contractor's Quality Control Plan in accordance with 1.04 B.
 - b. Precast concrete fabricator's planned schedule for all production and a Quality Control Plan a minimum of 15 days prior to the commencement of production.
 - c. Cold and Hot Weather Concreting Plans in accordance with 1.03 of the Specification. Materials and methods for protecting concrete from freezing.
 - d. Pumping Procedure Plan, including, at a minimum, the pumping scheme, pump description, line diameter, line length and the number of turns and line offsets.
 - e. Written placement procedures that are in conformance with ACI 304R, Chapter 8 if concrete is being placed underwater.
 - f. Method of adding concrete admixtures, high range water reducers, non chloride accelerators, corrosion inhibitors, anti-washout agent, latex, fibers, pigment, slag, fly ash and silica fume.
 - g. Mixing and placement procedures and methods, as well as catalog cuts of equipment for installation. For hand mixes, submit the methods of proportioning, mixing (including minimum time requirements), transferring and placing the concrete.
 - h. Method of concrete placement in pipe piles (including elephant trunk size, length and material type).
 - i. Method of concrete placement and consolidation adjacent to joint assemblies and embedded hardware.

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:

Catalog Cuts

- 03301B01 At least 35 calendar days prior to concrete placement, the following:
Name and address of proposed concrete supplier and type of plant.

Samples

- 03301C02 List of materials for Work of this Section.

Product Data

- 03301D01 Concrete Mix Proportions:
Appendix "B" "Concrete Materials and Mix Proportion Data" at least 35 calendar days prior to concrete placement in accordance with 2.03.A of the Specification. To substantiate the mix proportions, submit all data and field results in accordance with 2.03.A. of the Specification

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.
- 03301E03 At least 35 calendar days prior to concrete placement, the following:
Certification that admixtures conform to the requirements of 2.02.M. submitted with Appendix "B" "Concrete Materials and Mix Proportion Data". Include dosing and re-dosing charts, which shall demonstrate the effects of concrete temperatures from 50°F and 90°F.
- 03301E04 At least 35 calendar days prior to concrete placement, the following: Documentation of State Certification for plant

03301-45

03301E05 At least 35 calendar days prior to concrete placement, the following: Documentation of State Certification of ready mix trucks

Construction and Installation Procedures

03301G01 At least 35 calendar days prior to concrete placement, the following:
Cold and Hot Weather Concreting Plans to the Engineer in accordance with 1.03 of the Specification. Materials and methods for protecting concrete from freezing.

03301G02 At least 35 calendar days prior to concrete placement, the following:
Pumping Procedure Plan, including, at a minimum, the pumping scheme, pump description, line length, and the number of turns and line offsets.

03301G04 At least 35 calendar days prior to concrete placement, the following:
Method of adding concrete admixtures, high range water reducers, non chloride accelerators, corrosion inhibitors, anti-washout agent, latex, fibers, pigment, slag, fly ash, and silica fume.

03301G05 At least 35 calendar days prior to concrete placement, the following:
Mixing and placement procedures and methods, as well as catalog cuts of equipment for installation. For hand mixes, provide the methods of proportioning, mixing (including minimum time requirements), transferring and placing the concrete.

03301G06 At least 35 calendar days prior to concrete placement, the following:
Curing Procedure Plan in accordance with 3.04, including the method and materials for curing.

03301G08 At least 35 calendar days prior to concrete placement, the following:
Materials and procedures for filling cracks and patching honeycombs and/or spalls.

Qualifications

03301K01 ACI Grade I certification for all personnel performing concrete testing.

Quality Assurance-Quality Control

03301L01 At least 35 calendar days prior to concrete placement, the following:
Contractors Quality Control Plan in accordance with 1.04.B.

Record Documents

03301M01 Daily copy of batch records in accordance with 1.04.A.1.a of the Specification.

Information

03301 -46

03301S01 Pre-concrete construction meeting agenda a minimum of 15 days prior to the scheduled date of the meeting.

03301S02 Minutes of the pre-concrete construction meeting within 5 days of the meeting.

END OF APPENDIX "A"

03301-47

- j. Curing Procedure Plan in accordance with 3.04, including the method and materials for curing.
 - k. Control Joint Location Plan.
 - l. Materials and procedures for filling cracks and patching honeycombs and/or spalls.
2. Daily copy of batch records in accordance with 1.04 A.1.a.
- F. Concrete Mix Proportions
- 1. Appendix "B" "Concrete Materials and Mix Proportion Data" at least 35 calendar days prior to concrete placement in accordance with 2.03 A of the Specification. To substantiate the mix proportions, submit all data and field results in accordance with 2.03 A.
 - 2. ACI Grade I certification for all personnel performing concrete testing.
 - 3. Written request to the Engineer for approval if a change in the weights of fine and coarse aggregate and cement is required in the approved mix proportions.
- G. For Information Only
- 1. Pre-concrete construction meeting agenda a minimum of 15 days prior to the scheduled date of the meeting.
 - 2. Minutes of the pre-concrete construction meeting within 5 days of the meeting.
- H. Design Computations
- 1. If required by the Engineer or noted on the Contract Drawings, have design computations signed and sealed by the Professional Engineer licensed in the state where Work is being done.

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"

SECTION 03602

GROUTING (NON-METALLIC)

APPENDIX "A"

SUBMITTALS

- A. Submit to the Manager, Materials Engineering Division, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397, a sample of the grout material for approval.
- B. Submit manufacturer's instructions and methods for handling, storage, mixing and placing of the grout, for approval.

END OF APPENDIX "A"

DIVISION 3

SECTION 03730

CONCRETE SPALL REPAIRS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for the repair of deteriorated or delaminated concrete on horizontal, vertical or overhead surfaces, by means of concrete spall repair materials.

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 Rapid Determination of the Chloride Permeability of Concrete.
T-277

American Concrete Institute (ACI)

ACI 503R-30 Pullout Strength Test. Appendix A
ACI 546.1R-80 Guide for Repair of Concrete Bridge Structures.

American Society for Testing and Materials (ASTM)

ASTM A 185 Steel Welded Wire Fabric, Plain for Concrete Reinforcement.
ASTM A 615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
ASTM C 39 Compressive Strength of Cylindrical Concrete Specimens.
ASTM C 78 Flexural Strength (Modulus of Rupture)
ASTM C 109 Compressive Strength. Modified
ASTM C 157 Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
ASTM C 403 Time of setting of Concrete Mixtures by Penetration Resistance.
ASTM C 666 Rapid Freeze/Thaw Durability, Procedure A.
ASTM C 928 Specification for Packaged, Dry, Rapid Hardening Cementitious
Materials for Concrete Repairs.

Steel Structures Painting Council (SSPC)

1.03 PERFORMANCE REQUIREMENTS

Concrete spall repair materials shall be certified by an independent testing laboratory for compliance with the following minimum requirements:

A. Concrete Spall Repair Material for Vertical or Overhead Applications.

1. Bond Strength

The concrete spall repair material shall be tested as follows:

- a. A test panel, 2 ft. long X 1 ft. wide X 3 inches deep, shall be installed in an overhead position.
- b. A total thickness of 2 1/2 inches of the concrete spall repair material shall be applied in two lifts within the overhead test panel.
- c. After a 28-day dry-curing period, specimens shall be sawcut or cored into the overhead test panel, penetrating a minimum of 1/2 inch into the substrate. Each specimen shall be tested in direct pull out tension to attain a minimum bond strength of 25 psi. Acceptable specimen configurations shall be 3-inch or 4-inch diameter cores, or square specimens sawcut with a 4 inch side.

2. Length Change

The concrete spall repair material shall attain a shrinkage value no greater than - 0.15% after 28 days in air; and an expansion value no greater than 0.15% after 28 days in water. Preparation and testing of specimens shall be performed in accordance with the test method specified in ASTM C-157, except that shrinkage or expansion observations shall be recorded at the times specified in ASTM C-928.

3. Compressive Strength

The concrete spall repair material shall be tested in accordance with ASTM C-109 Modified, and shall attain minimum compressive strengths of 1000 psi in 24 hours, and 4000 psi in 28 days.

4. Flexural Strength

The concrete spall repair material shall be tested in accordance with ASTM C-78, and shall attain a minimum flexural strength of 600 psi in 28 days.

5. Time of Set

To determine the workability of the concrete spall repair material, its initial and final set times shall be tested in accordance with ASTM C-403.

6. Durability

The concrete spall repair material shall be tested in accordance with ASTM C-666, Method A. The test specimens shall have less than 10% weight loss after 300 cycles of testing, and the Relative Dynamic Modulus of Elasticity (R.D.M.E.) shall be no less than 75% of the original value.

7. Permeability

The concrete spall repair material shall be tested in accordance with AASHTO T-277, "Rapid Determination of Chloride Permeability of Concrete", to yield a permeability value of less than 1000 Coulombs.

B. Concrete Spall Repair Material for Horizontal Applications

1. Bond Strength

The concrete spall repair material shall be wet-cured for 28 days and tested in accordance with ACI-503R-Appendix A. The concrete spall repair material bond strength for roadways, bridge decks and other vehicular load carrying concrete surfaces shall be a minimum of 200 psi. For other concrete surfaces not subjected to vehicular traffic the bond strength shall be no less than 100 psi.

2. Length Change

The concrete spall repair material shall be tested in accordance with ASTM C-157, except that it shall attain a shrinkage value no greater than -0.10% after 28 days in air; and an expansion value no greater than 0.10% after 28 days in water.

3. Compressive Strength

Compressive strength testing for neat pastes shall be performed in accordance with ASTM C-109. Materials extended with No. 8 aggregate, shall be tested in accordance with ASTM C-39. Test cylinders shall be a minimum of 3 inches in diameter. The minimum compressive strength shall be 2000 psi in 6 hours or 3000 psi in 24 hours, unless otherwise shown on the Contract Drawings.

4. Flexural Strength

The concrete spall repair material shall be tested in accordance with ASTM C-78, and shall attain a minimum flexural strength of 600 psi in 28 days.

5. Time of Set

The initial set time and final set time of the concrete spall repair material shall be determined in accordance with ASTM C 403.

6. Durability

The concrete spall repair material shall be tested in accordance with ASTM C-666, Method A. The test specimens shall have less than 10% weight loss after 300 cycles of testing, and the Relative Dynamic Modulus of Elasticity (R.D.M.E.) shall be no less than 75% of the original value. This requirement will not apply at locations where freeze-thaw cycles do not occur or for temporary patching.

7. Permeability

The concrete spall repair material shall be tested in accordance with AASHTO T-277, "Rapid Determination of Chloride Permeability of Concrete", to yield a permeability value of less than 1000 Coulombs. This requirement will not apply to indoor applications.

1.04 ENVIRONMENTAL REQUIREMENTS

- A. All work in this section shall be performed in accordance with the environmental requirements specified by the manufacturer of each concrete spall repair material, unless otherwise indicated herein or on the Contract Drawings. In case of conflict the more stringent requirements shall apply.
- B. Cold Weather Requirements
 - 1. Do not mix or place the concrete spall repair material when the ambient temperature is below 45 degrees Fahrenheit, or when conditions indicate that the temperature will fall below 45 degrees Fahrenheit within 72 hours, unless special mixing and placement procedures are approved by the Engineer.
 - 2. Take all necessary precautions to insure that the temperature of the concrete spall repair material, as placed, is a minimum of 50 degrees Fahrenheit.

1.05 QUALITY ASSURANCE

- A. The Contractor shall submit to the Manager of Materials, Materials Engineering Laboratory, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397 for approval, with a copy to the Engineer, the name of a qualified representative of the concrete spall repair material manufacturer, who will be responsible for the following:
 - 1. Provide technical information regarding proper methods of mixing and placing the concrete spall repair material.
 - 2. Be present during the initial mixing and placing of the concrete spall repair material.
 - 3. Be available for technical consultation when concrete spall repair material mixing or application problems arise.
 - 4. Provide certification that the mixing, surface preparation, placement, finishing and curing procedure used during the initial placement were in compliance with the manufacturer's recommendations.
- B. The Contractor shall furnish all labor, materials and equipment required to assist the Engineer in performing inspection and testing of the applied concrete spall repair materials. The Contractor shall make scaffolding and other equipment available as necessary to permit access to all repaired areas.
- C. The Contractor shall install a test patch for the Engineer's inspection and approval, a minimum of 48 hours prior to proceeding with any concrete spall repair work shown on the contract drawings. The test patch location will be designated by the Engineer.
- D. The Engineer may inspect all concrete spall repair materials and application procedures at any time for compliance with the Specifications.
- E. The Engineer may take and test samples of each lot of the concrete spall repair materials delivered to the work site.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all materials in the manufacturers sealed original 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 it as required to protect it from the elements.

1.07 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

- A. The concrete spall repair material(s) are specified on the Contract Drawings. Concrete spall repair material(s) submitted for approval, shall be accompanied by a certification indicating compliance with the requirements of Paragraph 1.03A or 1.03 B of this Specification, as applicable, and shall be submitted in accordance with the requirements of "Workmanship and Materials" of Division 1 -GENERAL PROVISIONS.
- B. Stone aggregate shall be ASTM C-33, Size No. 8.
- C. Reinforcing Bars shall be ASTM A-615, Grade 60.
- D. Welded Wire Fabric shall be ASTM A-185.
- E. Abrasive Blast Material shall be "Black Beauty", as manufactured by Reed Minerals, a Division of Harsco Corporation, South Kearny, NJ or approved equal.

2.02 EQUIPMENT

Abrasive Blast Equipment shall be as manufactured by the following, or an approved equal.

- A. "Clemco" by Clementina, Oakland, CA.
- B. "Pauli and Griffin" by Pauli Griffin, Vacaville, CA.
- C. "Sandstorm" by Bowen Tools, Inc., Houston, TX.

PART 3. EXECUTION

3.01 SURFACE PREPARATION

- A. The type and extent of deteriorated or delaminated concrete to be repaired shall be as shown on the Contract Drawings.
- B. Square off the concrete area to be repaired with a 1/2-inch sawcut, and shall remove all loose, deteriorated and delaminated concrete by means of pneumatic or mechanical chipping tools.

- C. Removal of loose, deteriorated and delaminated concrete, efflorescence and incrustation on concrete surfaces by means of pneumatic or mechanical chipping tools shall be done as follows:
1. Pneumatic hammers heavier than nominal 30-pound class shall not be used.
 2. Pneumatic hammers or mechanical chipping tools shall be operated at an angle not to exceed 45 degrees relative to the surface of the area being repaired.
 3. The Contractor shall remove deteriorated concrete to a sound surface for a depth not less than 1/4 inch nor more than 3/4 inch beyond the deteriorated layer of concrete, except as noted in 3.01 F.
 4. All concrete surfaces to be repaired shall be cleaned of dirt, dust, laitance and other contaminants by abrasive blasting to yield a dry and sound concrete surface. Such work shall be performed within the same work period that the installation of the concrete spall repair material takes place.
- D. The Contractor shall not use power tools to remove concrete adhered to exposed reinforcing steel. Removal of concrete, rust and/or corrosion adhered to exposed rebars shall be performed by abrasive blasting to a SSPC-SP6 surface finish.
- E. The Contractor shall not damage or debond reinforcing steel, or shatter concrete beyond the area to be repaired.
- F. If concrete removal has exposed more than half of the perimeter of a reinforcing bar, the rebar shall be completely exposed to clear the remaining concrete by a minimum of 1/2 inch. The Contractor shall not pry up or displace rebars to accomplish this clearance.
- G. Corroded reinforcing bars, which exhibit 25% loss of cross section area, or more after cleaning, shall be repaired in accordance with the Reinforcing Bar Repair Detail shown on the Contract Drawings. Payment for such work shall be at the Net Cost thereof.

3.02 REPAIR MATERIAL INSTALLATION

- A. After preparing the concrete surface to be repaired in accordance with the requirements of 3.01, and immediately prior to priming, such concrete surface shall be moistened with clean water without leaving any standing water. The moist condition will not be required, if the concrete spall repair material manufacturer specifically recommends that the surface area to be repaired not be moistened.
- B. The concrete surface to be repaired shall be primed by scrubbing a slurry mix of the concrete spall repair material into the substrate using a mason's brush. The slurry shall be mixed in accordance with the manufacturer's recommendations, and its application shall be immediately followed by the installation of the approved concrete spall repair material.
- C. The concrete spall repair material shall be mixed, handled and placed in strict conformance with the manufacturer's instructions, and the surface shall be finished as shown on the Contract Drawings, to match the existing concrete surface.
- D. Horizontal concrete repair areas greater than 3/4 inch in depth shall have the concrete spall repair material extended with size No. 8 stone aggregate in accordance with the manufacturer's recommendations, or as approved by the Engineer.

- E. All concrete spall repairs shall be cured using either an approved wet curing procedure, or a water-based curing membrane. If a wet curing procedure is selected and approved, such procedure shall be maintained for the duration of the curing.

PART 4. PAYMENT

4.01 NET COST WORK

The Contractor will be compensated for the work specified in 3.01 G 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 for 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 03730

CONCRETE SPALL REPAIRS

SUBMITTALS

APPENDIX "A"

The following items shall be submitted to the Engineer, except as otherwise noted.

- A. Shop Drawings
 - 1. As per Division 1 "Shop Drawings, Catalog Cuts and Samples".
- B. Catalog Cuts, Material Certification and Test Results
 - 1. As per Division 1 "Shop Drawings, Catalog Cuts and Samples.
 - 2. Submit to the Manager of Materials, Materials Engineering Laboratory, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397, with a copy to the Engineer, a list of the concrete spall repair materials to be used in the performance of the Contract Work. Each concrete spall repair material shall be selected from the products specified on the Contract Drawings, and shall be properly identified for the type of concrete spall repair intended.
 - 3. The manufacturer's instruction for handling, storage, mixing and placing each of the concrete spall repair materials.
 - 4. Submit to the Manager of Materials a certification with a copy to the Engineer indicating compliance with the performance requirements outlined in Section 1.03. This certification shall include test results conducted within the last two years.
- C. Samples
 - 1. As per Division 1 "Shop Drawings, Catalog Cuts and Samples".
- D. Construction Procedures and Quality Assurance Documents
 - 1. Submit to the Manager of Materials certification with a copy to the Engineer on Quality Assurance Procedures outlined in Section 1.05.

END OF APPENDIX "A"

SECTION 03730
CONCRETE SPALL REPAIRS

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

03730A01 As per Division 1, "Shop Drawings, Catalog Cuts and Samples."

Certificates

03730E01 Submit to the Chief of Materials Engineering a certification with a copy to the Engineer indicating compliance with the performance requirements outlined in Section 1.03. This certification shall include test results conducted within the last two years.

Construction and Installation Procedures

03730G01 The manufacturer's instruction for handling, storage, mixing and placing each of the concrete spall repair materials.

Quality Assurance-Quality Control

03730L01 Submit to the Chief of Materials Engineering certification with a copy to the Engineer on Quality Assurance Procedures outlined in Section 1.05.

END OF APPENDIX "A"

PAGE NOT USED

DIVISION 4
SECTION 04060
MASONRY MORTAR

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for cementitious mortar for use with brick, concrete and glass unit masonry.
- B. Refer to other Division 4 Sections on unit masonry for installation of masonry mortar.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Concrete Institute (ACI)/American Society of Civil Engineers (ASCE)/
The Masonry Society (TMS)

ACI 530.1/ASCE 6 /TMS 602	Specification for Masonry Structures.
	<u>American Society for Testing and Materials (ASTM)</u>
ASTM C 91	Specification for Masonry Cement.
ASTM C 144	Specification for Aggregate for Masonry Mortar.
ASTM C 150	Specification for Portland Cement.
ASTM C 207	Specification for Hydrated Lime for Masonry Purposes.
ASTM C 270	Specification for Mortar for Unit Masonry.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials in unopened packages legibly marked with manufacturer's name, brand and label information.
- B. Deliver, store and handle materials to prevent damage by water or moisture and contamination by foreign materials.
 - 1. Store cementitious materials on elevated platforms or in dispensing silo and under cover.
 - 2. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Weather Requirements

Conform to requirements of ACI 530.1/ASCE 6/TMS 602 for hot and cold weather construction. Follow cold weather requirements for ambient temperatures below 40 degrees F. Follow hot weather requirements for ambient temperatures above 100 degrees F and for temperatures above 90 degrees F with wind speed above 8 mph.

B. Perform the following procedures while masonry construction is in progress. Temperature ranges indicated refer to ambient temperature at time of installation. Do not heat water for mortar above 140 degrees F.

1. 40 degrees F to 32 degrees F

Heat mixing water to produce mortar temperature between 40 degrees F and 120 degrees F at the time of mixing.

2. 32 degrees F to 25 degrees F

Heat mixing water and sand to produce mortar temperature between 40 degrees F and 120 degrees F at the time of mixing. Maintain temperature of mortar on boards above freezing.

3. 25 degrees F to 20 degrees F

Heat mixing water and sand to produce mortar temperature between 40 degrees F and 120 degrees F at the time of mixing. Maintain temperature of mortar on boards above freezing. Heat masonry surfaces to a minimum of 40 degrees F. Provide wind breaks when wind velocity exceeds 15 mph.

4. 20 degrees F and below

Heat mixing water and sand to produce mortar temperature between 40 degrees F and 120 degrees F at the time of mixing. Maintain temperature of mortar on boards above freezing. Heat masonry surfaces to a minimum of 40 degrees F. Provide wind breaks when wind velocity exceeds 15 mph and provide heated enclosure with minimum 32 degree F air temperature.

1.05 QUALITY ASSURANCE

Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

- A. Colored Masonry Cements, if any: Premixed colored masonry cements, complying with ASTM C 91, of formulation required to produce mortar color shown on the Contract Drawings, shall be one of the following or approved equal:

CEMEX, Wampum, PA, "Richcolor Masonry Cement"
Essroc Cement, Nazareth, PA, "Flamingo-Brixment Masonry Cements in Color"
Lehigh Cement Co., Allentown, PA, "Lehigh Custom Color Masonry Cement"

- B. Liquid Water Repellent Admixture: Mortar for use with concrete masonry units (face wythe only) and exterior glass unit masonry shall be one of the following or approved equal:

Grace Construction Products (W.R. Grace & Co.), Milwaukee, WI, "Dry-Block Mortar Admixture" or "Mortar Tite"
Master Builders, Inc. (div. Degussa Corp.), Cleveland, OH, "Rheomix Rheopel Mortar Admixture"

2.02 MATERIALS

- A. Portland Cement

ASTM C 150, Type I (normal), or Type III (high early strength) for winter construction, natural color. Winter construction occurs when ambient air temperatures for a period of 48 hours before mortar installation is below 40 degrees F.

- B. Masonry Cement: ASTM C 91, for use in preparation of ASTM C 270 Type N, S or M colored mortar.

- C. Hydrated Lime: ASTM C 207, Type S.

- D. Mortar Aggregate

1. ASTM C 144; for joints less than 1/4 inch use aggregate graded with 100 percent passing the No. 16 sieve.
2. White Mortar Aggregate: Natural white sand or ground white stone as required to produce required mortar color shown on the Contract Drawings.

- E. Water: Clean and potable.

- F. Admixtures

Field addition at time of mortar mixing of air-entraining materials or admixtures, plasticizers, accelerators, retarders, coloring pigments, water repellent agents or other admixtures is not permitted unless specifically indicated. Submit factory produced cement and mortar blends containing admixtures to the Engineer for review.

2.03 MIXES

- A. Mortar mixes and colored mortar mixes shall comply with ASTM C 270 *Proportion Specification Requirements* for types listed, except provisions under Section 8 "Quality Assurance" of ASTM C 270 regarding cost of tests shall not apply. Furnish the following mortar types as required, unless otherwise shown on the Contract Drawings:
 - 1. Type N mortar for exterior, above grade walls and for interior walls.
 - 2. Type M mortar for walls below grade and in contact with earth.
 - 3. Type S mortar for grouted, vertically reinforced walls (not for use with glass masonry units).
- B. Mortar Color: Natural (grey), unless otherwise shown on the Contract Drawings.

PART 3. EXECUTION

3.01 PREPARATION

- A. Mix mortar ingredients in quantities needed for immediate use.
- B. Measure materials by volume or equivalent weight. Do not measure by shovel.
- C. Mix materials in clean mechanical batch mixer for 5 minutes.
- D. Use maximum amount of water to produce workable consistency. For mortar used with glass masonry units, reduce amount of water to compensate for lack of absorption.
- E. Perform hand mixing of small quantities of mortar only if approved by the Engineer.

3.02 ADJUSTMENTS

- A. To restore mortar workability, retemper by adding water and remixing. Retemper mortar as required, within 1-1/2 hours after mixing. Discard mortar that has begun to stiffen or is not used within 2-1/2 hours of initial mixing.
- B. Do not retemper colored mortar. Discard colored mortar that is not used within 2-1/2 hours after mixing.
- C. Do not retemper mortar for use with glass masonry units.

3.03 PROTECTION

Curing: Conform to requirements of ACI 530.1/ASCE 6/TMS 602.

END OF SECTION

SECTION 04060
MASONRY MORTAR

APPENDIX "A"
SUBMITTALS

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

Samples

04060C01 Samples:Colored Mortar, if any: Fabricate samples for verification in a minimum 6 inch long 3/8 inch wide metal channel, using same sand and mortar ingredients to be used in the Work. Label samples to indicate types and amounts of pigments used.

Product Data

04060D01 Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 – GENERAL PROVISIONS:A. Product data for each product

Certificates

04060E01 Certifications 1. Compliance with ASTM C 270 for masonry mortar materials.

04060E02 Certifications 2. Compliance with ASTM C 91 and C 270 for premixed colored masonry cements, if any.

Construction and Installation Procedures

04060G01 Construction and Installation Procedures: For Cold or Hot Weather (if applicable): Detailed description of methods, materials and equipment to be used to comply with cold or hot weather requirements.

Calculations

04060H01 Design Mix: List products and mix proportions for mortar and source of aggregate (for information only).

END OF APPENDIX "A"

DIVISION 4
SECTION 04070
MASONRY GROUT

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for cementitious grout for use in unit masonry walls.
- B. Refer to other Division 4 Sections on unit masonry for installation of masonry grout.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Concrete Institute (ACI)/American Society of Civil Engineers (ASCE)/
The Masonry Society (TMS)

ACI 530.1/ASCE 6/ TMS 602 Specification for Masonry Structures.

American Society for Testing and Materials (ASTM)

ASTM C 94 Ready-Mixed Concrete.
ASTM C 143 Test Method for Slump of Hydraulic Cement Concrete.
ASTM C 150 Specification for Portland Cement.
ASTM C 207 Specification for Hydrated Lime for Masonry Purposes.
ASTM C 404 Specification for Aggregates for Masonry Grout.
ASTM C 476 Specification for Grout for Masonry.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials in unopened packages legibly marked with manufacturer's name, brand and label information.
- B. Deliver, store and handle materials to prevent damage by water or moisture and contamination by foreign materials.
 - 1. Store cementitious materials on elevated platforms or in dispensing silo and under cover.
 - 2. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Weather Requirements

Conform to requirements of ACI 530.1/ASCE 6/TMS 602 for hot and cold weather construction. Follow cold weather requirements for ambient temperatures below 40 degrees F. Follow hot weather requirements for ambient temperatures above 100 degrees F and for temperatures above 90 degrees F with wind speed above 8 mph.

B. Perform the following procedures while masonry construction is in progress. Temperature ranges indicated refer to ambient temperature at time of installation. Do not heat water for grout above 140 degrees F.

1. 40 degrees F to 32 degrees F

Heat mixing water to produce grout temperature between 40 degrees F and 120 degrees F at the time of mixing.

2. 32 degrees F to 25 degrees F

Heat mixing water and aggregate to produce grout temperature between 70 degrees F and 120 degrees F at the time of mixing, and to provide in-place grout temperature above 70 degrees F.

3. 25 degrees F to 20 degrees F

Heat mixing water and aggregate to produce grout temperature between 70 degrees F and 120 degrees F at the time of mixing, and to provide in-place grout temperature above 70 degrees F. Heat masonry to a minimum of 40 degrees F prior to grouting.

4. 20 degrees F and below

Heat mixing water and aggregate to produce grout temperature between 70 degrees F and 120 degrees F at the time of mixing, and to provide in-place grout temperature above 70 degrees F. Heat masonry to a minimum of 40 degrees F prior to grouting, and provide heated enclosure with minimum 32 degree F air temperature.

1.05 QUALITY ASSURANCE

Obtain grout ingredients of uniform quality from one manufacturer for each cementitious component and from one source and producer for each aggregate.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

- A. Portland Cement
ASTM C 150, Type I, or Type III for winter construction, natural color.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Grout Aggregate: ASTM C 404.
- D. Water: Clean and potable.
- E. Admixtures: Addition of air-entraining materials or admixtures, plasticizers, accelerators, retarders, water repellent agents or other admixtures is not permitted.

2.02 MIXES

- A. Grout shall comply with ASTM C 476, with proportions of ingredients determined by Table 1 *Grout Proportions by Volume*, for use in construction of reinforced and non-reinforced unit masonry.
- B. Use grout type as shown on the Contract Drawings (fine or coarse) or type in compliance with ACI 530.1/ASCE 6/TMS 602 Table 1.15.1 *Grout Space Requirements*.

PART 3. EXECUTION

3.01 PREPARATION

- A. Batch, mix and deliver ready-mixed grout in accordance with batching, mixing and delivery requirements of ASTM C 94. Continuously agitate after mixing, until placement.
- B. Mix pre-blended dry grout materials in a clean mechanical batch mixer for 5 minutes.
- C. Measure materials by volume or equivalent weight. Do not measure by shovel.
- D. Use water to produce a slump between 8 and 11 inches, as measured per ASTM C 143.
- E. Perform hand mixing of small quantities of grout only if approved by the Engineer.

3.02 ADJUSTMENTS

Do not retemper grout. Discard grout that is not placed within 1-1/2 hours after water is first added to the batch.

3.03 PROTECTION

Curing: Conform to requirements of ACI 530.1/ASCE 6/TMS 602.

END OF SECTION

SECTION 04070
MASONRY GROUT

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

04070D01 Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS: Product Data for each product indicated.

Certificates

04070E01 Certifications: Compliance with ASTM C 476 for masonry grout materials.

Manufacturer Test Reports

04070F01 Test Reports: Test results supporting compliance with performance requirements for grout (compressive strength), if shown on the Contract Drawings.

Construction and Installation Procedures

04070G01 Construction and Installation Procedures: For Cold or Hot Weather (if applicable): Detailed description of methods, materials and equipment to be used to comply with cold or hot weather requirements.

Calculations

04070H01 Design Mix: List products and mix proportions for grout and list source of aggregate (for information only).

END OF APPENDIX "A"

DIVISION 4

SECTION 04170

JOINT REINFORCEMENT AND STEEL REINFORCING

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for joint reinforcement and steel reinforcing for unit masonry assemblies.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Concrete Institute (ACI)/American Society of Civil Engineers (ASCE)/
The Masonry Society (TMS)

ACI 530.1/ASCE 6/ TMS 602 Specification for Masonry Structures.

American Society for Testing and Materials (ASTM)

ASTM A 82 Specification for Steel Wire, Plain, for Concrete Reinforcement.
ASTM A 153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
ASTM A 185 Specification for Steel Welded Wire Fabric, Plain, for Concrete.
ASTM A 497 Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
ASTM A 615 Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
ASTM A 775 Specification for Epoxy-Coated Steel Reinforcing Bars.
ASTM A 951 Specification for Masonry Joint Reinforcement.

1.03 DEFINITIONS

A. Joint Reinforcement

Horizontal joint reinforcement fabricated, generally, in truss-type configuration for placement in the horizontal mortar joints of masonry walls and partitions.

B. Steel Reinforcing

Steel reinforcing bars, generally, placed vertically in the cells of CMU walls or partitions or in the cavity of masonry cavity walls, or placed horizontally in bond beams.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver joint reinforcement and steel reinforcing packaged in manufacturer's original, unopened bundles with label data legibly marked. Different types and grades of products shall be packaged separately.
- B. Store in a clean dry location.
- C. Handle to prevent deterioration or damage due to moisture, contamination, corrosion and other causes.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements of this Section, furnish and install products as manufactured by one of the following, or approved equal:

Joint Reinforcement:

Dur-O-Wal Inc., Div. of Dayton Superior Corp., Aurora, IL
Hohmann & Barnard, Inc., Hauppauge, NY
Wire-Bond, Charlotte, NC

2.02 MATERIALS

- A. Joint Reinforcement
 - 1. Steel Wire: ASTM A 82.
 - 2. Finish: ASTM A 153, Class B-2 (1.5 oz. per sq. ft. of wire surface) hot-dip galvanized coating, applied after fabrication.
- B. Steel Reinforcing (Horizontal or Vertical)
 - 1. General

Furnish reinforcing steel complying with ACI 530.1/ASCE 6/TMS 602 requirements and this Section.
 - 2. Steel Reinforcing Bars

Material and grade and size as follows, as shown on the Contract Drawings:

 - a. Uncoated steel reinforcing bars: ASTM A 615.
 - b. Epoxy-coated steel reinforcing bars: ASTM A 615 and ASTM A 775.

- C. Grade 60 if bar sizes 7 to 10 are used; Grade 40 if bar sizes 3 to 6 are used; Grade 75 if bar sizes 11, 14 or 18 are used.
- D. Furnish one or more of the following, where shown on the Contract Drawings:
 - 1. Plain Welded Wire Fabric: ASTM A 185.
 - 2. Deformed Welded Wire Fabric: ASTM A 497.

2.03 FABRICATION

A. Joint Reinforcement

Fabricate joint reinforcement in accordance with ASTM A 951 and as follows:

- 1. Welded-wire units with deformed, continuous side rods and plain cross rods prefabricated into straight lengths of not less than 10 feet, with prefabricated corner and tee units.
- 2. Width

Fabricate in widths approximately 2 inches less than nominal width of walls and partitions to provide mortar coverage of not less than 5/8 inch on joint faces exposed to exterior and 1/2 inch elsewhere.
- 3. Wire Size
 - a. Side Rods: W1.7 or 0.1483 inch diameter (9 gage).
 - b. Cross Rods: W1.7 or 0.1483 inch diameter (9 gage).
- 4. Units shall be fabricated with continuous diagonal cross rods spaced not more than 16 inches on center, placed in the same plane as longitudinal wires with one side rod for each composite wall wythe or face shell.
- 5. Furnish types as required for single- or multi-wythe walls as shown on the Contract Drawings, including two-piece adjustable types for cavity wall and for seismic design as required.

B. Steel Reinforcing

Fabricate steel reinforcing in maximum 12 foot lengths, unless otherwise shown on the Contract Drawings, and in accordance with approved unit masonry Shop Drawings.

PART 3. EXECUTION

3.01 INSTALLATION

A. Horizontal Joint Reinforcement

- 1. Install joint reinforcement in all masonry walls and partitions, unless otherwise shown on the Contract Drawings.
- 2. Use prefabricated "L" and "T" sections at corners and intersections. At returns, offsets, curves and other special conditions, cut and bend joint reinforcement to ensure continuity.

3. Lap joint reinforcement at least 6 inches at splices and prefabricated sections.
 4. Space reinforcement as follows, unless otherwise shown on the Contract Drawings:
 - a. For single- and multi-wythe walls, 16 inches on center vertically.
 - b. For parapets, 8 inches on center vertically.
 - c. For masonry openings greater than 1 foot wide, place joint reinforcement 8 inches apart (vertically), immediately above lintel and below sill. Extend joint reinforcement at least 2 feet beyond opening jambs.
 5. Cut or interrupt horizontal joint reinforcement at control or expansion joints and terminate 2 inches back from such joints.
 6. Terminate horizontal joint reinforcement 2 inches back from jambs.
- B. Steel Reinforcing

Install horizontal and/or vertical bar steel reinforcing where shown on the Contract Drawings.

END OF SECTION

SECTION 04170
JOINT REINFORCEMENT AND STEEL REINFORCING

APPENDIX "A"

SUBMITTALS

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

Certificates

- 04170E01 For horizontal joint reinforcement submit manufacturer's technical data including certification of compliance with specified standards for wire and finish in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1-GENERAL PROVISIONS.
- 04170E02 Submit material certificates for the following signed by manufacturer and Contractor certifying that each material complies with requirements. 1. Each material and grade indicated for reinforcing bars. 2. Each type and size of joint reinforcement.

END OF APPENDIX "A"

04170-5

DIVISION 4
SECTION 04212
BRICK MASONRY

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for brick masonry units, anchors and accessories.
- B. Requirements for masonry mortar, masonry grout and masonry joint reinforcement are found in other Division 4 Sections.
- C. Requirements for concealed flashing are found in other Division 7 Sections.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Concrete Institute (ACI)/American Society of Civil Engineers (ASCE)/
The Masonry Society (TMS)

ACI 530.1/ASCE 6/ TMS 602 Specification for Masonry Structures.

ACI 315 American Concrete Institute (ACI)
Details and Detailing of Concrete Reinforcement.

American Society for Testing and Materials (ASTM)

ASTM A 82 Specification for Steel Wire, Plain, for Concrete Reinforcement.

ASTM A 153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

ASTM B 117 Practice for Operating Salt Spray (Fog) Apparatus

ASTM C 62 Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).

ASTM C 67 Test Methods for Sampling and Testing Brick and Structural Clay Tile.

ASTM C 126 Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.

ASTM C 216 Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).

ASTM C 954 Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

ASTM C 1093 Practice for Accreditation of Testing Agencies for Unit Masonry.

ASTM C 1364 Specification for Architectural Cast Stone.

ASTM C 1405	Specification for Glazed Brick (Single Fired, Brick Units).
ASTM E 119	Test Methods for Fire Tests of Building Construction and Materials.
ASTM B 117	Practice for Operating Salt Spray (Fog) Apparatus

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Provide brick masonry units that develop an installed compressive strength (f'm) of 1500 psi, unless greater compressive strengths are shown on the Contract Drawings.
- B. Where fire-rated masonry construction is shown on the Contract Drawings, provide materials and construction which are identical to assemblies tested and approved by a testing and inspecting agency acceptable to the Engineer as complying with ASTM E 119, by calculated fire resistance (equivalent thickness), or by other means as permitted by authorities who would have jurisdiction if the Authority were a private corporation.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Protection of Masonry

During masonry erection, cover tops of walls, projections and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

- 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- 2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention

Prevent grout, mortar and soil from staining the face of masonry to be left exposed or painted. Remove immediately grout, mortar or soil that comes in contact with such masonry.

- 1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
- 2. Protect sills, ledges and projections from mortar droppings.
- 3. Protect surfaces of window and door frames and similar elements with painted and integral finishes from mortar droppings.

D. Conform to requirements of ACI 530.1/ASCE 6/TMS 602 for hot and cold weather construction. Follow cold weather requirements for ambient temperatures below 40 degrees F. Follow hot weather requirements for ambient temperatures above 100 degrees F and for temperatures above 90 degrees F with wind speed above 8 mph.

1.05 QUALITY ASSURANCE

A. Inspecting Laboratory Qualifications

Arrange for Contractor-chosen independent testing laboratory to demonstrate to the Engineer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM C 1093, that it has the experience and capability to conduct the testing indicated in this Section without delaying the progress of the Work.

B. Single Source Responsibility

Obtain masonry units of uniform texture and color, or uniform blend as required, from a single manufacturer for each type of product required.

C. Color Variation

Before constructing mortared mock-up panel, dry-stack approximately 100 of each type of exposed brick to be used in the Work, for Engineer's review and approval of color variation.

D. Mock-ups

Where shown on the Contract Drawings, before masonry Work commences, construct a 4 foot by 4 foot panel of each type of exposed brick masonry, as directed by the Engineer, for approval. Use mortar of type and color to be used in the Work.

1. Protect mock-ups from the elements with a weather-resistant membrane.
2. Retain mock-ups during construction as standards for judging completed masonry Work. When directed by the Engineer, demolish mock-ups and remove from Authority property.
3. Prepare a list of materials used to construct mock-ups, for information only, for Engineer. Include manufacturer and product names, generic materials, suppliers, colors, identifying lot or batch numbers and design mixes.
4. Where masonry is shown on the Contract Drawings to match existing, construct mock-up panel adjacent to and parallel to existing surfaces to be matched.

E. Unit Masonry Standard

Comply with ACI 530.1/ASCE 6/TMS 602 *Specifications for Masonry Structures*, except as otherwise indicated.

1. Revise ACI 530.1/ASCE 6/TMS 602 to exclude Sections 1.4 and 1.7; Parts 2.1.2, 3.1.2, and 4.1.2; and Articles 1.5.1.2, 1.5.1.3, 2.1.1.1, 2.1.1.2 and 2.3.3.9.
2. The Engineer will perform any required testing to inspect foundations for compliance with dimensional tolerances specified in referenced unit masonry standard.

F. Contractor shall employ and pay a qualified independent testing laboratory to perform the following preconstruction testing indicated as well as other inspecting and testing services required by referenced unit masonry standard or indicated herein for source and field quality control:

G. Clay Unit Masonry Tests

For each different clay masonry unit shown on the Contract Drawings, units shall be tested in accordance with ASTM C 67, except 5 bricks shall be selected at random for each 100,000 units or fraction thereof installed. The specific test requirements are indicated below.

1. Facing Brick
 - a. Efflorescence
 - b. Compressive Strength
 - c. Maximum Water Absorption by 5 hr. Boiling
 - d. Maximum Saturation Coefficient
2. Glazed Facing Brick
 - a. Compressive Strength
 - b. Maximum Water Absorption by 24 hr. Cold
 - c. Maximum Saturation Coefficient
3. Building Brick (Common Brick)
 - a. Compressive Strength
 - b. Maximum Water Absorption by 5 hr. Boiling
 - c. Maximum Saturation Coefficient

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle all materials to prevent damage by breaking, water or moisture and contamination by foreign materials.
- B. Store materials on a clean, dry surface or platform, off ground, covered, separate from each other and protected from deterioration and the elements.
- C. During freezing weather protect materials with tarpaulins or other suitable material.

1.07 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. General

1. Furnish brick types and special shapes in colors and textures as shown on the Contract Drawings.
2. Special Shapes
 - a. Furnish as required by the installation or as shown on the Contract Drawings.
 - b. Size Tolerance: 1/8 inch.
 - c. For sills, caps and similar applications resulting in exposure of brick surfaces which otherwise would be concealed from view, furnish uncured or unfrosted units.
 - d. Do not substitute field cut brick for special shapes.

3. Color and Texture

As shown on the Contract Drawings, or if not shown, as selected by the Engineer from manufacturer's color chart and six-sample stretcher units which shall represent the full range of color shades to be furnished.

4. Where shown on the Contract Drawings to "match existing," furnish brick of color, texture and size to match existing adjacent brickwork.

B. Facing Brick

1. ASTM C 216, Grade SW, Type FBS, unless Type FBX is shown.
2. Brick Size: As shown.
3. Efflorescence Rating: "Not effloresced" in accordance with ASTM C 67.
4. Color and Texture: In accordance with 2.01 A.3.
5. Compressive Strength: Minimum average of 5 brick (gross area) compressive strength: 3000 psi.

C. Glazed Facing Brick

1. ASTM C 1405, Grade S, Type I or Type II (single-faced or two-faced) as shown, Class Exterior, unless otherwise shown.
2. Brick Size: As shown.
3. Back Surface: Manufacturer's standard except, where plaster application is shown, furnish scored back surface in accordance with ASTM C 126 Section 13.
4. Color and Texture: In accordance with 2.01 A.3.
5. Compressive Strength: Minimum average of 5 brick (gross area) compressive strength: 6000 psi for Class Exterior.

D. Building Brick (Common Brick)

1. ASTM C 62, Grade SW.

2. Brick Size: As shown.
3. Compressive Strength: Minimum average of 5 brick (gross area) compressive strength: 3000 psi.

E. Cast Stone Sills and Copings

ASTM C 1364, of shapes and sizes shown on the Contract Drawings, with finish as shown or to match samples in the Engineer's Office.

2.02 ACCESSORIES

A. Ties and Anchors

Where shown on the Contract Drawings, furnish and install products as listed below, or approved equals. Furnish hot-dip galvanized products, unless otherwise indicated herein or shown on the Contract Drawings.

1. Wire Ties

Cold-drawn steel wire, 3/16 inch diameter, ASTM A 82, with ASTM A 153 Class B-2 (1.5 oz. per sq. ft. of wire surface) hot-dip galvanized coating; with 2 inch ends bent at right angles to provide hooks; wire tie length as required to extend at least halfway through veneer, but held back to allow 5/8 inch thick minimum mortar cover on outside face.

2. Wall Anchors

- a. Heckmann Building Products, Inc., Chicago, IL Cat. No. 340 A; 1-1/2 inches wide by 6 inches long, or length as required, by 2 inches bend; 16 gage, corrugated, galvanized steel with 7/16 inch diameter hole.
- b. Hohmann & Barnard, Inc., Hauppauge, NY Cat. Nos. 360 and 360-C "Gripstay Channel" with Nos. 363, 364 and 365 "Gripstay Anchors", galvanized or stainless steel.

3. Anchors for Securing Masonry to Steel Columns

- a. Hohmann & Barnard, Inc. No. 354, 1-1/2 inch by 3/16 inch galvanized steel.
- b. Hohmann & Barnard, Inc. No. 356, 1/4 inch by 3/4 inch galvanized steel.

4. Anchors for Securing Masonry to Steel Studs

Hohmann & Barnard, Inc. "X-Seal Veneer Anchor" galvanized steel, or approved equal, sized to accommodate cavity wall sheathing/insulation thickness.

5. Dovetail Slots: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.0336-inch, galvanized steel sheet. Provide the following product, or approved equal: No. 303 and 305, or No. 315 (where applicable) by Hohmann & Barnard.

B. Compressible Filler

Premolded closed cell neoprene compressible filler strip with pressure sensitive adhesive; Hohmann & Barnard, Inc. No. NS, or approved equal.

C. Weeps/Vents

Rectangular cellular plastic extrusion, one piece, UV resistant, sized for full width and height of head joint, and depth 1/8 inch less than depth of outer wythe, honeycomb design allowing weeping while preventing insect entry, in color as selected; Hohmann & Barnard, Inc. "Quadro-Vent," or approved equal.

D. Cavity Drainage Material

Free-draining mesh, made from polymer strands that will not degrade within wall cavity, 10 inches high and in thickness to match cavity size, designed to break up mortar; as manufactured by Mortar Net USA, Ltd., or approved equal.

E. Fasteners for Steel Studs

ASTM C 954 steel drill screws, except manufactured with hex washer head and neoprene washer, No. 10 diameter by length required to penetrate stud flange by minimum 3 exposed threads, with organic-polymer coating or other corrosion-protective coating having a salt-spray resistance of more than 700 hours in accordance with ASTM B 117.

PART 3. EXECUTION

3.01 PREPARATION

- A. Verify that the foundation on which the brick masonry wall is to be built has a clean, level surface free from laitance, other foreign materials, and frost or ice.
- B. Verify that the foundation elevation is such that the masonry bed joint will not vary more than 1/4 inch in 10 feet. The foundation edge shall be true to line so that the masonry does not project over the edge more than 1/4 inch.
- C. Verify that dowels and inserts for securing masonry are properly located and installed.
- D. Clean projecting dowels and reinforcement steel to remove loose rust, scale, dirt, concrete or other material that will inhibit bond.

3.02 INSTALLATION

A. General

- 1. Comply with referenced unit masonry standard and other requirements indicated in this Section applicable to each type of installation included in this Contract.
- 2. Comply with construction site tolerances of referenced unit masonry standard.
- 3. Blending: Select and arrange brick for use in exposed applications to produce a uniform blend of color and texture, either by mixing brick from several pallets or cubes as installation progresses, or by using manufacturer's preblended product.

4. Use full-size units without cutting where possible.
 - a. Where required to provide a continuous pattern or to fit to adjoining construction, cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Avoid using less-than-half size units.
 - b. Do not cut glazed facing brick.

B. Wetting

1. Wet bricks until they have an Initial Rate of Absorption (IRA) ~~not exceeding~~ 0.035 ounces (1 gram) per minute per square inch as determined in conformance with ASTM C 67. When being laid, the brick shall have suction sufficient to hold the mortar and to absorb the excess water from the mortar. The brick shall be sufficiently damp so that the mortar will remain plastic enough to permit the brick to be leveled and plumbed immediately after being laid, without destroying bond.
2. Do not wet brick having an IRA less than 0.2 grams per minute per square inch.

C. Laying Brick

1. Brick shall be clean and free of dust, dirt or other foreign materials before laying.
2. Lay brick plumb, level and true to line. Corners and angles shall be square unless otherwise shown on the Contract Drawings.
3. Line blocks shall be used whenever possible. When it is necessary to use line pin, the hole in the joint shall be filled with mortar immediately after pin is withdrawn.
4. Brick shall be laid as shown on the Contract Drawings in full, unfurrowed mortar beds and shoved to a solid bearing with uniform joints completely filled except where otherwise shown on the Contract Drawings.
5. Bond pattern and joint size shall be as shown on the Contract Drawings.
6. Tool joints in weather exposed brick slightly concave with an approved jointing tool, unless otherwise shown on the Contract Drawings. Use nonmetallic jointing tool on glazed facing brick.
7. Composite Masonry Wall (where shown on the Contract Drawings): Where face brick is shown backed-up by concrete block or building brick, bond with metal anchors or joint reinforcement as shown on the Contract Drawings, and except in the case of cavity walls, back parge with a continuous coat of mortar 3/8 inch thick before backup masonry is placed, or if backup units are laid first, they shall be similarly parged before the face bricks are laid.
 - a. Where bed joints of wythes are not in alignment, use adjustable, two-piece type reinforcement.
8. Masonry Cavity Wall (where shown on the Contract Drawings): Bond face wythe to the backup wythe with joint reinforcement. Joint reinforcement shall have drips and shall be in the configuration shown on the Contract Drawings. Furnish additional bonding ties at openings in wall, spaced not more than 3 feet apart around the opening and located within 12 inches of the opening.
 - a. Where bed joints of wythes are not in alignment, use adjustable, two-piece type reinforcement.

- b. Where one wythe is of clay masonry and the other wythe is of concrete masonry, whether bed joints are aligned or not, use adjustable, two-piece type reinforcement.
 - 9. Steel Stud Cavity Wall (where shown on the Contract Drawings): Bond brick veneer to the wall framing with screw-attached anchors of type shown, with two fasteners per anchor, or as otherwise required by anchor design.
 - 10. Keep cavities clean of mortar droppings and other materials. Make provisions during laying up of cavity walls to permit the removal of mortar droppings and other debris that may fall into the cavity. Strike mortar joints within the cavity clean to eliminate the mortar extrusion and to keep the cavity clear.
- D. Installation of Miscellaneous Items
 - 1. Install flashings and other sheet metal items to be incorporated in masonry as shown on the Contract Drawings, fully bedded in mortar above and below and overlapping a minimum of 4 inches at ends.
 - a. Thru-wall flashing shall extend completely through wall, or shall terminate in a stainless steel drip edge.
 - 2. Install anchor bolts, sleeves, lintels, shelf angles and other miscellaneous steel items to be incorporated in masonry in accordance with the Contract Drawings and approved Shop Drawings submitted under other Sections. Solidly fill spaces between such items and masonry with mortar and tool exposed joints.
 - a. Install compressible filler under shelf angles supporting masonry. Backer rod and sealant is specified in Division 7 Section on sealants.
 - 3. Install wall vents (brick vents) where shown on the Contract Drawings.
 - 4. Install cavity wall insulation where shown on the Contract Drawings using adhesive type as recommended by insulation manufacturer, compatible with dampproofing or air/vapor barrier, if any.
 - 5. Install weeps and vents located and spaced as shown on the Contract Drawings, not to exceed 24 inches on center.
 - 6. Install cavity drainage material per manufacturer's recommended configuration.
- E. Laying Sills And Copings
 - 1. Set masonry sills and copings where shown on the Contract Drawings using anchors as recommended by the manufacturer in a manner so as not to affect waterproofing integrity of the flashings underneath.
 - 2. Install expansion joints at ends of sills and caulk joints where shown on the Contract Drawings and as specified in other Sections.
 - 3. Install expansion joints in copings where shown on the Contract Drawings consisting of 1/2 inch joints for sealants specified in other Sections.
- F. Steel Reinforcing
 - 1. If a foundation dowel does not line up with a vertical core, it shall not be sloped more than 1 inch horizontally per 6 inches vertically. Grout dowels within a core to a vertical alignment, even though it may be in a cell adjacent to the vertical wall reinforcing.

2. Where reinforcing bars are to be spliced, lap reinforcing bars by a minimum distance equivalent to 30 reinforcing bar diameters. Bars to be spliced must be adjacent to each other, with no gaps between them permitted.

G. Horizontal Joint Reinforcement

1. Completely embed joint reinforcement in mortar or grout. Joints with wire reinforcement shall be a minimum of twice the thickness of the wire. Lap reinforcement 6 inches minimum at splices to contain at least one cross wire of each piece of reinforcement in the lapped area.

H. Install control and expansion joint materials in brick masonry as Work progresses. Offset control joints from expansion joints in wythes.

I. General Grouting

1. Placement Standard: Comply with ACI 530.1/ASCE 6/TMS 602 *Specifications for Masonry Structures*, including requirements for pour height.
2. Place grout only after entire height of masonry to be grouted has attained proper strength to resist grout pressure. Stop grout pour 1 inch from top of masonry unit so that next pour will be keyed in.
3. Steel reinforcing shall be in place before grouting begins.
4. Vibrate, rod or puddle grout in place.
5. Maintain vertical cell alignment to preserve a continuous unobstructed cell area.
6. Solidly fill with grout cells containing reinforcement, bolts or other anchor devices, and where shown on the Contract Drawings.
7. Solidly fill spaces at metal door frames and other built-in items with grout or mortar.

J. Patching

Point holes and defective mortar joints in exposed masonry. Where necessary, cut out and repoint defective joints in exposed masonry. Patching shall match adjoining masonry in quality and appearance.

K. Matching Existing Masonry: Match coursing, bond pattern, color and texture of new masonry with existing masonry.

3.03 FIELD QUALITY CONTROL

- A. Verify compliance with compressive strength requirements of completed masonry, where shown on the Contract Drawings or required by the Engineer.

3.04 CLEANING AND PROTECTION

- A. Protect exposed masonry against staining from grouting or other sources and clean excess mortar off surfaces as the Work progresses.
- B. Furnish temporary protection for door jambs and corners during the Work. Remove temporary protection when directed by the Engineer.

- C. Upon completion of masonry construction, clean exposed masonry surfaces with stiff-bristled brushes and water so as to leave the masonry surfaces clean and free of mortar daubs.
- D. If ordinary cleaning is not adequate, use special methods and materials to clean surfaces as approved by the Engineer.

END OF SECTION

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SECTION 04212
BRICK MASONRY

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

- 04212A01 Shop drawings for stone trim in form of cutting and setting drawings showing sizes, profiles, and locations of each stone trim unit required.
- 04212A02 Shop drawings and/or manufacturer's catalog cuts of dovetail slots and other devices, if any, required for anchoring masonry to steel or other materials, including instructions for their proper use.

Samples

- 04212C01 Six samples for approval for each different type of exposed brick required, showing full range of exposed color, texture, and dimensions to be expected in completed construction. When required by 2.01 A.4, submit samples for color selection.
- 04212C02 Two sample sections of cast stone sills and coping, if any, showing color and texture of finish.
- 04212C03 Samples of accessories embedded in the masonry.

Product Data

- 04212D01 Include size variation data verifying that actual range of sizes for brick falls within ASTM C 216 dimension tolerances where modular dimensioning is shown.

Certificates

- 04212E01 Submit test results from a qualified testing lab, certifying that masonry complies with 1.05 F.

Construction and Installation Procedures

- 04212G01 Cold-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.

04212-12

04212G02 Hot-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.

Qualifications

04212K01 Qualification data for firms and persons specified in 1.05 to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, telephone numbers, names of Architects and Owners, and other information specified.

END OF APPENDIX "A"

DIVISION 4
SECTION 04220
CONCRETE MASONRY UNITS

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for concrete masonry units and accessories.
- B. Requirements for masonry mortar, masonry grout, masonry joint reinforcement and steel reinforcing are found in other Division 4 Sections.
- C. Requirements for concealed flashing are found in other Division 7 Sections.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Concrete Institute (ACI)/American Society of Civil Engineers (ASCE)/
The Masonry Society (TMS)

ACI 117	Standard Specifications for Tolerance for Concrete Construction and Materials
ACI 530.1/ASCE 6/ TMS 602	Specification for Masonry Structures.
<u>American Concrete Institute (ACI)</u>	
ACI 315	Details and Detailing of Concrete Reinforcement.
<u>American Society for Testing and Materials (ASTM)</u>	
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 C 90	Specifications for Loadbearing Concrete Masonry Units.
ASTM C 140	Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
ASTM C 331	Specification for Lightweight Aggregates for Concrete Masonry Units.
ASTM C 426	Test Method for Linear Drying Shrinkage of Concrete Masonry Units.
ASTM C 549	Specification for Perlite Loose Fill Insulation
ASTM C 578	Specification for Rigid, Cellular Polystyrene Thermal Insulation.
ASTM C 744	Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
ASTM C 1093	Practice for Accreditation of Testing Agencies for Unit Masonry.

ASTM C 1262	Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units.
ASTM C 1364	Specification for Architectural Cast Stone.
ASTM D 2000	Classification System for Rubber Products in Automotive Applications.
ASTM D 2240	Test Method for Rubber Property—Durometer Hardness.
ASTM E 119	Test Methods for Fire Tests of Building Construction and Materials.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Provide concrete masonry units that develop an installed compressive strength (f_m) of 1500 psi, unless greater compressive strengths are shown on the Contract Drawings.
- B. Where fire-rated masonry construction is shown on the Contract Drawings, provide materials and construction which are identical to assemblies tested and approved by a testing and inspecting agency acceptable to the Engineer as complying with ASTM E 119, by calculated fire resistance (equivalent thickness), or by other means as permitted by authorities who would have jurisdiction if the Authority were a private corporation.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Protection of Masonry

During masonry erection, cover tops of walls, projections and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

- 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- 2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention

Prevent grout, mortar and soil from staining the face of masonry to be left exposed or painted. Remove immediately grout, mortar or soil that comes in contact with such masonry.

- 1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
- 2. Protect sills, ledges and projections from mortar droppings.
- 3. Protect surfaces of window and door frames and similar elements with painted and integral finishes from mortar droppings.

D. Weather Requirements

1. Conform to requirements of ACI 530.1/ASCE 6/TMS 602 for hot and cold weather construction. Follow cold weather requirements for ambient temperatures below 40 degrees F. Follow hot weather requirements for ambient temperatures above 100 degrees F, or for temperatures above 90 degrees F with wind speed above 8 mph.
2. Do not lay masonry units that are wet or frozen.
3. Remove masonry damaged by freezing conditions.
4. Erect windbreaks or enclosures when wind is 15 mph or more.

1.05 QUALITY ASSURANCE

A. Inspecting Laboratory Qualifications

The Contractor-chosen independent testing laboratory must demonstrate to the Engineer's satisfaction, based on his evaluation of laboratory-submitted criteria conforming to ASTM C 1093, that it has the experience and capability to conduct the testing indicated in this Section without delaying the progress of the Work.

B. Single Source Responsibility

Obtain exposed masonry units of uniform texture and color from a single manufacturer for each type of product required.

C. Mock-ups

Where shown on the Contract Drawings, before masonry Work commences, construct a panel approximately 6 foot long by 4 foot high of each type of exposed concrete masonry unit, as directed by the Engineer, for approval. Use mortar of type and color to be used in the Work.

1. Protect mock-ups from the elements with a weather-resistant membrane.
2. Retain mock-ups during construction as standards for judging completed masonry Work. When directed by the Engineer, demolish mock-ups and remove from Authority property.
3. Prepare a list of materials used to construct mock-ups, for information only, for Engineer. Include manufacturer and product names, generic materials, suppliers, colors, identifying lot or batch numbers and design mixes.
4. Where masonry is shown on the Contract Drawings to match existing, construct mock-up panel adjacent to and parallel to existing surfaces to be matched.

D. Unit Masonry Standard

Comply with ACI 530.1/ASCE 6/TMS 602 *Specifications for Masonry Structures*, except as otherwise indicated.

1. Revise ACI 530.1/ASCE 6/TMS 602 to exclude Sections 1.4 and 1.7; Parts 2.1.2, 3.1.2, and 4.1.2; and Articles 1.5.1.2, 1.5.1.3, 2.1.1.1, 2.1.1.2, and 2.3.3.9.

E. The Engineer will perform any required testing to inspect foundations for compliance with dimensional tolerances specified in ACI 117.

F. Preconstruction Testing

Employ and pay a qualified independent testing laboratory to perform the following preconstruction testing indicated as well as other inspecting and testing services required by referenced unit masonry standard or indicated herein for source and field quality control:

1. Concrete Masonry Unit Tests

Test each different concrete masonry unit shown on the Contract Drawings for dimensions, compressive strength, absorption, weight (density) and moisture content per ASTM C 140. Test exposed and/or exterior units with water repellent additive for water penetration, in accordance with the requirements of ASTM E 514.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle all materials to prevent damage by breaking, water or moisture and contamination by foreign materials.
- B. Store materials on a clean, dry surface or platform, off ground, covered, separate from each other and protected from deterioration and the elements.
- C. During freezing weather protect materials with tarpaulins or other suitable material.

1.07 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. General

- 1. Special Shapes: Furnish as required by the installation or as shown on the Contract Drawings.
- 2. Integral Water Repellent

Furnish units with integral liquid water repellent additive for exposed unit applications, manufactured by W.R. Grace & Co. Conn., Grace Construction Products Div., "Dry-Block," or approved equal.

- a. Where block is furnished with integral water repellent, assemblies shall include mortar containing water repellent additive by same manufacturer.

B. Concrete Masonry Units (CMU)

- 1. Hollow or solid load-bearing units: ASTM C 90.
- 2. Weight Classification

Lightweight; except furnish normal weight for exposed CMU to be painted.

3. Unit Compressive Strength: Provide units with minimum average net area compressive strength of 1900 psi.

4. Aggregate

Lightweight aggregate, 100 percent expanded clay, shale or slate produced by the rotary kiln process and conforming to ASTM C 331. The blending of screenings or any other deleterious substances which will impair the block's fire rating or insulation value shall not be permitted.

5. Linear Shrinkage: Maximum 0.065 percent, tested in accordance with ASTM C 426.

6. Size: Nominal 16 inch by 8 inch face dimension, unless otherwise shown on the Contract Drawings, by thickness indicated.

7. Exposed Faces

a. Color and Texture: Manufacturer's standard, unless otherwise shown on the Contract Drawings.

b. Pattern: Plain face, unless otherwise shown on the Contract Drawings.

C. Decorative Concrete Masonry Units

Where special finishes are shown on the Contract Drawings, furnish ASTM C 90 hollow or solid load-bearing units, with exposed faces of the following general description in color and texture shown on the Contract Drawings, or if not shown, as selected by the Engineer from manufacturer's standard color chart and six sample stretcher units which shall represent the full range of color variation.

1. Standard aggregate, ground finish.
2. Special aggregate, ground finish.
3. Standard aggregate, split face finish.
4. Special aggregate, split face finish.
5. Standard aggregate, split ribbed finish.
6. Special aggregate, split ribbed finish.

D. Ground Face or Prefaced Units

Color shall be as shown on the Contract Drawings or, if not shown, as selected by the Engineer from manufacturer's standard color chart and six sample stretcher units which shall represent the full range of color variation.

E. Ground Face Masonry Units (GFMU)

In addition to complying with 2.01 C, GFMU shall be as follows:

1. ASTM C 90 hollow or solid load-bearing units, as shown on the Contract Drawings, integrally colored block with manufacturer's standard treated clear satin gloss acrylic face coating conforming to ASTM C 744 with respect to adhesion, color change and resistance to crazing; and to ASTM C 1262 with respect to freezing and thawing.
2. Furnish filled units with single or double face as shown on the Contract Drawings.

3. Products: Subject to compliance with the requirements of this Section, furnish and install "Trendstone"; Trenwyth Industries, Inc., Emigsville, PA, or approved equal.

F. Prefaced Concrete Masonry Units (PCMU)

In addition to complying with 2.01 C, PCMU shall be as follows:

1. ASTM C 90 hollow or solid load-bearing units, as shown on the Contract Drawings, with manufacturer's standard resinous tile facing complying with ASTM C 744 and 1/16 inch thick returns of facing to create 1/4 inch mortar joints with modular coursing.
2. Products: Subject to compliance with the requirements of this Section, furnish and install PCMU of one of the following, or approved equal:
 - a. "Astra-Glaze-SW+"; Trenwyth Industries, Inc., Emigsville, PA.
 - b. "Spectra-Glaze II"; produced by a manufacturer licensed by Spectra Development Corp. Licensing and Chemical Div., Baltimore, MD.

G. Cast Stone Sills and Copings

ASTM C 1364, of shapes and sizes shown on the Contract Drawings, with finish as shown or to match samples in the Engineer's Office.

2.02 ACCESSORIES

A. Ties and Anchors

Where shown on the Contract Drawings, furnish and install products as listed below, or approved equals. Furnish hot-dip galvanized products, unless otherwise indicated herein or shown on the Contract Drawings.

1. Ties, if any, shall be wire ties as specified in other Sections and as shown on the Contract Drawings.
2. Wall Anchors

Heckmann Building Products, Inc. Chicago, IL, No. 340-A; 16 gage corrugated galvanized steel, 1-1/2 inches wide by 6 inches long, or length as required, by 2 inches bend with 7/16 inch diameter hole.
3. Channel System Wall Anchor
 - a. Channel: Hohmann & Barnard, Inc. No. 360 or No. 360-C; 10 gage galvanized steel, "Gripstay Channel".
 - b. Anchors: Hohmann & Barnard, Inc. No. 364 or No. 365; 3/16 inch by 1-1/4 inch stainless steel, "Gripstay Anchor"; length as shown on the Contract Drawings.
4. Anchors for Securing Masonry to Steel Columns
 - a. Hohmann & Barnard, Inc., Hauppauge, NY, No. 353, 353L; 1-1/4 inch wide by 3/16 inch galvanized steel.
 - b. Hohmann & Barnard, Inc., Hauppauge, NY, No. 354; 1-1/2 inch wide by 3/16 inch galvanized steel.

5. Anchors for Securing Masonry to Steel Beams

Hohmann & Barnard, Inc. No. 357; 1-1/4 inch wide by 3/16 inch galvanized steel.

6. Intersecting Rigid Partition Anchors

Hohmann & Barnard, Inc. No. 344; 1-1/4 inch wide by 3/16 inch galvanized steel, length as required.

7. Wire Mesh Wall Ties

16 gage galvanized steel, 1/2 inch square mesh; minimum 12 inches long; width as required to provide 5/8 inch mortar cover at edges; Heckmann Building Products, Inc. No. 269, or approved equal.

8. Stone Anchors

Stainless steel, size and diameter as shown on the Contract Drawings; Hohmann & Barnard, Inc. No. 408, or approved equal.

9. Anchor Bolts

Steel bolts with hex nuts and flat washers complying with ASTM A 307, Grade A, hot-dip galvanized to comply with ASTM A 153, Class C, in size and configuration as shown on the Contract Drawings.

10. Dovetail Slots: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.0336-inch, galvanized steel sheet. Provide the following product, or approved equal: No. 303 and 305, or No. 315 (where applicable) by Hohmann & Barnard.

11. Premolded Control Joint Gaskets

Extruded rubber material complying with ASTM D 2000 2AA-805, durometer hardness of 80 plus or minus 5 when tested in accordance with ASTM D 2240; designed to fit CMU sash block; "No. RS Series" as manufactured by Hohmann & Barnard, Inc., or approved equal.

B. Compressible Filler

Premolded closed cell neoprene compressible filler strip with pressure sensitive adhesive; "No. NS" as manufactured by Hohmann & Barnard, Inc., or approved equal.

C. Weeps/Vents

Rectangular plastic tube, 1-1/2 inches by 3-1/2 inches by 3/8 inch outside width and spaced as shown on the Contract Drawings, manufactured by Hohmann & Barnard, Inc., or approved equal.

D. Insulation

1. Cavity Wall Insulation

Extruded Polystyrene Board Insulation: Rigid cellular thermal insulation with closed cells and integral high-density skin, formed by the expansion of polystyrene base resin in an extrusion process, CFC-free, complying with ASTM C 578, Type IV; with *shiplap interlocking edges for additional air and moisture barrier protection*; thicknesses as shown on the Contract Drawings.

2. Masonry Cell Insulation

- a. Molded Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene resin beads or granules in a closed mold to comply with ASTM C 578, Type I; furnish specially shaped units designed for installation in cores of concrete masonry units.
- b. Loose Granular Fill: Perlite complying with ASTM C 549, Type II or Type IV.

PART 3. EXECUTION

3.01 PREPARATION

- A. Ensure that the foundation on which the wall is to be built has a clean, level surface free from laitance, other foreign materials, and frost or ice.
- B. Verify that the foundation elevation is such that the masonry bed joint shall not vary more than 1/4 inch in 10 feet and that the foundation edge is true to line so that the masonry does not project over the edge more than 1/4 inch.
- C. Clean projecting dowels and steel reinforcing to remove loose rust, scale, dirt, concrete or other material that will inhibit bond.
- D. Verify that dowels and inserts for securing masonry to concrete and metal ties for securing masonry to structural steel are properly located and installed.

3.02 INSTALLATION

A. General

- 1. Comply with referenced unit masonry standard and other requirements indicated in this Section applicable to each type of installation included in this Contract.
- 2. Comply with construction site tolerances of referenced unit masonry standard.
- 3. Maintain uniform thickness of horizontal and vertical joints.
- 4. Use full-size units without cutting where possible. Where required to provide a continuous pattern or to fit to adjoining construction, cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges.
- 5. Cut units accurately to fit penetrations for plumbing, ducts, electrical, fire protection and communication Work, and patch holes neatly.
- 6. Use proper special shape units for windows, doors, bond beams, lintels, pilasters and corners with a minimum of unit cutting.

B. Laying CMU

1. Furnish and install concrete masonry units of the types and sizes shown on the Contract Drawings and which are dry, sound, clean and free from dust, dirt and cracks before laying.
2. Lay units plumb, level and true to line, with cells vertical.
3. Fully bed each concrete masonry unit in mortar with vertical joints completely filled and shove unit to a solid bearing.
4. Joint Size: Not more than 3/8 inch thick, except for PCMU which shall have 1/4 inch apparent joints.
5. Lay units in running bond pattern, unless otherwise shown on the Contract Drawings.
6. Point and tool joints in exposed concrete masonry units slightly concave with an approved jointing tool. Strike joints smooth and flush with a trowel at surfaces within wall cavity and at surfaces to be plastered, stuccoed, covered with masonry, paneling or gypsum board, or where resilient base is to be applied.
7. Where epoxy mortar joints are shown on the Contract Drawings, rake out setting mortar to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy mortar manufacturer's instructions.
8. Completely fill with mortar the hollow cores of concrete masonry units which support additional loads such as lintels, brackets, mechanical or electrical equipment, those adjacent to door frames and elsewhere where shown on the Contract Drawings. Unless units below are shown on the Contract Drawings to be filled also, install 1/4 inch square mesh grout screen to prevent grout from dripping into voids below.
9. Solidly grout longitudinal joints in two or more wythe masonry, except for cavity in cavity wall construction, if any.
10. Keep cavities clean of mortar droppings and other materials. Make provisions during laying up of cavity walls to permit the removal of mortar droppings and other debris that may fall into cavity.
11. Anchor concrete masonry unit walls to columns, beams, joists and similar structural members with anchor bolts or equivalent devices. Anchors shall be fully and solidly grouted in place. Embedment shall be not less than two-thirds of the wall thickness, unless otherwise shown on the Contract Drawings.

C. Installation of Miscellaneous Items

1. Install flashings and other sheet metal items to be incorporated in masonry as shown on the Contract Drawings, fully bedded in mortar above and below and overlapping a minimum of 4 inches at ends.
 - a. Thru-wall flashing shall extend completely through wall, or shall terminate in a stainless steel drip edge.
2. Install anchor bolts, sleeves and other miscellaneous steel items to be incorporated in masonry in accordance with the Contract Drawings and approved Shop Drawings submitted under other Sections. Solidly fill spaces between such items and masonry with mortar and tool exposed joints.

D. Laying Sills and Copings

1. Set masonry sills and copings where shown on the Contract Drawings using anchors as recommended by the manufacturer in a manner so as not to affect the waterproofing integrity of the metal flashings underneath the sills and copings.
2. Install expansion joints at ends of sills and caulk joints where shown on the Contract Drawings and as specified in other Sections.
3. Install expansion joints in copings where shown on the Contract Drawings consisting of 1/2 inch joints for sealants as specified Division 7 Section on sealants.

E. Steel Reinforcing

1. If a foundation dowel does not line up with a vertical core, it shall be sloped not more than 1 inch horizontally per 6 inches vertically. Grout dowels within a core to a vertical alignment, even though it may be in a cell adjacent to the vertical wall reinforcing.
2. Where reinforcing bars are to be spliced, lap reinforcing bars by a minimum distance equivalent to 30 reinforcing bar diameters. Separate overlapping reinforcing bars by 1 bar diameter or wire together.

F. Horizontal Joint Reinforcement

1. Completely embed joint reinforcement in mortar or grout. Joints with wire reinforcement shall be a minimum of twice the thickness of the wire. Lap reinforcement 6 inches minimum at splices to contain at least one cross wire of each piece of reinforcement in the lapped area.
2. Cut or interrupt joint reinforcement at control and expansion joints.
3. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" reinforcement sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns.

G. Install control and expansion joint materials in unit masonry as Work progresses. Offset control joints from expansion joints in wythes.

H. General Grouting

1. Placement Standard: Comply with ACI 530.1/ASCE 6/TMS 602 *Specifications for Masonry Structures*, including requirements for pour height.
2. Place grout only after entire height of masonry to be grouted has attained proper strength to resist grout pressure. Stop grout pour 1 inch from top of masonry unit so that next pour will be keyed in.
3. Steel reinforcing shall be in place before grouting begins.
4. Vibrate, rod or puddle grout in place.
5. Keep mortar droppings out of grout spaces.
6. Maintain vertical cell alignment to preserve a continuous unobstructed cell area not less than 2 inches by 3 inches.
7. Solidly fill with grout, cells containing steel reinforcing, bolts or other anchor devices and where shown on Contract Drawings.

8. Solidly fill spaces at metal door frames and other built-in items with grout or mortar.

I. Install cavity wall insulation where shown on the Contract Drawings using adhesive type as recommended by insulation manufacturer, compatible with dampproofing or air barrier, if any.

J. Patching

Point holes and defective mortar joints in exposed masonry. Where necessary, cut out and repoint defective joints in exposed masonry. Patching shall match adjoining masonry in quality and appearance.

K. Matching Existing Masonry: Match coursing, bond pattern, color and texture of new masonry with existing masonry.

3.03 FIELD QUALITY CONTROL

A. Place grout only after the Engineer has verified compliance of steel reinforcing grade, sizes and placement, anchorages and grout spaces with the requirements of the Section of the Specifications on steel reinforcement, as well as Contract Drawing requirements.

B. Verify compliance with compressive strength requirements of completed masonry, where shown on the Contract Drawings or as required by the Engineer.

3.04 CLEANING AND PROTECTION

A. Protect exposed masonry against staining from grouting or other sources and clean excess mortar off surfaces as the Work progresses.

B. Furnish temporary protection for door jambs and corners during the Work. Remove temporary protection when directed by the Engineer.

C. Upon completion of masonry construction, clean exposed masonry surfaces with stiff-bristled brushes and water so as to leave the masonry surfaces clean and free of mortar daubs.

D. If ordinary cleaning is not adequate, use special methods and materials to clean surfaces as approved by the Engineer.

END OF SECTION

SECTION 04220
CONCRETE MASONRY UNITS

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

- 04220A01 Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcing" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.
- 04220A02 Shop drawings detailing cutting and setting for stone trim, if any. Show sizes profiles, locations and material description.
- 04220A03 Shop drawings and/or manufacturer's catalog cuts of dovetail slots and other devices, if any, required for anchoring masonry to steel or other materials, including instructions for their proper use.

Samples

- 04220C01 When required by 2.01 A.4.b.1, prefaced or ground face, concrete masonry unit samples for color selection or verification.
- 04220C02 Samples of full-size units for each different exposed masonry unit required showing full range of exposed color, texture, and dimensions to be expected in completed construction.
- 04220C03 Two sample sections of cast stone sills and copings, if any, showing color and texture of finish.
- 04220C04 Samples of accessories embedded in the masonry.

Product Data

- 04220D01 Manufacturer's product data for each type of concrete masonry unit and accessory including certifications that each complies with specified requirements.

Certificates

04220E01

Submit test results from a qualified testing lab, certifying that masonry complies with 1.05 F.

END OF APPENDIX "A"

DIVISION 4
SECTION 04466
REUSED GRANITE

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for reuse of existing granite.

1.02 REFERENCES

Not Used.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Granite to be furnished by the Authority, if any, is available in accordance with the requirements of "Materials Furnished by the Authority" of Division 1 - GENERAL PROVISIONS.
 - 1. Select from furnished material, stone which is free of cracks, spalls, chips or other defects, and which can be redressed to match facing and parapet stone size, thickness and finish requirements for Work of this Contract.
 - 2. Clean mortar joint material and other substances adhering to the stone that may affect bonding or appearance.
- B. Existing face and parapet stone to be removed at the construction site and reused, if any, shall be removed within the limits shown on the Contract Drawings.
 - 1. Exercise care during removal to prevent damage to edges, surfaces and anchoring recesses.
 - 2. Hand clean mortar and sealant from removed units that are to be reinstalled.
- C. Provide anchoring devices, dovetail slots, weeps and other required stonework accessories as required for installation of reused granite.

1.04 DELIVERY, STORAGE, AND HANDLING

Conform to the requirements of the Section of these Specifications entitled "GRANITE-EXTERIOR".

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

- A. Conform to requirements of 1.02 herein and Part 2 of the Section of these Specifications entitled "GRANITE - EXTERIOR".
- B. Coordinate use of new and reused materials to ensure that materials match aesthetically to the fullest extent possible.

PART 3. EXECUTION

3.01 INSTALLATION

Conform to requirements of Part 3 of the Section of these Specifications entitled "GRANITE - EXTERIOR".

3.02 PROTECTION

Where Work includes removal and reuse of existing facing and parapet stone:

- A. Perform removal using methods least likely to damage elements to be retained. In general, use hand or small power tools.
- B. Protect existing construction during removal. Protect openings, and existing construction exposed during removal from adverse weather.
- C. Patch or repair existing construction that is to remain as shown on the Contract Drawings.

END OF SECTION

**SECTION 04466
REUSED GRANITE**

**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

04466A01 Shop drawings shall indicate locations of reused granite and the mark number, if any, that corresponds to the number on each reused unit.

END OF APPENDIX "A"

DIVISION 5

SECTION 05120

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SUMMARY

This Section specifies requirements for structural steel.

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 Highway Bridges

American Institute of Steel Construction (AISC)

Code of Standard Practice for Steel Buildings and Bridges:

Sections 2; 6; 8; and 10, only (except that all references to the responsibility of the Owner and the Engineer will not apply.)

Specifications for Structural Steel Buildings

Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts

Quality Certification Program

American Society for Non-destructive Testing (ASNT)

SNT-TC-1A Recommended Practice

American Welding Society (AWS)

D 1.1 Structural Welding Code, Steel

D 1.5 AASHTO/AWS Bridge Welding Code

QC1 Certification of Welding Inspectors

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Connection Design and Detailing

1. Complete details shall be shown on the shop drawings. For all Work, other than structural steel for bridges, the Contractor shall complete the design of connections for any portion of the structures not shown on the Contract Drawings or indicated in the Specifications.
2. For bridges, the design of connections for any portion of the structures not shown on the Contract Drawings or specified in the Specifications will be provided by the Engineer.
3. Design and detailing for any alternative connections proposed by the Contractor and accepted by the Engineer shall be prepared by the Contractor. All connection design and detailing prepared by the Contractor shall be performed under the supervision of a Professional Engineer licensed in the state where the steel is to be installed. The calculations and shop drawings shall also bear the signature and seal of a Professional Engineer licensed in the state where the steel is to be installed.
4. In the case of conflict between the requirements of this Contract and the Codes and Standards contained in the AASHTO or AISC publications referenced in 1.02, the requirements of this Contract shall govern.

B. Shop Drawings

1. The shop drawings shall contain all dimensional and geometric information. Materials shall not be ordered, fabricated, or delivered to the construction site before the shop drawings have been approved.
2. Prior to review of the shop drawings by the Engineer, such shop drawings shall have been reviewed and approved by the Contractor and shall be stamped to indicate this by the Contractor. Such approval by the Contractor shall constitute the Contractor's representation that the Contractor has verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and has reviewed or coordinated each shop drawing with other shop drawings and samples and with the requirements of the Work and the Contract Drawings and Specifications.
3. Shop drawings shall include layouts and details showing the type of steel for each member, sizes of members, connections, cuts, copes, cope reinforcing, bolts, welds and other pertinent data. Provisions for the connection of any other work shall be indicated on the shop drawings.
4. All welds shall be indicated by standard welding symbols as defined by AWS. Shop drawings shall show the size, length, and type of each weld.
5. Job standards for all typical connections for beams and girders, column splices, moment connections and wind bracing details shall be prepared by or under the supervision of a Professional Engineer, licensed in the

state where the steel is to be installed and shall have the signature and seal of the Professional Engineer.

6. Shop drawings shall be submitted in complete packages so that individual parts and the assembled unit may be reviewed together. Index sheets shall be furnished with all beam, girder and column details at the same time the details are submitted for review.
7. The review of shop drawings by the Engineer shall not in any way relieve the Contractor from the responsibility for the adequacy of the design of the connections and all required detailing, the responsibility for the proper fitting of the Work in strict conformance with the Contractor requirements and from the necessity of furnishing material and workmanship required by Contract Drawings and Specifications in addition to that indicated on the shop drawings
8. The Contractor shall supply a complete set of stamped, approved drawings to the Authority Quality Assurance representative at the fabrication shop prior to the commencement of any fabrication.

C. Erection Drawings

1. The erection drawings shall include plans showing exact locations of base and bearing plates, and/or bolts and other embedded items. All field-bolted connections, not specifically shown on shop drawings, shall be shown on erection drawings.

1.04 QUALITY CONTROL

A. Requirements

1. The entity performing the Work of this Section shall have a minimum of three years experience in structural steel work involving complexities similar to those required under this Contract and shall employ labor and supervisory personnel experienced in this type of Work.
2. When the total quantity of steel furnished under this contract exceeds 10 tons, the fabrication shop shall be certified under the AISC certification program as Category Sbd for conventional steel building structures or Sbr for simple steel bridges, unless a higher category is shown on the Contract Drawings.
3. The Contractor's Quality Control Plan shall be submitted to the Engineer for review and approval. The Engineer may elect to inspect the fabrication shop to verify that the fabrication is performed in accordance with Contract Documents and that the shop is operated in accordance with the Quality Control Plan. At a minimum, the Quality Control Plan for fabrication shall address all the items listed in Appendix A.

- B. The Contractor shall qualify welding processes and welding operators in accordance with the applicable AWS Welding Code and shall provide certification that welders to be employed in the Work have satisfactorily passed AWS qualification tests.
- C. The Contractor shall maintain a Quality Control Program for both fabrication and erection of structural steel to assure that all installations conform to the requirements of the Contract Drawings and Specifications. The Quality Control Program shall conform to the AISC Code of Standard Practice for Steel Buildings and Bridges, as well as the requirements in this Section for both shop and field inspection and testing. The Contractor shall employ non-destructive testing personnel that meet ASNT SNT-TC-IA Level II qualifications and an AWS Certified Welding Inspector (CWI).

For bridge work where "Fracture Critical Members" are shown on the Contract Drawings, the Contractor shall satisfy the requirements of the Fracture Control Plan as defined in the current AASHTO/AWS D1.5 Bridge Welding Code, including the Charpy Impact notch toughness requirements for Zone 2.

D. High Strength Bolts

- 1. Each shipment shall be accompanied by a mill certification report that shows mill test results for the included production lots. The Engineer reserves the right to sample and test bolts from any shipment.
- 2. Bolts may be sampled by the Engineer on site and tested by the Authority for wedge tensile and Rockwell hardness requirements in accordance with the appropriate American Society for Testing and Materials (ASTM) specifications. If any samples do not meet the test requirements, then the corresponding lot of bolts shall be rejected for use. Any bolts already installed from a failed lot or heat number shall be removed and replaced at no additional cost to the Authority.
- 3. Sampling shall be performed using the "shipping lot method" in which the ASTM specified number of bolts shall be taken from each shipment of the same nominal bolt size and length. Bolt containers shall be clearly marked with the manufacturer's name, the production lot number, and the heat number of steel. After sampling, as indicated in 1.04 D.2., the containers shall be so labeled in a manner approved by the Engineer.
- 4. All bolts used for bridge construction and all galvanized bolts shall also meet the requirements for rotational capacity testing as specified in the appropriate AASHTO/ASTM specification (e.g. ASTM A325, ASTM A490, AASHTO Section 11.5.6.4.2).

- E. In addition to performing field inspection, the Contractor shall inspect structural steel at the fabricating shop.

- F. Welds shall be inspected and tested at the fabricating shop by the Contractor in accordance with AWS D1.1 (AWS D 1.5 for bridge members) and as follows:
1. All welds shall be visually inspected by an AWS Certified Welding Inspector (CWI).
 2. All full penetration welds shall be non-destructively tested for 100 percent of the weld length by radiographic or ultrasonic methods, as approved by the Engineer, unless otherwise noted.
 3. Areas of suspected defects found visually in partial penetration and fillet welds shall be non-destructively tested by magnetic particle or dye penetrant methods, as approved by the Engineer. However, for bridge members, test a minimum of 10 percent of the length of all partial penetration and fillet welds in accordance with AWS D1.5. If, in the opinion of the Engineer, the test results disclose unacceptable welds, then the percentage of welds required to be tested may be increased, as deemed necessary by the Engineer, up to 100%, without additional compensation.
- G. The Contractor shall have sole responsibility for coordinating the Work and notify the Engineer in a timely manner to assure that all testing and inspection procedures required by the Engineer are properly provided.
- H. The Authority will perform Quality Assurance testing to ensure quality workmanship. Inspection and testing will include, but not be limited to, visual inspections, ultrasonic, radiographic, magnetic particle or dye penetrant testing of the welding and cutting performed in the fabrication shop and in the field. The percentage and extent of testing will be no less than 25% of that required of the Contractor. The Contractor shall notify the Engineer and the Authority Materials Engineering Division 15 days prior to the start of fabrication.
- I. The Contractor shall supply equipment and personnel, at no additional cost to the Authority, to assist in moving members as necessary for adequate access to properly perform Quality Assurance inspections and testing by the Authority. Coupons of material may also be requested and shall be cut in the presence of the Engineer at no additional cost to the Authority. The Contractor shall also provide a desk and adequate workspace for the Authority shop inspector. Access to the use of telephones, fax machines and copy machines shall be provided at all times.

1.05 SHIPPING

- A. All material that has been inspected and accepted by the Authority's Quality Assurance shop inspector will be stamped with the initials "PA" and a number near its piece mark. A stamped shipment report will also be provided and shall accompany each shipment. Any material that is shipped to the construction site that is not stamped or included on the shipment report and noted as "Accepted" on said shipment report shall immediately be rejected by the Engineer and shall not be permitted to be unloaded at the construction site. Application of the inspector's stamp does not imply that the material will not be rejected by the Authority if subsequently found to be damaged or defective.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the construction site at appropriate intervals so as to ensure uninterrupted progress of Work.
- B. Material shall be stored in an area designated or approved by the Engineer. Structural steel shall be drained properly. Adequate shoring and protection shall be provided to prevent distortion and other damage. Structural steel shall be stored on timber and not on mud or cinders, and otherwise handled so as not to damage shop paint. All sections which are to be placed in ground storage shall be readily accessible for inspection.

1.07 SUBMITTALS

- A. See Appendix "A" for submittals requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural Steel

Structural steel shall mean structural steel as defined in Section 2 - Classification of Materials of the AISC "Code of Standard Practice for Steel Buildings and Bridges". Structural steel shall conform to types shown on the Contract Drawings. The types are indicated by the ASTM or AASHTO designation for each. Each type shall conform to all of the requirements of the indicated ASTM or AASHTO specifications.

- B. High Strength Bolts

High strength bolts, nuts and washers shall be of the types shown on the Contract Drawings. Joints using high strength bolts shall conform to the provisions of the AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts". In the case of bridge Work, conform to AASHTO Standard Specifications for Highway Bridges, Division II, Section 11.5.6.

C. Anchor Bolts

Anchor bolts shall conform to ASTM type shown on the Contract Drawings and shall be the regular hexagon-bolt type.

D. Welding Electrodes: Comply with AWS D1.1 (D1.5 for bridge members).

E. Grout: In accordance with Section 03602 of the specifications entitled Grout (Non-Metallic).

F. Paint: In accordance with Section 09910 of the specifications entitled Painting.

2.02 FABRICATION

A. Fabrication shall not begin without approvals for the following:

1. Shop Drawings
2. Quality Control Plan
3. Welding Procedure Specifications
4. Procedure Qualification Records (if applicable)
5. Welder Qualifications
6. Mill Test Reports
7. Quality Control personnel, including an AWS Certified Welding Inspector (CWI), and non-destructive testing personnel that meet ASNT SNT-TC-1A Level II qualifications.

Any fabrication performed without prior approval of these items shall not be accepted. In addition, a copy of all signed approvals, including the supporting documentation, shall be in the possession of the fabrication shop prior to the commencement of fabrication and shall be made available to the Authority's Quality Assurance inspector at all times.

B. Fabricate and assemble structural assemblies in shop to greatest extent possible. Provide camber and fabricate items of structural steel in accordance with the standards and specifications referenced herein and as indicated on shop drawings approved by the Engineer.

- C. Properly mark and match-mark materials for field assembly. Fabricate for a delivery sequence, which will expedite erection and minimize field handling of materials.
- D. Where finishing is required, complete assembly, including welding of units, before the start of finishing operations. Provide finish surfaces of members, exposed in final structure, free of markings, burrs, and other defects.
- E. For bridge members the following shall be in accordance with Division II, Section 11 of the AASHTO Standard Specifications for Highway Bridges:
 - 1. Workmanship, methods, standards, and accuracy of fabrication.
 - 2. Fitting, cutting, drilling, punching, reaming, bending, curving, finishing, straightening, and cambering of steel.
 - 3. Preparation, shop assembly, fitting and correction for misfits of connections.

2.03 SHOP PAINTING

- A. Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2 inches of embedded areas only.
 - 1. For high strength bolted surfaces with friction type connections, paint with an approved slip critical zinc rich coating.
- B. Unless otherwise shown on the Contract Drawings, do not paint:
 - 1. surfaces which are to be welded;
 - 2. surfaces which are scheduled to receive sprayed-on fireproofing;
 - 3. surfaces of exposed, corrosion-resistant, high-strength, low-alloy steel members.
- C. Apply an additional coat of paint to surfaces which are inaccessible after assembly or erection. Change color of additional coat to distinguish it from first. Where shop painting is required, paint erection marks on painted surfaces.
- D. Type of paint and surface preparations, if any, shall be as shown on the Contract Drawings, or as specified in Section 09910 of the Specifications entitled "Painting".
- E. Notify the Authority Materials Engineering Division 10 days in advance of painting so arrangements can be made to inspect surface preparation prior to coating. In addition to inspecting surface preparation and coating the Authority will also perform tests to confirm blast profile, dry film thickness and adhesion. Samples of coatings may be selected for testing by the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Work Under Other Sections

Examine all Work prepared under other Sections of these Specifications to incorporate the Work of this Section and ensure any defects affecting installation are corrected. Prior to commencement of the Work under this Section, verify the dimensions and coordinate the structural steel Work with Work under other Sections.

B. Anchor Bolts

The Contractor shall ascertain by accurate survey the location, alignment and elevation of the anchor bolts embedded in the concrete under other Sections, at least 21 working days prior to the start of the structural steel erection. Any discrepancy between the Contract Drawings and Specifications and the as-built conditions shall be corrected, as approved by the Engineer, prior to the start of steel erection.

3.02 ERECTION

A. Workmanship

All Work shall be erected plumb, square and true to lines and levels in strict accordance with Contract requirements and within tolerances of the AISC "Code of Standard Practice for Steel Buildings and Bridges" and in the case of bridges in accordance with AASHTO Specifications.

B. Temporary Shoring and Bracing

Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

C. Temporary Planking

Provide temporary planking and working platforms as necessary to effectively complete Work.

D. Field Assembly

Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure within specified AISC tolerances or more stringent tolerances when shown on the Contract Drawings. Establish required leveling and plumbing measurements at mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature of structure when completed and in service.

E. Touch-up Painting

Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting in accordance with Section 09910 of the Specifications entitled "Painting".

F. Bolting with high strength bolts shall conform with AISC Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts, or in the case of bridge work, AASHTO Standard Specifications for Highway Bridges, Division II, Section 11.5.6.

G. Grouting shall be performed in accordance with Section 03602 of the Specifications entitled Grout (Non-Metallic).

3.03. FIELD TESTS

A. The Contractor shall perform inspections of the following items in accordance with the Codes and Standards contained in the AASHTO or AISC publications referenced in 1.02: connections; proper tensioning of bolts (the Contractor shall furnish an approved calibrated torque wrench and assign two workers to assist the Engineer.); levels, plumbness and alignment of the framing; and field painting.

B. Field welding shall be inspected and tested by the Contractor in accordance with 1.04.F and the Contractor's Quality Control Plan for erection.

C. The Authority will perform Quality Assurance testing for field connections and welds in accordance with 1.04 H. The Contractor shall supply equipment

and personnel needed to allow access for said testing, at no additional cost to the Authority.

END OF SECTION

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SECTION 05120
STRUCTURAL 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

- 05120A01 As per Division 1, "Shop Drawings."
- 05120A02 Prior to the commencement of fabrication, approval of shop drawings for all structural steel as per 1.03 B.
- 05120A03 Erection drawings as per 1.03 C.

Catalog Cuts

- 05120B01 As per Division 1, "Catalog Cuts and Samples."
- 05120B02 Prior to the commencement of fabrication, approval of shop drawings for all structural steel as per 1.03 B.

Certificates

- 05120E01 Prior to commencing with fabrication of steel, certified copies of all mill reports covering the chemical and physical properties of all steel used in this Contract shall be submitted. Such certification shall be obtained from the mills producing the steel and shall certify that the steel meets the minimum requirements as to physical properties, inspection, marking, and tests for structural steel as defined by the American Society for Testing and Materials (ASTM) or in the case of bridges, AASHTO, for the type of steel shown on the Contract Drawings.
- 05120E02 Prior to commencing fabrication, mill certificates for high strength bolts as described in 1.04 D.1.

Qualifications

- 05120K01 Prior to commencing with fabrication of steel, welder qualifications and welding procedure specifications in accordance with 1.04 B.

Quality Assurance-Quality Control

05120 -12

- 05120L01 Copy of the fabrication shop's Quality Control Program as outlined in 1.04 C. The program, at a minimum, shall include the following:
- A. A copy of AISC certification for the fabrication shop indicating the required Category as specified.
 - B. Organizational chart indicating specific names and titles of personnel clearly identifying the reporting structure of personnel and the qualifications of the individuals responsible for implementing the program.
 - C. Material traceability, indicating the procedure used to identify each individual piece mark and its components that can be traced to a specific heat number on mill test reports.
 - D. A procedure for handling nonconformance issues, including a sample worksheet for recording nonconformance issues. Include the name and title of the person responsible for final acceptance.
 - E. The certifications and qualifications for an AWS Certified Welding Inspector (CWI), Non-Destructive testing personnel qualified to ASNT SNT-TC-1A Level II requirements, and their respective employers. Include samples of inspection and testing forms to be used for the Work of this Contract.
 - F. A detailed schedule for the duration of fabrication at each shop. The schedule shall show, at a minimum, the start and end dates for ordering material, cutting material, fabricating material, painting material, and shipping material. If the schedule changes, a revised schedule shall be submitted.
 - G. A brief statement that explains the amount of steel, in tons, the shop is fabricating and the application(s) the fabrication is intended.

05120L02 Name and location of shop that will perform painting work along with the shop's Quality Control Plan in accordance with Section 09910 entitled "Painting".

05120L03 Notification, in writing, 15 days prior to commencing fabrication of structural steel.

05120L04 Notification, in writing, 15 days prior to commencing with surface preparation and painting.

05120L05 Notification, in writing, 15 days prior to commencing field welding operations.

Inspection Reports

05120O01 Inspection and test results from fabrication shop as per 1.04 F within five calendar days of inspections and tests.

05120O02 Inspection and test results from field tests as per 3.03 within five calendar days of inspections and tests.

END OF APPENDIX "A"

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DIVISION 5
SECTION 05311
STEEL DECK

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for steel floor and roof deck.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Iron and Steel Institute (AISI)

Specification for the Design of Cold-Formed Steel Structural Members

American Welding Society (AWS)

D1.1 Structural Welding Code, Steel

D1.3 Structural Welding Code - Sheet Steel

American Society for Testing and Materials (ASTM)

ASTM A36 Specification for Structural steel

ASTM A108 Specification for Steel Bars, Carbon, Cold Finished, Standard Quality

ASTM A611 Specification for Steel Sheet, Carbon, Cold Rolled, Structural Quality

ASTM A653 Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process.

Steel Deck Institute (SDI)

Design Manual for Composite Decks, Form Decks, Roof Decks and Cellular Metal Floor Deck with Electrical Distribution (Publication No. 29).

Diaphragm Design Manual

Factory Mutual Engineering Corporation (FM)

1-28 Loss Prevention Data Sheet - Insulated Steel Deck

1.03 QUALITY ASSURANCE

- A. The entity performing the Work of this Section shall have a minimum of five years experience in metal decking work involving complexities similar to those required under this Section and shall employ labor and supervisory personnel experienced in this type of Work.
- B. The Contractor shall employ currently qualified welding processes and welding operators in accordance with AWS Specifications and shall provide certification that welders to be employed in the Work have satisfactorily passed AWS qualification tests.
- C. Shear connector welds will be inspected and tested according to the requirements of AWS D.1.1 for stud welding. Contractor shall remove and replace work that does not comply with the specified requirements.
- D. The composite behavior of floor deck shall be verified by tests as specified in SDI Publication No. 29. See Section 5 of the specifications for composite steel floor deck.
- E. The composite behavior of cellular metal floor deck (for electrical distribution) with the concrete slab shall be verified by tests similar to that specified in SDI Publication No. 29. See Section 5 of the specifications for composite floor deck, also Sections 1 and 2 of the specifications for cellular metal floor deck. Where trench headers interrupt the composite action of concrete slab with metal deck, the deck shall be considered non-composite. The deck sheet shall be modified as required by the Engineer.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Do not bend or mar decking.
- B. Store off ground with one end elevated for drainage.
- C. Cover decking with waterproof material.
- D. Do not store on roof or floor framing unless material is securely tied down and the framing has been analyzed to ensure that such storage will not cause an overload.
- E. Also see Section 3.02 "Protection".

1.05 SUBMITTALS

For Submittals see Appendix A.

PART 2. PRODUCTS

2.01 MATERIALS

The following materials shall conform to the types shown on the Contract Drawings. The types are indicated by the American Society for Testing and Materials (ASTM) or the Military Specifications Designation for each.

- A. Steel for Painted Deck Units: ASTM A 611.
- B. For composite floor deck use grades C and D. For non-composite floor deck and for roof deck use Grades C, D or E.
- C. Steel for Galvanized Metal Deck Units: ASTM A653 SQ Grade 33.
- D. Miscellaneous Steel Shapes: ASTM A 36.

2.02 ACCESSORIES

- A. Shear Connectors, if any
Headed stud type, ASTM A 108, Grade 1015 or 1020, cold-finished carbon steel.
AWS D1.1 Type B
- B. Sheet Metal Accessories
Commercial quality, ASTM A 653, galvanized (coating designation G90).
- C. T-toggles when their use is permitted by the Engineer.

2.03 FABRICATION

- A. General
Form deck units in lengths to span three or more supports with flush, telescoped or nested 2-inch laps at ends and interlocking or nested side laps, unless otherwise shown on the Contract Drawings. The deck manufacturer's design and fabrication shall be based on the total load stress limited to 20,000 psi for roof deck and 22,000 psi for floor deck. The live load deflection shall be limited to 1/360 of the span.
- B. Metal Joint Cover Plates, if any
Fabricate metal joint cover plates of not less than the same thickness as decking for end-abutting floor deck units and at changes in direction. Form to match contour of deck units and to be approximately 6 inches wide.
- C. Metal Closure Strips, if any
Fabricate metal closure strips, for cell raceways and openings between decking and other construction, of not less than 0.045-inch, minimum (18-gage) sheet steel unless otherwise shown on the Contract Drawings. Form to provide tight-fitting closures at open ends of cells or flutes and sides of decking.

D. Roof Sump Pans

Fabricate from single piece of 0.071-inch, minimum (14-gage) galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain, unless otherwise shown on the Contract Drawings. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3-inches wide. Recess pans not less than 1-1/2 inches below roof deck surface, unless otherwise shown on the Contract Drawings or required by deck configuration. Holes for drains shall be cut in field.

E. Tolerances

Fabrication tolerances for deck shall be in accordance with the provisions of SDI Publication No. 29.

2.04 SHOP PAINTING

A. Galvanizing: ASTM A 653, G 60 (Z 180) minimum.

B. Galvanizing Repair Paint

High zinc-dust content paint for damaged galvanized surfaces complying with Military Specifications MIL-P-21035 (Ships).

C. Coating for Exposed Galvanized Deck Surfaces

Where deck will remain exposed to view in the finished construction, the hot-dipped, zinc-coated deck shall be coated by the same entity that is to apply the prime coat and all subsequent coats.

D. Shop Prime Painting and Surface Preparation, if any

Shop prime painting and surface preparation shall be as shown on the Contract Drawings.

PART 3. EXECUTION

3.01 INSTALLATION

A. General

1. Install deck units and accessories in accordance with manufacturer's recommendations and approved shop drawings, and as specified herein.
2. Coordinate the location of deck bundles with structural steel erector to prevent overloading of structural members.
3. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before permanently fastening. Do not stretch or contract side lap interlocks.
4. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.

5. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
 6. Do not place deck units on concrete supporting structure until concrete has cured and is dry.
 7. Minimum bearing length of deck on supporting members shall be 1-1/2 inches unless otherwise shown on the Contract Drawings.
- B. Fastening Floor Deck Units
- Fasten floor deck units to steel supporting members by not less than 3/4-inch diameter fusion welds spaced not more than 12 inches o.c. with a minimum of 2 welds per unit at each support. Side laps are to be welded with a maximum spacing of 36 inches on center. Tack weld at 4 feet o.c. for fastening end closures.
- C. Fastening Roof Deck Units
- Fasten roof deck units to steel supporting members by not less than 5/8-inch diameter fusion welds spaced not more than 12 inches o.c. at every support, and at closer spacing where required for lateral and uplift force resistance. Uplift resistance for the roof shall meet the requirements of class 1-90 rating in accordance with Factory Mutual (FM) Data Sheet 1-28. Side laps are to be welded with a maximum spacing of 36 inches on center. In addition, secure deck to each supporting member in ribs where side laps occur.
- D. Alternative Fastening of Deck Units
- Where shown on the Contract Drawings, an Engineer approved self tapping screw fastener may be used in lieu of fusion welds specified in 3.01 B and C above. Only one type of fastening method shall be used for the steel deck fastening.
- E. Welding
- Comply with AWS specifications requirements and procedures for appearance and quality of welds, and for methods used in correcting welding work. Use welding washers where recommended by deck manufacturer. Recommendations concerning the use of weld washers that appear in SDI Publication No. 29 shall be considered minimum requirements.
- F. Cutting and Fitting
- Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.
- G. Reinforcement at Openings
- Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other Work shown on the Contract Drawings.

- H. Metal Joint Cover Plates, if any
Provide metal joint cover plates at abutting ends and changes in direction of floor deck units, except where taped joints are required.
- I. Roof Sump Pans
Place over openings provided in roof decking and weld to top decking surface. Space welds not more than 12 inches o.c. with at least one weld at each corner. Cut opening in roof sump bottom to accommodate drain size shown.
- J. Shear Connectors, if any
Weld shear connectors to supports through decking units in accordance with manufacturer's instructions. Do not weld shear connectors through two layers (lapped ends) of decking units. Weld only on clean, dry deck surfaces.
- K. Closure Strips
Provide metal closure strips at open uncovered ends and edges of roof decking, and in voids between decking and other construction. Weld into position to provide a complete decking installation.
- L. Touch-up Painting
After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of deck units and supporting steel members. Touch up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions. Touch up painted surfaces with same type of shop paint used on adjacent surfaces. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

3.02 PROTECTION

- A. Do not use deck units for storage or working platforms until permanently secured in position.
- B. Assure that construction loads and concrete weight do not exceed acceptable levels indicated by the manufacturer's load tables. Such loads shall be limited so that the maximum sag is less than 1/180 of the span or 1/2 inch whichever is less.
- C. No deck placed or stored shall be left unsecured at end of each day's Work. Deck units shall be secured from movement due to wind at all times.

END OF SECTION

SECTION 05311

STEEL DECK

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

05311A01 As per Division 1 "Shop Drawings, Catalog Cuts and Samples". The shop drawings shall clearly indicate the dimensions, section properties, material types and finishes with ASTM designations, hardware, framing, laps, reinforcement, connections, anchorage, sump pans, cant strips, ridge and valley plates, closure strips, pour strips, factory installed knockouts and other details required by the Work of this Section. The preparation of these drawings shall be coordinated with the Work of other Sections.

Samples

05311C01 As per Division 1 "Shop Drawings, Catalog Cuts and Samples"; submit samples of the metal decking of sufficient size to show the materials, finishes, construction, connections, and workmanship involved in fabrication of the decking.

Product Data

05311D01 Test data, calculations or design charts for self tapping screws prepared by the screw manufacturer.

Certificates

05311E01 Submit a letter of certification from the deck manufacturer stating that the design and fabrication of the metal decking to be installed under this Section are in accordance with these specifications and SDI Design Manuals.

Construction and Installation Procedures

05311G01 Submit manufacturer's recommended installation instructions.

Qualifications

05311K01 The Contractor shall submit certification that welders to be employed in the Work have satisfactorily passed AWS qualification tests.

END OF APPENDIX "A"

05311 -7

DIVISION 5
SECTION 05510
METAL STAIRS

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for metal stairs complete with steel pipe railings and handrails.

1.02 REFERENCES

- A. The following is a listing of the publications referenced in this Section:

American Society of Mechanical Engineers (ASME)

ASME B 18.2.1 Square and Hex Bolts and 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 (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

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 1008 Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

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 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 Methods 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.
	<u>American Welding Society, Inc. (AWS)</u>
AWS D1.1	Structural Welding Code – Steel.
AWS D1.3	Structural Welding Code – Sheet Steel.
	<u>The Society for Protective Coatings (SSPC)</u>
SSPC-PA 1	Shop, Field and Maintenance Painting of Steel.
SSPC-SP 3	Surface Preparation Specification No. 3 – Power Tool Cleaning.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

- A. When installed, metal stair assemblies shall comply with the following minimum requirements for structural performance, unless otherwise shown on the Contract Drawings:
1. Treads and Platforms of Steel Stairs

Capable of withstanding a uniform load of 100 lbs. per sq. ft. and a concentrated load of 300 lbs. per 4 sq. in., so located as to produce maximum stress conditions.
 2. Handrails and Toprails of Guards

Capable of withstanding the following loads applied as indicated when tested per ASTM E 935 and of transferring these loads through the supports to the structure:

 - 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.
 - c. Have attachment devices and supports to transfer these loads to the structure.
 - d. Uniform and concentrated loads described above need not be assumed to act concurrently.
 3. Guards

Intermediate rails, 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 a part. Load need not be assumed to be acting concurrently with uniform horizontal loads on top rails of railing assembly in determining stress on guard supporting members.

1.04 QUALITY ASSURANCE

- A. When required by Appendix "A", submit structural calculations for metal stairs, 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. Engineering services are defined as those performed for installations of metal stairs that are similar to those shown on the Contract Drawings for Work of this Contract in material and design.

- D. Metal Bar Grating Standards: Comply with requirements of applicable portions of NAAMM MBG 531.

- E. Welding Standards

Comply with applicable provisions of AWS D1.1 *Structural Welding Code – Steel* and AWS D1.3 *Structural Welding Code – Sheet Steel*.

- I. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and if pertinent, has undergone recertification.

- F. Field Measurements

Check actual locations of walls and other construction to which metal fabrications must fit, by taking accurate field measurements before fabricating. Show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.05 DELIVERY, STORAGE, AND HANDLING

Protect material from damage, scratches, nicks, dents and gouges during delivery, storage, assembly and installation. Remove damaged material from the construction site and replace it at no cost to the Authority.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

- A. Ferrous Metals

- I. Metal Surfaces: Smooth and free of surface blemishes including pitting, roughness, seam marks, roller marks and rolled trade names where exposed to view on finished stair surfaces.

2. Steel Plates, Shapes and Bars: ASTM A 36.
3. Steel Bar Grating: ASTM A 36.
4. Steel Wire Rod for Grating Crossbars: ASTM A 510.
5. Steel Tubing: Cold-formed, ASTM A 500; or hot-rolled, ASTM A 501.
6. Structural Steel Sheet: Hot-rolled, ASTM A 1011, or cold-rolled ASTM A 1008, Class 1; of grade required for design loading.
7. 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.
8. Brackets, Flanges and Fittings: Cast or formed metal of the same type material and finish as supported rails, unless otherwise shown on the Contract Drawings.
9. Gray Iron Castings: ASTM A 48, Class 30.
10. Malleable Iron Castings: ASTM A 47, grade as selected by fabricator.
11. 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. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.
6. Plain Washers: Round, carbon steel, ASME B18.22.1.
7. 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: Stainless steel bolts complying with ASTM F 593, Alloy Group 1 or 2 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, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C 1107. Furnish grout specifically recommended by the manufacturer for interior or exterior applications, as shown on the Contract Drawings.

E. Concrete Fill

1. Concrete Materials and Properties

Comply with the requirements of Division 3 Section on concrete for normal weight, ready-mix concrete with minimum 28-day compressive strength of 2500 psi, minimum 440 lbs. cement per cu. yd. and maximum water/cement (W/C) ratio of 0.65, unless higher strengths are shown on the Contract Drawings.

2. Non-Slip Aggregate Finish

Factory-graded, packaged material containing fused aluminum oxide grits or crushed emery as abrasive aggregate; rust-proof and non-glazing; unaffected by freezing, moisture or cleaning materials, where shown on the Contract Drawings.

2.02 FABRICATION

A. General

Fabricate units to sizes, shapes and profiles shown on the Contract Drawings or approved Shop Drawings. Fabricate from structural steel shapes, plates and steel bars of type, size and thickness as shown on the Contract Drawings 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. Use welded construction with mitered joints for field connections, except as otherwise shown on the Contract Drawings.
3. Weld corners and seams continuously, complying with AWS D1.1 recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

4. 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 on the Contract Drawings. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown on the Contract Drawings or, if not shown, Phillips flathead (countersunk) screws or bolts.
6. Provide weep holes where water may accumulate.
7. Cut, reinforce, drill and tap components to receive anchorage, finish hardware and similar items.
8. Furnish anchorage of type shown on the Contract Drawings, coordinated with the supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
9. 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.
10. 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 Framed Stairs

Construct stairs to conform to sizes and arrangements shown on the Contract Drawings and join pieces together by welding unless otherwise shown. Furnish complete stair assemblies including but not limited to metal framing, hangers, columns, railings, newels, balusters, struts, clips, brackets, bearing plates and other components necessary for the support of stairs and platforms and as required to anchor and contain the stairs on the supporting structure.

1. Stair Framing

Fabricate stringers of structural steel channels or plates, or a combination thereof, as shown on the Contract Drawings. Furnish closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as shown on the Contract Drawings. Bolt or weld headers to stringers, newels and framing members to stringers and headers; fabricate and join so that bolts, if used, do not appear on finish surfaces.

2. Metal Pan Risers, Subtreads and Subplatforms

Shape metal pans for risers and subtreads to conform to configuration shown on the Contract Drawings. Furnish thicknesses of structural steel sheet for metal pans shown but not less than required to support the total design loading.

- a. Form metal pans of cold-rolled carbon steel sheet, unless otherwise shown on the Contract Drawings.

- b. Directly weld risers and subreads to stringers. Locate welds on side of metal pans to be concealed by concrete fill.

3. Stair Railings and Handrails

Comply with requirements specified elsewhere in this Section for steel pipe railings and handrails and the following:

- a. Fabricate newels of steel tubing and furnish newel caps of gray-iron castings, as shown on the Contract Drawings.
- b. Railings may be bent at corners, rail returns and wall returns, instead of using prefabricated fittings.
- c. Connect railing posts to stair framing by direct welding, unless otherwise shown on the Contract Drawings.

C. Steel Pipe Railings and Handrails

Fabricate steel pipe railings and handrails to design, dimensions and details shown on the Contract Drawings, formed of pipe of sizes and wall thickness shown on the Contract Drawings, but not less than required to support design loading.

1. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise shown on the Contract Drawings.
2. At tee and cross intersections provide coped joints.
3. At bends interconnect pipe by means of prefabricated elbow fittings or flush radius bends, as applicable, of radii shown on the Contract Drawings.
4. Return rails to wall at ends of wall-mounted handrails, except where otherwise shown on the Contract Drawings.
5. Close exposed ends of pipe by welding 3/16 inch thick steel plate in place or by use of prefabricated fittings.
6. Brackets, Flanges, Fittings and Anchors

Furnish wall brackets, end closures, flanges, miscellaneous fittings and anchors for interconnections of pipe and attachment of railings and handrails to other Work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete or masonry.

7. Toe Boards

Furnish toe boards at railings around openings and at the edge of open-sided floors and platforms where shown on the Contract Drawings. Fabricate to dimensions and details shown on the Contract Drawings or, if not shown, use 4 inch high by 1/8 inch thick continuous plate welded to, and centered between each railing post.

D. Cast Treads and Nosings

1. Fabricate units of material, color, sizes and configurations as 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. Manufacturers

Subject to compliance with the requirements of this Section, furnish and install cast treads and nosings from one of the following:

American Safety Tread Co., Inc., Helena, AL
Balco Inc., Wichita, KS
Barry Pattern & Foundry Co., Inc., Birmingham, AL
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 recommended by the manufacturer.

E. Metal Bar Grating Treads and Platforms

1. Fabricate treads and platforms of steel bar grating where shown on the Contract Drawings, in sizes and finish shown, including carrier end plates provided with hole and slot for bolted attachment to stair stringers.
2. Fabricate using steel bar grating with cross bars and bearing bars in sizes, spacings and of fabrication method shown on the Contract Drawings. Cross bar and bearing bar spacing shall meet structural performance requirements.
3. Finish: Hot-dip galvanized or shop primed as shown on the Contract Drawings.
4. Traffic Surface: Plain, serrated, knurled or an applied abrasive finish consisting of aluminum oxide aggregate in an epoxy-resin adhesive, as shown on the Contract Drawings.
5. Fabricate treads and platforms with nosings where shown on the Contract Drawings, of material and surfacing shown. Weld grating platform to platform framing.

F. Miscellaneous Framing and Supports

1. Furnish miscellaneous steel framing and supports that are not a part of structural steel framework, as required to complete Work.
2. Galvanize miscellaneous frames and supports where shown on the Contract Drawings.

2.03 SHOP PAINTING

A. Surface Preparation

Prepare ferrous metal surfaces to comply with requirements of SSPC-SP 3.

- B. Apply shop primer to surfaces of metal stairs except those that are galvanized or shown on the Contract Drawings to be embedded in concrete or masonry. Comply with requirements of SSPC-PA 1 for shop painting.

1. Stripe paint all edges, corners, crevices, bolts, welds and sharp edges.

PART 3. EXECUTION

3.01 PREPARATION

- A. 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. Fastening to In-Place Construction

Furnish and install anchorage devices and fasteners where necessary for securing metal stairs to construction in-place at the construction site, 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 stair fabrications. Set Work accurately in location, alignment and elevation, 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 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 for procedures of manual shielded metal-arc welding, appearance and quality of welds made and for methods used in correcting welding.

- E. Adjust railing prior to anchoring to ensure matching alignment at joints. Space posts as shown on the Contract Drawings or, if not shown, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
 1. Anchor posts to steel with steel oval flanges, angle type or floor type as required by conditions, welded to posts and bolted to steel supporting members.
 2. Anchor rail ends into concrete and masonry with steel round flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.
 3. Anchor rail ends to steel with steel oval or round flanges welded to rail ends and bolted to structural steel members, unless otherwise shown on the Contract Drawings.

F. Secure handrails to wall with wall brackets and end fittings. Bracket shall have clearance of not less than 1-1/2 inches from inside face of handrail and finished wall surface. Locate brackets as shown on the Contract Drawings or, if not shown, at spacing required for design loading. Secure wall brackets and wall return fittings to building construction as follows:

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. For concrete and solid masonry anchorage, use drilled in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.
3. For hollow masonry anchorage use toggle bolts having square heads.
4. For stud partitions use lag bolts set into wood backing between studs. Coordinate with stud installation for accurate location of backing members.

G. Concrete Filled Treads and Platforms

Place and finish concrete fill for concrete treads and platforms, if any, to comply with Division 3 Section on concrete. Install abrasive nosings with anchors fully embedded in concrete.

H. Cast Treads and Nosings

1. Install cast treads and nosings with manufacturer's recommended anchorage system. Apply bituminous coating to concealed bottoms, sides and edges of cast-iron units set into concrete.
2. Nosings shall be centered and terminate not more than 3 inches from ends of treads for poured concrete stairs; nosings shall be full length of tread, less 1/8 inch clearance, on concrete filled steel pan stair treads, unless otherwise shown on the Contract Drawings.

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 05510

METAL STAIRS

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

05510A01 Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS: Shop Drawings. For fabrication and erection of metal stair 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.

Samples

05510C01 Samples: Representative samples of materials, color, texture or design of finished products for treads and nosings, if any.

Product Data

05510D01 Product Data: Manufacturer's technical information, specifications, anchor details and installation instructions for products used in metal stair fabrications, including grout and paint products.

Calculations

05510H01 Design Calculations: Submit design calculations signed and sealed by a professional engineer licensed in the state in which Work is to be performed, showing compliance with Design and Performance Requirements loading criteria.

Qualifications

05510K01 E. Qualifications

1. Fabricator: Experience, in service performance and capability qualifications.
2. Professional Engineer: Include experience qualifications, if design calculations are required.
3. Welder: Evidence of current AWS certification.

END OF APPENDIX "A"

05510 -11

DIVISION 5

SECTION 05523

STEEL PIPE AND TUBE RAILINGS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for steel pipe and tube handrails and railings.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	<u>American Institute of Steel Construction, Inc. (AISC)</u>
AISC 335	Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design with Commentary.
	<u>American Society for Testing and Materials (ASTM)</u>
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 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 780	Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
ASTM B 633	Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
ASTM C 1107	Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
	<u>American Welding Society, Inc. (AWS)</u>
AWS D1.1	Structural Welding Code – Steel.
	<u>The Society for Protective Coatings (SSPC)</u>
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 1	Surface Preparation Specification No. 1 – Solvent Cleaning.

SSPC-SP 3	Surface Preparation Specification No. 3 – Power Tool Cleaning.
SSPC-SP 7	Surface Preparation Specification No. 7 – Brush-Off Blast Cleaning.
SSPC-SP 10	Surface Preparation Specification No. 10 – Near-White Blast Cleaning.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Structural Performance

1. Handrails and railings shall be capable of resisting structural loads required by the New York City Building Code or the New Jersey Uniform Construction Code, as applicable to where the Project is located.
2. When installed, handrail and railing assemblies shall be capable of withstanding required gravity loads and structural loads, applicable to the specific location or use, without exceeding the allowable design working stress of the materials involved, including anchors and connections.
3. Thermal Movements: Allow for thermal movements of handrails and railings resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

- B. Corrosion Control: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

1.04 QUALITY ASSURANCE

- A. Where required by Appendix "A", submit structural calculations for handrails and railings. Determine allowable design working stresses of handrail and railing materials based on AISC 335.

B. Engineer Qualifications

A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for design of handrails and railings indicated for this Project in material, design and installation.

C. Welding Standards

Comply with applicable provisions of AWS D1.1 *Structural Welding Code – Steel*.

1. Each welder shall have satisfactorily passed AWS qualification tests for welding processes involved and shall be currently AWS certified.

D. Single Source Responsibility

Obtain each type of handrail and railing through one source from a single manufacturer.

E. Field Measurements

Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.05 DELIVERY, STORAGE, AND HANDLING

Protect material from damage including, but not limited to, scratches, nicks, dents and gouges during delivery, storage, assembly and installation.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. General

Metal surfaces shall be free from pitting, seam marks, roller marks, stains, discolorations and other imperfections where exposed to view on finished units.

B. Steel and Iron

Furnish steel and iron in the form shown on the Contract Drawings complying with the following requirements:

1. Steel Pipe: ASTM A 53.
 - a. Type and Weight Class: Type F or Type S, Grade A, Schedule 40 (standard weight), unless another grade and weight are required by structural loads.
 - b. Finish: Black finish or hot-dip galvanized, as shown on the Contract Drawings.
2. Steel Tubing: Cold-formed, ASTM A 500; or hot-rolled, ASTM A 501; black finish or hot-dip galvanized, as shown on the Contract Drawings.
3. Steel Plates, Shapes and Bars: ASTM A 36.
4. Castings: Gray iron, ASTM A 48, Class 30 or malleable iron, ASTM A 47, grade as recommended by fabricator for use shown on the Contract Drawings.

C. Brackets, Flanges and Fittings

Cast or formed metal of same type of material and finish as supported handrails and railings, unless otherwise shown on the Contract Drawings.

D. Welding Electrodes and Filler Metal

Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength and compatibility in fabricated items.

E. Fasteners

1. Use zinc-plated fasteners complying with ASTM B 633, Class Fe/Zn 25 (Service Condition 4--very severe). Do not use metals that are corrosive or incompatible with materials joined. Furnish concealed fasteners for interconnection of handrail and railing components and for their attachment to other Work.
2. Fasteners for Anchoring Handrails and Railings to Other Construction: Type, grade and class required to produce connections suitable for anchoring handrails and railings to other types of construction shown on the Contract Drawings and capable of withstanding design loads.

F. Anchors and Inserts

Type, size and material recommended by the railing manufacturer for type of loading and installation condition shown on Contract Drawings. Use stainless steel or hot-dip galvanized anchors and inserts for exterior locations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts as required, to be set into concrete or masonry.

G. 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.

H. Nonmetallic Grout

Pre-mixed, factory-packaged, nonshrink, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Furnish grout of grade specifically recommended by the manufacturer for interior or exterior applications.

I. Erosion Resistant Anchoring Cement

Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at the construction site to create pourable anchoring, patching and grouting compound. Formulation shall be resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and shall be recommended by manufacturer for exterior use.

2.02 FABRICATION

A. General

Fabricate handrails and railings to dimensions and details shown on the Contract Drawings. Furnish handrail and railing members in sizes and profiles shown on Contract Drawings, with supporting posts and brackets of size and spacing shown, but not less than required to support the design loadings required by 1.03 A.

1. 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. Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges to a radius of approximately 1/32 inch. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
3. Cut, reinforce, drill and tap components to receive anchorage, finish hardware and similar items.
4. Close exposed ends of handrail and railing members with prefabricated end fittings.
5. Fabricate wall returns at ends of wall-mounted handrails. Close ends of returns. Furnish railing extensions at bottom and top of stairs as shown on the Contract Drawings.
6. Form bends by using prefabricated elbow fittings and radius bends, as applicable, of radii shown on the Contract Drawings, except where configuration shown requires bending of railing members.
7. Fabricate connections that will be exposed to weather in a manner to exclude water. Where water may accumulate, provide weepholes.

B. Welded Connections

Fabricate handrails and railings with welded connections, unless otherwise shown on the Contract Drawings. Cope components at perpendicular and skew connections to provide close fit or use fittings designed for this purpose. Weld connections continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blend so no roughness shows after finishing and so welded surface matches contours of adjoining surfaces.

C. Nonwelded Connections

Where railings are shown on the Contract Drawings to be adhesively or mechanically attached:

1. Fabricate handrails and railings to accommodate interconnection of members using railing manufacturer's standard concealed mechanical fasteners and fittings.

2. Assemble members and fittings to produce flush, smooth and rigid hairline joints.
3. Splice joints for field connection shall use epoxy structural adhesive where such procedure represents manufacturer's standard splicing method.

D. Toe Boards

Incorporate toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details shown on the Contract Drawings or, if not shown, fabricate toe boards 4 inches high. Use manufacturer's standard toe board material.

E. Brackets, Flanges, Fittings and Anchors

1. Use manufacturer's standard wall brackets, flanges, miscellaneous fittings and anchors for interconnection of handrail and railing members to other Work. Furnish inserts and other anchorage devices as shown on the Contract Drawings and as required to provide support. Coordinate anchorage types with supporting structure.
2. For railing posts set in concrete, furnish minimum 6 inch long galvanized steel sleeves, matching shape and configuration of railing posts and with outside dimensions not less than 1/2 inch greater than outside dimensions of post. Weld galvanized steel plate closures to bottoms of sleeves. Plate closures shall be 1 inch greater in length and width than outside dimensions of sleeves.
 - a. Touch-up galvanized surfaces damaged by welding or abrasion by applying galvanizing repair paint to comply with ASTM A 780.

F. Galvanizing

1. Hot-dip galvanize railings shown on the Contract Drawings to be galvanized. Comply with applicable standards:
 - a. Iron and steel products made from rolled, pressed and forged steel shapes, castings, plates, bars and strips: ASTM A 123.
 - b. Iron and steel hardware: ASTM A 153.
2. Furnish galvanized fittings, brackets, fasteners, sleeves and other ferrous components for use with galvanized handrails and railings.
3. Fill vent and drain holes that will be exposed in finished Work, except those intended to remain as weep holes, by plugging with zinc and filing off smooth.

2.03 SHOP PAINTING

A. Galvanized Steel

Preparation for Shop Priming: After galvanizing, thoroughly clean handrails and railings of grease, dirt, oil, flux and other foreign matter and treat with zinc phosphate process. Apply primer within 12 hours of galvanizing or, if this can not be achieved, submit to the Engineer for approval, additional surface preparation measures to be performed, including but not limited to SSPC-SP 7.

B. Uncoated Steel

Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed handrails and railings:

1. Exteriors (SSPC Zone 1B): SSPC-SP 10.
 2. Interiors (SSPC Zone 1A): SSPC-SP 1 and SSPC-SP 3.
- C. Apply shop primer to prepared surfaces of handrail and railing components, unless otherwise shown on Contract Drawings. Comply with requirements in SSPC-PA 1 for shop painting. Primer is not required on surfaces to be embedded in concrete or masonry.
- D. Apply additional paint coats as specified in Division 9 Section on painting.
- E. Stripe paint edges, corners, crevices, bolts and welds.

PART 3. EXECUTION

3.01 PREPARATION

Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages, such as sleeves, inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction specified in other Sections. Coordinate delivery of such items to the construction site in time for installation.

3.02 INSTALLATION

A. General

1. Fit exposed connections accurately together to form tight, hairline joints.
2. Perform cutting, drilling and fitting required for installation of handrails and railings. Set Work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
3. Do not weld, cut or abrade surfaces of handrails and railing components which have been coated or finished after fabrication and are intended for field connection by mechanical means without further cutting or fitting.
4. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
5. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
6. Adjust handrails and railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval shown on the Contract Drawings or, if not shown, as required by design loadings.

B. Anchoring Posts

1. Anchor posts in concrete using steel sleeves preset and anchored into the concrete, unless other methods are shown on the Contract Drawings. After posts have been inserted into sleeves, solidly fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.
2. Leave anchorage joint exposed, unless otherwise shown on the Contract Drawings. Wipe off excess grout and leave 1/8 inch build-up, sloped away from post. For installation exposed to exterior or to flow of water, seal grout to comply with grout manufacturer's directions.
3. Anchor posts to metal surfaces with manufacturer's standard fittings designed for this purpose.

C. Railing Connections

1. Use fully welded joints for permanently connecting railing components, unless otherwise shown on the Contract Drawings. Comply with requirements in 2.02 B for welded connections whether welding is performed in the shop or in the field.
2. Where railings are shown on the Contract Drawings to be mechanically or adhesively attached, use mechanical or adhesive joints for permanently connecting railing components. Prevent damage to railing members and fittings while making connections. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of handrails and railings.

D. Expansion Joints

Install expansion joints at locations shown on the Contract Drawings, but not farther apart than required to accommodate thermal movement. Furnish slip-joint internal sleeve extending 2 inches beyond joint on either side. Fasten internal sleeve securely to one side and locate joint within 6 inches of post.

E. Anchoring Railing Ends

1. Anchor railing ends into concrete or masonry with manufacturer's standard fittings designed for this purpose.
2. Anchor railing ends to metal surfaces with manufacturer's standard fittings using concealed fasteners.

F. Attachment of Handrails to Walls

1. Secure handrails to walls with manufacturer's standard wall brackets and end fittings.
2. For concrete and solid masonry, use drilled-in expansion shields for concealed bolts.
3. For hollow masonry anchorage, use toggle bolts with square heads.

3.03 ADJUSTING

- A. At the construction site, repair finishes of handrails and railings damaged as a result of the Contractor's operations or furnish and install new railings. Remove handrails and railings whose finish cannot be repaired at the construction site and either return them to the fabrication shop, restore the finishes and reinstall, or furnish and install new handrails and railings. All such remedial Work shall be performed to the satisfaction of the Engineer and at no cost to the Authority.
- B. 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.

3.04 PROTECTION

Protect finishes of handrails and railings from damage during installation and other Work of the Contract by use of temporary protective coverings approved by the railing manufacturer. Remove protective covering when other Work of the Contract is completed or when directed by the Engineer.

END OF SECTION

SECTION 05523
STEEL PIPE AND TUBE RAILINGS

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

05523A01 Drawings for fabrication and erection of handrails and railings, showing sizes, shapes and layout of all railing components. Include plans, elevations and details of fittings, connections, and anchorages to other Work. Provide G22 templates for anchors and bolts to be installed under other Sections. Where materials or fabrications are required to comply with certain requirements for design loadings specified in this Section or otherwise shown on the Contract Drawings, submit structural computations, material properties and other information needed for structural analysis. Structural computations shall be signed by a Professional Engineer licensed in the State where the Work is to be performed.

Samples

05523C01 Samples for each type of finish shown on the Contract Drawings. Prepare samples on metal of same gauge and alloy to be used in Work. Where normal color and texture variations are to be expected, samples shall show limits of such variations. Include 6-inch long samples of distinctly different railing members including handrails, top rails, posts, rail coverings, and any appurtenances thereto, if any. Include samples of fittings and brackets.

Product Data

05523D01 Manufacturer's product specifications and instructions for products and processes used in the fabrication, assembly and installation of handrails and railings, including finishes and grout.

END OF APPENDIX "A"

DIVISION 5
SECTION 05530
GRATINGS

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for the following grating types and accessories, where shown on the Contract Drawings:
1. Metal bar gratings.
 2. Expanded metal gratings.
 3. Formed metal plank gratings.
 4. Extruded aluminum plank gratings.
 5. Metal frames and supports for gratings.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	<u>American Architectural Manufacturers Association (AAMA)</u>
AAMA 611	Specification for Anodized Architectural Aluminum.
	<u>American Society of Mechanical Engineers (ASME)</u>
ASME B18.21.1	Lock Washers (Inch Series).
ASME B18.22.1	Plain Washers.
	<u>American Society for Testing and Materials (ASTM)</u>
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 276	Specification for Stainless Steel Bars and Shapes.
ASTM A 307	Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
ASTM A 510	Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
ASTM A 563	Specification for Carbon and Alloy Steel Nuts.
ASTM A 653	Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
ASTM A 666	Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
ASTM A 780	Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

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 209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
ASTM B 221	Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
ASTM B 316	Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods.
ASTM B 633	Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
ASTM D 1187	Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metals.
ASTM E 488	Test Method for Strength of Anchors in Concrete and Masonry Elements.
ASTM F 593	Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
ASTM F 594	Specification for Stainless Steel Nuts.
ASTM F 1267	Specification for Metal, Expanded, Steel.
	<u>American Welding Society, Inc. (AWS)</u>
AWS D1.1	Structural Welding Code – Steel.
AWS D1.2	Structural Welding Code – Aluminum.
AWS D1.3	Structural Welding Code – Sheet Steel.
AWS D1.6	Structural Welding Code – Stainless Steel.
	<u>National Association of Architectural Metal Manufacturers (NAAMM)</u>
NAAMM MBG 531	Metal Bar Grating Manual for Steel, Stainless Steel, and Aluminum Gratings and Stair Treads.
NAAMM MBG 532	Heavy-Duty Metal Bar Grating Manual for Structural Carbon Steel and Stainless Steel.
AMP 500-505	Metal Finishes Manual for Architectural and Metal Products.
	<u>The Society for Protective Coatings (SSPC)</u>
SSPC-Paint 12	Paint Specification No. 12 – Cold Applied Asphalt Mastic (Extra Thick Film).
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. Gratings shall be capable of resisting structural loads required by provisions of the New York City Building Code and the New Jersey Uniform Construction Code which would apply if the Authority were a private corporation. Gratings shall also comply with applicable portions of OSHA. If OSHA is more stringent, it shall apply.
- B. Gratings shall be capable of withstanding required gravity loads and structural loads, applicable to the specific grating use, without exceeding the allowable design working stress of the materials involved, including anchors and connections.

1.04 QUALITY ASSURANCE

- A. When required by Appendix "A" of this Section, submit structural calculations for gratings, 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

A firm experienced in producing gratings similar to those shown on the Contract Drawings for Work of this Contract, with a record of successful in-service performance and sufficient production capacity to produce required units.

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. Engineering services are defined as those performed for installations of gratings that are similar in material, design and extent to those shown on the Contract Drawings for Work of this Contract.

D. Metal Bar Grating Standards

Comply with requirements of applicable portions of NAAMM MBG 531 and NAAMM MBG 532.

E. Welding Standards

Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and if pertinent, has undergone recertification. Qualify procedures and personnel according to the following as applicable:

1. AWS D1.1 Structural Welding Code – Steel.
2. AWS D1.2 Structural Welding Code – Aluminum.
3. AWS D1.3 Structural Welding Code – Sheet Steel.
4. AWS D1.6 Structural Welding Code – Stainless Steel.

F. Field Measurements

Where gratings are shown on the Contract Drawings to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate 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 MANUFACTURERS

A. Subject to compliance with requirements, furnish and install products by one of the following:

1. Metal Bar Gratings

Alabama Metal Industries Corp. (AMICO), Birmingham, AL
All American Grating, Inc., Pittsburgh, PA
Barnett/Bates Corp., Joliet, IL
Fisher & Ludlow (Div. of Harris Steel Ltd.), Plymouth, MI
IKG Borden, Paramus, NJ
Ohio Gratings, Inc., Canton, OH
Tru-Weld Grating, Inc., Wexford, PA

2. Expanded Metal Gratings

Alabama Metal Industries Corp. (AMICO), Birmingham, AL
All American Grating, Inc., Pittsburgh, PA
Fisher & Ludlow (Div. of Harris Steel Ltd.), Plymouth, MI

3. Formed Metal Plank Gratings

Alabama Metal Industries Corp. (AMICO), Birmingham, AL
Fisher & Ludlow (Div. of Harris Steel Ltd.), Plymouth, MI
GS Metals Corp., Pinckneyville, IL
IKG Borden, Paramus, NJ
Morton Manufacturing Co., Libertyville, IL
Unistrut Corp., Wayne, MI

4. Extruded Aluminum Plank Gratings

AMICO-Klemp Corp., Birmingham, AL
IKG Borden, Paramus, NJ
Ohio Gratings, Inc., Canton, OH

2.02 MATERIALS

A. Steel

1. Steel Plates, Shapes, and Bars: ASTM A 36.
2. Steel Wire Rod for Grating Crossbars: ASTM A 510.
3. Uncoated Steel Sheet: ASTM A 1011, Commercial Steel, Type B.
4. Galvanized Steel Sheet: ASTM A 653, structural quality, Grade 33, with G90 coating.
5. Expanded Metal, Carbon Steel: ASTM F 1267, Type Regular or Flattened as shown on the Contract Drawings, Class 1 (uncoated sheet per ASTM A 1011, CS Type B).
6. Expanded Metal, Galvanized: ASTM F 1267, Type Regular or Flattened as shown on the Contract Drawings, Class 2 (hot-dip zinc-coated), Grade A (1.5 oz. per sq. ft. minimum coating thickness).

B. Stainless Steel

1. Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
2. Bars and Shapes: ASTM A 276, Type 304.
3. Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316.
4. Bars and Shapes: ASTM A 276, Type 316.
5. Expanded Metal: ASTM F 1267, Type Regular or Flattened as shown on the Contract Drawings, Class 3.
6. For stainless steel units fabricated by welding, if any, use low-carbon type stainless steel.

C. Aluminum

1. Extruded Bars and Shapes: ASTM B 221, alloys as follows:
 - a. For bearing bars of gratings and shapes: 6061-T6 or 6063-T6.
 - b. For grating crossbars: 6061-T1.
2. Aluminum Sheet: ASTM B 209, alloy 5052-H32.

D. Fasteners

1. General: Type 304 or 316 stainless steel fasteners for exterior use and fasteners complying with ASTM B 633, 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. Fasteners for Stainless Steel Gratings: Type 304 or 316 stainless steel.
3. Fasteners for Aluminum Gratings: Type 304 or 316 stainless steel.
4. Bolts and Nuts: Regular hexagon-head bolts, carbon steel, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and flat washers where shown.
5. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.
6. Plain Washers: Round, carbon steel, ASME B18.22.1.
7. 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 to comply with ASTM B 633, Class Fe/Zn 8.
 - b. Exterior Locations: Stainless steel bolts complying with ASTM F 593, Alloy Group 1 or 2 and nuts complying with ASTM F 594.

E. Paint

1. Shop Primer for Steel

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 mastic complying with SSPC-Paint 12 except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.03 FABRICATION, GENERAL

Form gratings from materials of type, size, thickness and shapes shown on the Contract Drawings, but not less than that needed to support design loading.

- A. Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Shear and punch metals cleanly and accurately. Remove burrs. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise shown on the Contract Drawings.
- C. Fit exposed connections accurately together to form hairline joints.
- D. Welding: Comply with AWS recommendations and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
- E. Provide for anchorage of type shown on the Contract Drawings; coordinate with supporting structure. Fabricate and space anchoring devices to secure gratings, frames and supports rigidly in place and to support design loading.
- F. Toe Plates, if any: Fabricate to fit grating units and weld to units in shop, unless otherwise shown on the Contract Drawings.
 - 1. Height: Extend toe plates minimum of 4 inches above the top surface of the grating, unless otherwise shown on the Contract Drawings.

2.04 CONSTRUCTION FEATURES

- A. Provide cutouts in grating sections for penetrations in sizes and at locations shown on the Contract Drawings. Cut openings neatly and accurately to size. Arrange cutouts to permit grating removal without disturbing items penetrating gratings where removable grating section is shown on the Contract Drawings.
- B. Metal Bar Gratings
 - 1. Fabricate bar grating by one of the following methods as shown on the Contract Drawings:
 - a. Welded (steel or stainless steel).

- b. Press-Locked (steel, aluminum or stainless steel).
 - c. Swage-Locked (aluminum or stainless steel).
 - d. Riveted (steel, aluminum or stainless steel).
2. Fabricate gratings with cross bars and bearing bars in material, type, sizes and spacings shown on the Contract Drawings, but not less than that required to comply with structural performance requirements.
 3. Edge-band openings in grating that interrupt 4 or more bearing bars with bars of the same size and material as bearing bars.
 4. Fabricate removable grating sections, if any, with banding bars attached by welding to entire perimeter of each removable section. Include anchors and fasteners of type shown on the Contract Drawings or, if not shown, as recommended by manufacturer for attaching to supports.
 5. Traffic Surface for Steel and Stainless Steel Bar Gratings

Plain, serrated, knurled or an applied abrasive finish consisting of aluminum oxide (corundum) aggregate in an epoxy-resin adhesive, as shown on the Contract Drawings.
 6. Traffic Surface for Aluminum Bar Gratings

Plain, grooved or an applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive, as shown on the Contract Drawings.
 7. Finish
 - a. Steel: Hot-dip galvanize exterior steel bar gratings after fabrication; shop prime paint interior steel bar gratings, unless otherwise shown on the Contract Drawings.
 - b. Aluminum: Mill finish, as fabricated, unless otherwise shown on the Contract Drawings.
 - c. Stainless Steel: Mill finish, as fabricated, unless otherwise shown on the Contract Drawings.
- C. Expanded Metal Gratings
1. Furnish expanded metal gratings in material, finish, type, size, thickness and weight shown on the Contract Drawings or, if not shown, as recommended by manufacturer for applications shown and as needed to support design loads.
 2. Edge-band openings with bars of thickness not less than overall grating thickness at contact points.
 3. Where gratings are pierced by pipes, ducts and structural members, cut openings and weld a strap collar not less than 1/8 inch thick to the cut ends. Divide panels into sections only to the extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts and structural members.
- D. Formed Metal Plank Gratings
1. Furnish formed metal plank gratings in type, size, thickness, material and finish shown on the Contract Drawings or, if not shown, as recommended by manufacturer for applications shown and as needed to support design loads.
 2. Type: C-shaped channel rolled from heavy sheet metal, punched in serrated diamond shape to produce raised slip-resistant surface and drainage holes.

3. Material: As follows and as shown on the Contract Drawings:
 - a. Steel: 0.1046 inch thick (12 gage), ASTM A 653, G90 pre-galvanized.
 - b. Aluminum: 0.100 inch thick, mill finish, unless otherwise shown.
4. Edge-band openings with metal sheet or bars having a thickness not less than grating material.
5. Where gratings are pierced by pipes, ducts and structural members, cut openings and weld a minimum 1/8 inch thick strap collar to the cut ends. Divide panels into sections only to the extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts and structural members.
6. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

"Diamond-Grip", Alabama Metal Industries Corp. (AMICO), Birmingham, AL
"Grip Span", Fisher & Ludlow (Div. of Harris Steel Ltd.), Plymouth, MI
"Grip Strut", GS Metals Corp., Pinckneyville, IL
"Deck Span", IKG Borden, Paramus, NJ
"Grip-Trac", Morton Manufacturing Co., Libertyville, IL
"United Interlock", Unistrut Corp., Wayne, MI

E. Extruded Aluminum Plank Gratings

1. Furnish extruded aluminum plank gratings in type, size and finish shown on the Contract Drawings or, if not shown, as recommended by manufacturer for applications shown and as needed to support design loads.
2. Type: Extruded aluminum planks approximately 6 inches wide with multiple flanges approximately 1.2 inches o.c., acting as bearing bars connected by a web that serves as a walking surface. Top surface shall have raised ribs to increase slip resistance.
3. Depth: 2 inches, unless otherwise shown on the Contract Drawings.
4. Perforations: Rectangular, 19/32 by 3 inches, with adjacent rows staggered, unless otherwise shown on the Contract Drawings.
5. Finish: Mill, as fabricated, unless otherwise shown.

F. Grating Frames and Supports

1. Steel Frames and Supports: Fabricate from steel shapes, plates and bars of same basic metal and finish as grating, unless otherwise shown. Fabricate of welded construction to sizes, shapes and profiles shown on the Contract Drawings and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill and tap units to receive anchorage, hardware and similar items.
2. Aluminum Frames: Fabricate frames for extruded aluminum gratings from extruded aluminum shapes of same basic material and finish as grating, to sizes, shapes and profiles shown on the Contract Drawings and as necessary to receive gratings. Miter and weld connections. Cut, drill and tap units to receive anchorage, hardware and similar items.

3. Equip units with integrally welded anchors for casting into concrete or building into masonry.
 - a. Space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long, unless otherwise shown on the Contract Drawings.
4. Galvanize steel frames and supports in the following locations:
 - a. Exterior.
 - b. Interior, where shown on the Contract Drawings.

2.05 SHOP FINISHING

A. Galvanized Steel

For items indicated to be galvanized, apply zinc coating by the hot-dip process complying with ASTM A 123. Minimum coating weight shall be 1.8 oz. per sq. ft. of coated surface. Where gratings, frames and supports are shown to be painted after galvanizing, prime and finish paint in accordance with Division 9 Section on Painting.

B. Painted Uncoated Steel

1. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed items:
 - a. Exteriors (SSPC Zone 1B): SSPC-SP 6.
 - b. Interiors (SSPC Zone 1A): SSPC-SP 3.
2. Shop Priming: Apply shop primer to prepared, uncoated surfaces of gratings, frames and supports, except those to be embedded in concrete or masonry, unless otherwise shown on the Contract Drawings. Comply with SSPC-PA 1 for shop painting.
3. Finish Painting: Finish paint shop primed surfaces of gratings, frames and supports in accordance with Division 9 Section on Painting.

C. Finishes

1. Comply with NAAMM's *Metal Finishes Manual for Architectural and Metal Products* for recommendations for applying and designating finishes.
2. Finish aluminum and stainless steel gratings, frames and supports after assembly.
3. Aluminum Finish: Class I clear anodic; AA M12-C22-A41 (0.7 mil or thicker), complying with AAMA 611 for gratings, supports and frames where shown on the Contract Drawings.
4. Stainless Steel Finish: Mill, unless other finish is shown on the Contract Drawings.

PART 3. EXECUTION

3.01 PREPARATION

Coordinate installation of anchorages for gratings, grating frames and supports. Furnish setting drawings, templates and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to construction site in time for installation.

3.02 INSTALLATION

A. General

1. **Fastening to In-Place Construction:** Install anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts and other connectors.
2. **Cutting, Fitting, and Placement:** Perform cutting, drilling and fitting required for installing gratings. Set units accurately in location, alignment and elevation measured from established lines and levels and free from rack.
3. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
4. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
5. Field attach toe plates which could not be factory welded by field welding, unless otherwise shown on the Contract Drawings.
6. **Field Welding:** Comply with the following:
 - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - b. Obtain fusion without undercut or overlap.
 - c. Remove welding flux immediately.
 - d. Do not weld, cut or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
7. **Corrosion Protection:** Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood or dissimilar metals with a heavy coat of bituminous paint.

B. Installing Metal Bar Gratings

1. **General:** Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes shown on the Contract Drawings, including installation clearances, minimum bearing dimensions at supports and standard anchoring details.
2. Install gratings with cross bars on top side.
3. Do not notch bearing bars at supports to maintain elevation.

4. Attach removable units to supporting members with type and size of clips and fasteners shown on the Contract Drawings or, if not shown, as recommended by grating manufacturer for type of installation conditions shown.
5. Attach nonremovable units to supporting members by welding where both materials are the same; otherwise, fasten by bolting as indicated above.

C. Installing Expanded Metal Gratings

1. General: Comply with manufacturer's written instructions for installing gratings.
2. Place units with straight edge of bond up and with the long direction of diamond-shaped openings (LWD) parallel to direction of span.
3. Attach removable units to supporting members by bolting at 6 inch intervals.
4. Attach nonremovable units to supporting members by welding, unless otherwise shown on the Contract Drawings. Space welds at 6 inch intervals.
5. Attach aluminum units to steel supporting members by bolting at 6 inch intervals.
6. Butt edges parallel to long direction of diamond-shaped openings and weld at every second bond point. Place individual grating sections so diamonds of one piece are aligned with diamonds of adjacent sections.

D. Installing Metal Plank Gratings

1. General: Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard anchor clips and hold-down devices for bolted connections.
2. Attach removable units to supporting members by bolting at every point of contact.
3. Attach nonremovable units to supporting members by welding, unless otherwise shown on the Contract Drawings. Comply with manufacturer's written instructions for size and spacing of welds.
4. Attach aluminum units to steel supporting members by bolting at side channels at every point of contact and by bolting intermediate planks at each end on alternate sides. Bolt adjacent planks together at midspan.

3.03 ADJUSTING AND CLEANING

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 the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop painted surfaces. Apply by brush or spray in a minimum dry film thickness of 2.0 mils.
2. Galvanized Surfaces: Clean field welds, bolted connections and abraded areas. Repair galvanizing to comply with ASTM A 780. Apply by brush or spray in a minimum dry film thickness of 3 mils.

END OF SECTION

SECTION 05530

GRATINGS

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

05530A01 Shop Drawings: Show fabrication and installation details for gratings. Include plans, elevations, sections, and details of connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation, where required.

Product Data

05530D01 Formed-metal plank gratings.

05530D03 Clips and anchorage devices for gratings.

05530D04 Paint products.

Certificates

05530E01 Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

05530E02 Welding Certificates: Copies of certificates for welding procedures and personnel.

END OF APPENDIX "A"

DIVISION 5

SECTION 05700

ORNAMENTAL METALWORK

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies finished ornamental metalwork not specified in Division 5 Section on sheet metal fabrications, including but not limited to extrusions, castings, moldings and rolled shapes.
- B. Items specified in this Section include, but are not limited to the following, where shown on the Contract Drawings:
 - 1. Ornamental railings, excluding pipe railings specified in other Division 5 Sections.
 - 2. Ornamental diffusers, grilles and frames.
 - 3. Ornamental castings.
 - 4. Extruded reveals.
 - 5. Extruded wall and column cladding.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	<u>The Aluminum Association, Inc. (AA)</u>
	Aluminum Design Manual – Specifications for Aluminum Structures.
	<u>American Architectural Manufacturers Association (AAMA)</u>
AAMA 611	Specification for Anodized Architectural Aluminum.
AAMA 2603	Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
AAMA 2605	Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
	<u>American Society for Testing and Materials (ASTM)</u>
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 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 276	Specification for Stainless Steel Bars and Shapes.

ASTM A 312	Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
ASTM A 492	Specification for Stainless Steel Rope Wire.
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 554	Specification for Welded Stainless Steel Mechanical Tubing.
ASTM A 666	Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
ASTM A 743	Specification for Castings, Iron Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
ASTM A 780	Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
ASTM B 26	Specification for Aluminum-Alloy Sand Castings.
ASTM B 36	Specification for Brass Plate, Sheet, Strip, and Rolled Bar.
ASTM B 43	Specification for Seamless Red Brass Pipe, Standard Sizes.
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings.
ASTM B 108	Specification for Aluminum-Alloy Permanent Mold Castings.
ASTM B 135	Specification for Seamless Brass Tube.
ASTM B 209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
ASTM B 211	Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
ASTM B 221	Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
ASTM B 247	Specification for Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings.
ASTM B 249	Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes and Forgings.
ASTM B 429	Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
ASTM B 455	Specification for Copper-Zinc-Lead Alloy (Leaded Brass) Extruded Shapes.
ASTM B 483	Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.
ASTM B 584	Specification for Copper Alloy Sand Castings for General Applications.
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.

American Welding Society Inc. (AWS)

AWS D1.1	Structural Welding Code – Steel.
AWS D1.2	Structural Welding Code – Aluminum.
AWS D1.6	Structural Welding Code – Stainless Steel.

National Association of Architectural Metal Manufacturers (NAAMM)

Metal Finishes Manual for Architectural and Metal Products.

The Society for Protective Coatings (SSPC)

SSPC-Paint 12	Paint Specification No. 12 – Cold-Applied Asphalt Mastic (Extra Thick Film).
SSPC-Paint 20	Paint Specification No. 20 – Zinc Rich Primers (Type I, Inorganic, and Type II, Organic).
SSPC-SP 6	Surface Preparation Specification No. 6 – Commercial Blast Cleaning.
SSPC-SP 7	Surface Preparation Specification No. 7 – Brush-Off Blast Cleaning.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Items requiring design computations by the Contract Drawings shall be designed to withstand all structural loads, as required by building codes which would apply if the Authority were a private corporation.

- B. Thermal Movements

Design components to allow for expansion and contraction for a maximum ambient temperature change (range) of 120 degrees F without causing buckling, excessive opening of joints or overstressing of welds and fasteners.

- C. Corrosion Control

Prevent galvanic action and other forms of corrosion by isolating metals and other materials from other incompatible materials.

1.04 QUALITY ASSURANCE

- A. Where required by the Engineer or by Appendix "A", submit structural calculations for ornamental handrails and railings.

- B. Engineer Qualifications

A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installation of handrails and railings that are similar to those indicated for this Project in material, design and extent.

- C. Fabricator Qualifications

Firm experienced in successfully producing ornamental metalwork similar to that indicated for Work of this Contract and with sufficient production capacity to produce required units without delaying the Work.

- D. Organic Coating Applicator Qualifications

Firm experienced in successfully applying organic coatings of type indicated to aluminum extrusions and equipped with the following:

1. A multistage aluminum cleaning and pretreatment system capable of complying with test requirements of AAMA standard referenced for type of coating indicated.
2. Spray equipment required to apply a uniform coating.

3. Baking facilities required to cure coating to achieve maximum hardness, mar-resistance and exterior durability.

E. Anodic Finish Applicator Qualifications

Firm experienced in successfully applying anodic finishes of type indicated, employing competent control personnel to conduct continuing, effective quality control program to ensure compliance with requirements.

F. Welding Standards

Comply with applicable provisions of AWS D1.1 *Structural Welding Code – Steel*, AWS D1.2 *Structural Welding Code – Aluminum*, and AWS D1.6 *Structural Welding Code – Stainless Steel*.

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and if pertinent, has undergone recertification.
2. All welders shall be licensed in the state in which the Work is to be performed.

G. Field Measurements

Where ornamental metalwork is shown on the Contract Drawings to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication and indicate recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.05 DELIVERY, STORAGE, AND HANDLING

Protect materials from scratches, nicks, dents and gouges during delivery, storage, assembly and installation. Remove damaged materials from the construction site and replace them at no cost to the Authority.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers

Subject to compliance with requirements of this Section, manufacturers offering products and assemblies that may be incorporated in the Work include, but are not limited to, the following:

1. Ornamental Railings

Milgo/Bufkin, Brooklyn, NY
Moli Metal Inc., St. Leonard, QU
Soheil Mosun, Toronto, ON
Rippel Architectural Metals, Inc., Chicago, IL
Zephyr Metals, Inc., Tulsa, OK

2. Ornamental Diffusers, Grilles and Frames

Architectural Grille, Div. of Giumenta Corp., Brooklyn, NY
Reggio Register Co., Inc., Ayer, MA
Register & Grille Manufacturing Co., Inc., Brooklyn, NY

3. Ornamental Castings

Lawler Machine & Foundry Co. Inc., Birmingham, AL
Milgo/Bufkin, Brooklyn, NY
Moli Metal Inc., St. Leonard, QU
Soheil Mosun, Toronto, ON
Tennessee Fabricating Co., Memphis, TN

4. Stainless Steel Wire Rope and Fittings

Décor Cable, Chicago, IL
Feeney Wire Rope & Rigging, Oakland, CA
Seco South Inc., Largo, FL

5. Extruded Wall and Column Cladding

Custom Enclosures, Inc., Wheeling, IL
Hi-Tech Metals, Inc., Maspeth, NY
MM Systems Corp., Pendergrass, GA
Milgo/Bufkin, Brooklyn, NY
Moli Metal Inc., St. Leonard, QU
Soheil Mosun, Toronto, ON

2.02 MATERIALS

A. General

Select material which has a high degree of surface flatness, smoothness and freedom from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces that exhibit pitting, seam marks, roller marks, "oil-canning", stains, discolorations or other imperfections on finished units will not be acceptable.

B. Aluminum

Comply with the following standards for the forms and types of aluminum for the required Work.

1. Furnish alloy and temper as shown on the Contract Drawings, except as otherwise recommended by the aluminum producer or finisher.
2. Extrusions: Alloy and temper shall be as recommended by aluminum producer or finisher with not less than the strength and durability properties specified in ASTM B 221 for 6063-T5.
3. Extruded Pipe and Tubes: ASTM B 429, 6063-T6.
4. Plate and Sheet: Alloy and temper as recommended by aluminum producer or finisher for type of use and finish required, and with not less than strength and durability properties specified in ASTM B 209 for 6061-T6.
5. Bars, Rods and Wire: ASTM B 211.
6. Drawn Seamless Tube: ASTM B 483.
7. Die and Hand Forgings: ASTM B 247, 6061-T6.
8. Castings: ASTM B 26 or ASTM B 108, alloy 214 for natural anodized finish and alloy 43 for color anodized or baked enamel finish, except as otherwise recommended by aluminum producer or finisher.

C. Stainless Steel

Grade and type designated below for each form required:

1. Tubing: ASTM A 554, Grade MT, 304, for interior use; Grade MT, 316, for exterior use.
2. Pipe: ASTM A 312, Grade TP 304, for interior use; Grade TP 316, for exterior use.
3. Castings: ASTM A 743, Type 304, Grade CF8 or CF20, for interior use; Type 316, Grade CF8M, for exterior use.
4. Plate: ASTM A 666, Type 304 for interior use; Type 316 for exterior use.
5. Bar Stock: ASTM A 276, Type 304 for interior use; Type 316 for exterior use.
6. Wire Rope: Specifically fabricated 1-by-19 cable that is drawn through a die after laying to produce a smooth outer surface, made from wire conforming to ASTM A 492, Type 316.

D. Steel and Iron

Furnish steel and iron in the form indicated complying with the following requirements:

1. Tubing: Cold-formed, ASTM A 500; or hot-rolled, ASTM A 501.
2. Steel Plate, Shapes, and Bars: ASTM A 36.
3. Castings: Gray iron, ASTM A 48, Class 30 or malleable iron, ASTM A 47, grade as recommended by fabricator for use shown on the Contract Drawings.

E. Copper Alloys, Brass

Furnish copper alloy of type and form shown on the Contract Drawings to comply with the following requirements:

1. Extruded Shapes: ASTM B 249, alloy UNS No. C36000 (free-cutting brass).
2. Plate and Bars: ASTM B 36, alloy UNS No. C26000 (cartridge brass, 70 percent copper).
3. Seamless Tubes: ASTM B 135, alloy UNS No. C26000 (cartridge brass, 70 percent copper).
4. Sand Castings: ASTM B 584, alloy UNS No. C85200 (high copper yellow brass).

F. Copper Alloys, Bronze

Furnish copper alloy of type and form shown on the Contract Drawings to comply with the following requirements:

1. Extruded Shapes: ASTM B 455, alloy UNS No. C38500 (architectural bronze).
2. Plate and Bars: ASTM B 36, alloy UNS No. C28000 (Muntz metal, 60 percent copper).
3. Seamless Pipe: ASTM B 43, alloy UNS No. C23000 (red brass, 85 percent copper).
4. Seamless Tubes: ASTM B 135, alloy UNS No. C23000 (red brass, 85 percent copper).
5. Composition Bronze Castings: ASTM B 62, alloy UNS No. C83600 (85-5-5-5 or composition bronze).

G. Welding Electrodes and Filler Metal

Type and alloy of filler metal and electrodes shall be as recommended by producer of the metal to be welded, complying with applicable AWS specifications and as required for color match, strength and compatibility between dissimilar materials in the fabricated items.

H. Fasteners

Finish of fastener metal and alloy shall match color and texture of the metal being fastened. Use concealed fasteners for interconnection of ornamental metalwork components and for their attachment to other Work, except where otherwise shown on the Contract Drawings. Use Phillips flat-head screws, countersunk, for exposed fasteners, if any.

I. Anchors and Inserts

Furnish inserts to be set in concrete or masonry and furnish other anchoring devices as required for the installation of ornamental metal items. Use toothed steel or lead shield expansion bolt devices or drilled-in-place anchors. Furnish hot-dip galvanized anchors and inserts for exterior installations. Exposed surfaces of units shall match texture and finish of the metal item anchored.

J. Wire Rope Fittings

Connectors of types indicated, fabricated from stainless steel and with capability to sustain, without failure, a load equal to the minimum breaking strength of the wire rope with which they are used.

K. 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 mastic painting system complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

L. Protective Lacquer

Clear, air-drying, non-yellowing acrylic lacquer for protection of finished copper alloy surfaces.

M. Nonmetallic Grout

Premixed, factory-packaged, nonshrink, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Furnish grout specifically recommended by manufacturer for interior and exterior applications.

2.03 FABRICATION

A. General

Form metalwork to the required shapes, sizes and finishes, with true curves, lines and angles. Furnish necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners wherever possible. Finish exposed surfaces to smooth, sharp, well-defined lines and arrises.

1. 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. Comply with AWS for recommended practices in shop welding and brazing. Welds and brazes behind finished surfaces shall not distort or discolor exposed side. Clean exposed welded joints of all welding flux and dress all exposed and contact surfaces.
3. Castings shall be sound and free of warp or defects that impair strength and appearance. Mill joints to a close fit and finish exposed surfaces to smooth, sharp, well-defined lines and arrises.
4. Fabricate wire rope assemblies in the shop to field measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so that maximum amount is available for tensioning wire ropes. Tag wire rope assemblies and fittings to identify installation locations and orientations for coordinated installation.
5. Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges to a radius of approximately 1/32 inch unless otherwise shown. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
6. Use connections that maintain structural value of joined pieces.
7. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.
8. Provide weepholes where water may accumulate.

B. Fabricating Handrails and Railings

1. **Nonwelded Connections:** Fabricate railing systems and handrails to interconnect members with concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints. Fabricate splice joints for field connection using an epoxy structural adhesive where this represents fabricator's standard splicing method.
2. **Welded Connections:** Fabricate handrails and railing systems of materials indicated to interconnect members by welding where shown on the Contract Drawings. Use welding method that is appropriate for metal and finish indicated and that develops strength required to comply with structural performance criteria. Finish exposed welds and surfaces smooth, flush and blended to match adjoining surfaces.

3. Brackets, Flanges, Fittings and Anchors: Furnish wall brackets, flanges and miscellaneous fittings required to interconnect handrail and railing members to other Work. Furnish inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry Work. Fabricate anchorage devices that are capable of withstanding load imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.
4. Form changes in direction of railing members by radius bends of radius shown on the Contract Drawings.
5. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required. Maintain profile of member throughout entire bend without buckling, twisting or otherwise deforming exposed surfaces of handrail and railing components.
6. Close exposed ends of handrail and railing members with manufacturer's standard prefabricated end fittings.
7. Furnish wall returns at ends of wall-mounted handrails, unless otherwise shown on the Contract Drawings. Close ends of returns, unless clearance between end of railings and wall is 1/4 inch or less. Furnish railing extensions at bottom and top of stairs as shown on the Contract Drawings.
8. For handrails and railing systems that are exposed to exterior or to moisture from condensation or other sources, provide weepholes or another means to drain water entrapped in hollow sections of railing members.

C. Fabricating Diffusers, Grilles and Frames

1. Fabricate ornamental grilles from metal components of thickness, size and shape shown on the Contract Drawings. Form perforations, when required, by punching, cutting or drilling to produce openings of sizes and shapes indicated. Roll, press and grind perforated metal to flatten and remove burrs and deformations.
 - a. The required perforation patterns shown on the Contract Drawings, if any, are based on the products of one manufacturer. Similar patterns produced by other manufacturers may be considered, subject to Engineer's approval.
2. Where grilles without frames are shown on the Contract Drawings, drill and countersink grilles for countersunk mounting screws. Furnish units with countersunk screws of metal to match grilles.
3. Where grilles with frames are shown on the Contract Drawings, fabricate grille frames from extruded metal of profiles and to sizes and shapes indicated. Miter frame members at corners and connect with concealed splice plates welded or brazed to the back of frames.
4. Drill and countersink frames for countersunk mounting screws. Furnish units with countersunk screws of metal to match frames.

D. Fabricating Castings

Fabricate cast metal units to design from cast metal type shown on the Contract Drawings. Drill and tap castings for threaded mounting studs.

E. Fabricating Metal Reveals

Cut reveals from metal channels of material and sizes shown on the Contract Drawings. Drill and countersink for mounting screws.

F. Fabricating Extruded Wall and Column Cladding

Fabricate wall and column cladding from extrusions of dimensions shown on the Contract Drawings. Incorporate reveals, trim and concealed anchorages for attachment to columns or adjacent construction as shown on the Contract Drawings.

2.04 SHOP FINISHING

A. General

1. Comply with NAAMM's *Metal Finishes Manual for Architectural and Metal Products* for recommendations relative to application and designations of aluminum, stainless steel and copper alloy finishes, except as otherwise shown on the Contract Drawings.
2. Protect mechanical finishes on exposed surfaces from damage by application of strippable temporary protective covering prior to shipment.

B. Aluminum Finishes

Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes, listed in NAAMM's *Metal Finishes Manual for Architectural and Metal Products*.

1. Anodized Finish

- a. Class I Clear Anodic: AA M12-C22-A41 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear film 0.7 mil or thicker), complying with AAMA 611.
- b. Class I Color Anodic: AA M12-C22-A42/A44 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, film 0.7 mil or thicker with integral color or electrolytically deposited color), complying with AAMA 611.
- c. Color: As shown on the Contract Drawings or, if not shown, as selected by Engineer from full range of industry colors and color density range.

2. Baked Enamel Finish

AA C21-C42-R1x (Chemical Finish: cleaned with inhibitive chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's specification for cleaning, conversion coating and painting.

- a. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603, except with a minimum dry film thickness of 1.5 mils, medium gloss.
- b. Color: As selected by Engineer from manufacturer's full range of colors.

3. High Performance Organic Coating

AA C12-C42-R1x (Chemical Finish: cleaned with inhibitive chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Arrange for a licensed applicator to prepare, pretreat and apply coating to exposed metal surfaces in accordance with coating and resin manufacturer's instructions.

- a. Fluoropolymer 3-Coat System: 3-coat thermocured system consisting of specially formulated inhibitive primer, 0.2 mil minimum dry film thickness; fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight, in a dry film thickness of 1.0 mil minimum; and a clear PVDF based seal coat. Comply with AAMA 2605.
- b. Color and Gloss: As selected by Engineer from manufacturer's full range of choices for color and gloss.
- c. Manufacturer shall furnish a written warranty for the Authority's benefit covering failure of the fluoropolymer coating system for a period of 20 years after the date of Final Completion.

C. Stainless Steel Finishes

Finish designations prefixed by "AISI" conform to the system established by the American Iron and Steel Institute for designating stainless steel finishes, listed in NAAMM's *Metal Finishes Manual for Architectural and Metal Products*.

1. Remove or blend tool and die marks and stretch lines into finish.
2. Grind and polish surfaces to produce uniform, directional, textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
3. Furnish one or more of the following finishes, where shown on the Contract Drawings:
 - a. Bright, Directional Polish: AISI No. 4 finish.
 - b. Satin, Directional Polish: AISI No. 6 finish.
 - c. Satin, Reflective, Directional Polish: AISI No. 7 finish.
 - d. Mirror-Like Reflective, Nondirectional Polish: AISI No. 8 finish.
 - e. Nondirectional Finish: #BJNDF-60 finish, as manufactured by Milgo Industrial, Inc., Brooklyn, NY, or approved equal.
4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

D. Iron and Steel Finishes

1. Galvanizing: Hot-dip galvanize items shown on the Contract Drawings to be galvanized to comply with applicable standard listed below:
 - a. Iron and steel products made from rolled, pressed and forged steel shapes, castings, plates, bars and strips: ASTM A 123.
 - b. Iron and steel hardware: ASTM A 153.

2. Fill vent drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
3. Preparation for Shop Priming: After galvanizing, thoroughly clean ornamental metalwork of grease, dirt, oil, flux and other foreign matter and treat with metallic phosphate process.
4. Uncoated Steel

Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed ornamental metalwork:

- a. Exteriors (SSPC Zone 1B): SSPC-SP 6.
- b. Interiors (SSPC Zone 1A): SSPC-SP 7.
5. Factory Primed Finish: Apply air-dried primer immediately following cleaning and pretreatment, to provide a minimum dry film thickness of 2.0 mils per applied coat to surfaces that will be exposed after assembly and installation, and to concealed, nongalvanized surfaces.
6. Apply an air-dried primer in shop and successive coats in field, as specified in Division 9 Section on Painting.

E. Copper Alloy Finishes (Brass and Bronze)

Finish designations prefixed by "CDA" conform to the system established by the Copper Development Association for designating copper alloy finishes, listed in NAAMM's *Metal Finishes Manual for Architectural and Metal Products*.

1. Natural Satin Finish, Lacquered: CDA M31-M34-06x (Mechanical Finish: directional textured, hand-rubbed; clear organic coating: Clear air-drying, acrylic lacquer specially developed for coating copper alloy products, applied by air spray in 2 coats per manufacturer's directions, with interim drying, to a total thickness of 1.0 mil. Subject to compliance with requirements, furnish "Incralac" developed by International Copper Research Association (INCRA).
2. Statuary (Oxidized) Conversion Coating over Satin Finish: CDA M32-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide).
 - a. Color: As shown on the Contract Drawings or, if not shown, as selected by the Engineer.
3. Patina (Verde Antique) Conversion Coating: CDA M36-C12-C52 (Mechanical Finish: directionally textured, uniform; Chemical Finish: nonetched cleaned, degreased; Chemical Finish: conversion coating, ammonium sulfide).
 - a. Color: As shown on the Contract Drawings or, if not shown, as selected by the Engineer.

PART 3. EXECUTION

3.01 PREPARATION

- A. Coordinate and furnish anchorages and setting drawings, diagrams, templates, instructions and directions for installation of items having integral anchors which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the construction site.
- B. Inspect ornamental metal items before installation to verify that they are free from scratches, nicks, dents and other defects. Repair or replace defective items.

3.02 INSTALLATION

A. General

Install anchorage devices and fasteners where necessary for securing ornamental metal items to existing construction in-place at the construction site, including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

- 1. Perform all cutting, drilling and fitting required for the installation of the ornamental metal items. Set Work accurately in location, alignment and elevation, plumb, level and true, measured from established lines and levels, and in proper alignment and relationship to adjacent construction. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry or similar construction.
- 2. Form tight joints with exposed connections accurately fitted with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding and grinding are required for proper shop fitting and jointing of Work, restore finishes to eliminate any evidence of such corrective Work.
- 3. Do not cut or abrade finishes of ornamental metalwork unless such finishes can be completely restored at the construction site. Any item whose finish cannot be cut or abraded and subsequently refinished solely at the construction site, shall either be removed to a location where required alterations can be performed and refinishing accomplished or replaced with a new item, at the option of the Contractor and at no cost to the Authority.
- 4. Install concealed gaskets, joint fillers, insulation and flashings, if any, as the Work progresses to make the Work weather-tight, soundproof or lightproof as required by the applications shown on the Contract Drawings.
- 5. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with concrete, masonry, wood or dissimilar metals, in exterior Work and Work to be built into exterior and below grade walls and decks, with a heavy coat of bituminous paint. Do not extend coating onto exposed surfaces.

B. Installing Handrails and Railings

- 1. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loadings.

2. Anchoring Posts: Anchor posts in concrete using sleeves preset and cast into concrete, unless other methods are shown on the Contract Drawings. After posts have been inserted into sleeves, solidly fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.
 - a. Anchor posts to metal surfaces with fittings designed for this purpose.
3. Railing Connections
 - a. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components, unless otherwise shown on the Contract Drawings. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes for exposed locking screws using plastic filler, cement colored to match finish of handrails and railing systems.
 - b. Welded Connections: Where welding is shown on the Contract Drawings, use fully welded joints for permanently connecting railing components. Cope or butt components to provide 100 percent contact or use fittings designed for this purpose.
4. Anchor railing ends into concrete or masonry with fittings designed for this purpose.
5. Anchor railing ends to metal surfaces with fittings using concealed fasteners.
6. Anchor railing ends to metal surfaces by welding.
7. Expansion Joints: Install expansion joints at locations shown on the Contract Drawings or, if not shown, at intervals not to exceed 40 feet. Furnish slip-joint internal sleeve extending 2 inches beyond joint on either side. Fasten internal sleeve securely to one side and locate joint within 6 inches of post.

C. Installing Ornamental Mechanical Grilles

Mount ornamental mechanical grilles at heights and in positions indicated, adjusting ductwork as required to be centered on grilles. Secure to wall framing with wood screws. On marble, brick and other solid surfaces, secure with wood screws in plastic sleeves.

3.03 ADJUSTING AND CLEANING

- A. Cleaning
 1. Wash aluminum and stainless steel thoroughly with clean water and soap; rinse thoroughly with clean water and wipe dry.
 2. Clean copper alloy per fabricator's written recommendations.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections and abraded areas of shop paint are specified in Division 9 Section on painting.
- C. Galvanized Surfaces: Clean field welds, bolted connections and abraded areas. Apply galvanizing repair paint to comply with ASTM A 780.

3.04 PROTECTION

- A. Retain protective coverings intact. Restore protective coverings that have been damaged during shipment or installation of the Work. Remove protective coverings only when there is no possibility of damage from other Work to be performed at the same location.
 - 1. Remove protective coverings simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.
 - 2. Remove protective coverings from conversion coated copper alloy units as soon as possible after installation.

END OF SECTION

SECTION 05700
ORNAMENTAL METALWORK

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

05700A01 Include plans, elevations and detail sections. Indicate materials, gage, methods, types of joinery, fasteners, anchorages and accessory items; specify finishes. Provide setting diagrams and templates for anchorages, sleeves, and bolts installed by other trades

Samples

05700C01 For each type of metal finish shown on the Contract Drawings, prepare samples of metal of same alloy and thickness to be used for the Work. Where normal color and texture variations are to be expected, include 2 or more units in each set of samples set forth below, showing the limits of such variations. a. Include 6-inch long samples of linear shapes. b. Include 6-inch square samples of plates. c. Include full-size samples of castings and forgings.

Product Data

05700D01 Manufacturer's, fabricator's and finisher's specifications and installation instructions for products used in ornamental metalwork, including finishing materials and methods.

Construction and Installation Procedures

05700G01 Patterns, models, or plaster castings made for each design of casting, shown on the Contract Drawings required.

Calculations

05700H01 Submit design computations signed and sealed by a Professional Engineer licensed in the State where the Work is performed, where required.

END OF APPENDIX "A"

DIVISION 7
SECTION 07270
FIRESTOPPING

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies firestopping for the following applications:
1. Penetrations through fire resistance rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
 3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
 4. Sealant joints in fire-resistance-rated construction.
 5. Voids at the intersection of partitions with structure above.

1.02 REFERENCES

The following is a listing of publications referenced in this Section:

- American Society for Testing and Materials (ASTM)
- | | |
|------------|---|
| ASTM E 84 | Surface Burning Characteristics of Building Materials |
| ASTM E 119 | Fire Tests of Building Construction and Materials |
| ASTM E 136 | Behavior of Materials in a Vertical Tube Furnace |
| ASTM E 814 | Fire Tests of Through - Penetration Fire Stops |
- Underwriters Laboratories (UL)
- Fire Resistance Directory

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

- A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated in this Specifications Section, and the passage of smoke and other gases.

- B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings shown on the Contract Drawings, as determined per ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.
- C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814, where shown on the Contract Drawings and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where firestop systems protect penetrating items larger than a 4-inch-diameter nominal pipe or 16 sq. in. in overall cross-sectional area.
- D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings shown on the Contract Drawings, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.
- E. For firestopping exposed to traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.
 - 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- F. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E 84.
- G. Conditions Requiring Firestopping
 - 1. General:
 - a. Provide firestopping for conditions specified whether or not firestopping is shown on the Contract Drawings, and, if shown, whether such material is designated as insulation, safing or otherwise.
 - b. Insulation types specified in other Sections of the Specifications shall not be installed in lieu of firestopping material specified herein.
 - 2. Building Exterior Perimeters:
 - a. Where exterior facing construction is continuous past a structural floor, and a space (i.e. construction joint) would otherwise remain open between the inner face of the wall construction and the outer perimeter edge of the structural floor, provide firestopping to equal the fire resistance of the floor assembly. Mineral wool by itself is not an acceptable firestop. If mineral wool is part of firestop system, the mineral wool must be completely covered by appropriate thickness of UL or Warnock Hersey listed firestop sealant.
 - b. Firestopping shall be provided whether or not there are any clips, angles, plates, or other members bridging or interconnecting the facing and floor systems, and whether or not such items are continuous.

- c. Where an exterior wall of composite type construction passes a perimeter structural members, such as a girder, beam, or strut and the finish on the interior wall face does not continue up too close with the underside of the structural floor above, thus interrupting the fire-resistive integrity of the wall system, and a space would otherwise remain open between the interior face of the wall and lower edge of the structural members, provide firestopping to continuously fill such open space.
3. Interior Walls and Partitions:
 - a. Construction joints between top of fire rated walls and underside of floors above, shall be firestopped.
 - b. Firestop system installed shall have been tested by either UL or Warnock Hersey, including exposure to hose stream test and including for use with steel fluted deck floor assemblies.
 - c. Firestop system used shall allow for deflection of floor above.
 4. Penetrations:
 - a. Penetrations include conduit, cable, wire, pipe, duct, or other elements that pass through one or both outer surfaces of a fire rated floor, wall or partition.
 - b. Except for floors on grade, where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining structural floor or roof, provide firestopping to fill such spaces in accordance with ASTM E 814 (UL 1479).
 - c. These requirements for penetrations shall apply whether or not sleeves have been provided. Firestop the annular space between sleeve and surrounding surfaces.
 5. Provide firestopping to fill miscellaneous voids and openings in fire rated construction in a manner essentially the same as specified herein.

1.04 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements:
 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction, as though the Authority were a private corporation.
 2. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.

- b. Through-penetration firestop systems correspond to those shown on the Contract Drawings by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by Warnock Hersey, or by another qualified testing and inspecting agency.
 - 3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from the face exposed to furnace fire. Provide systems complying with the following requirements:
 - a. Fire-Resistance Ratings of Joint Sealants: As shown on the Contract Drawings by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
 - b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.
- B. Information on Contract Drawings referring to specific design designations of through-penetration firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Engineer's prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction, as though the Authority were a private corporation.
- C. Installer Qualifications: Engage an experienced Installer who has completed firestopping that is similar in material, design, and extent to that shown on the Contract Drawings for Work of this Contract and that has performed successfully.
- D. Installer Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- E. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition shown on the Contract Drawings from a single manufacturer.
- F. Field-Constructed Mockup: Prior to installing firestopping, erect mockups for each different through-penetration firestop system shown on the Contract Drawings to verify selections made and to demonstrate qualities of materials and execution. Build mockups to comply with the following requirements, using materials shown on the Contract Drawings for final installations.
 - 1. Locate mockups on site in locations shown on the Contract Drawings or, if not shown on the Contract Drawings, as directed by Engineer.
 - 2. Notify Engineer 1 week in advance of the dates and times when mockups will be erected.
 - 3. Obtain Engineer's acceptance of mockups before start of final unit of Work.

4. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging completed unit of Work.
 - a. When directed, demolish and remove mockups from Project site.
 - b. Accepted mockups in an undisturbed condition at time of Substantial Completion may become part of completed unit of Work.
- G. Provide firestopping products containing no asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."
- H. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.
- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."
- J. Engineer may employ and pay a qualified inspection agency to check installed firestopping systems for compliance with requirements.
- K. Sequencing and Scheduling
 1. Notify Engineer at least 1 week in advance of firestopping installations; confirm dates and times on days preceding each series of installations.
 2. Do not cover up those firestopping installations that will become concealed behind other construction until Engineer and authorities having jurisdiction, if any, have examined each installation.

1.05 ENVIRONMENTAL CONDITIONS

- A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
- B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.07 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

- A. Endothermic, Latex Sealant:
 - 1. LC-150 Firestop Sealant; Specified Technologies, Inc.; Somerville, NJ;
 - 2. 3M Fire Dam 150; 3M Company, Construction Markets Division; St. Paul, MN;
 - 3. Tremstop Acrylic Latex; Tremco, Inc.; Cleveland, OH.
- B. Endothermic, Latex Compounds:
 - 1. LC-150 Firestop Compound; Specified Technologies, Inc.;
 - 2. 3M Fire Dam 150; 3M Company, Construction Markets Division.
- C. Firestop Sleeve:
 - 1. Biostop Pipe Collars; Bio Fireshield, Inc.;
 - 2. Metacaulk Universal Collar 880; The RectorSeal Corporation;
 - 3. 3M Plastic Pipe Devices; 3M Company, Construction Markets Division;
 - 4. Fyre Can; Tremco, Inc.; Cleveland, OH.
- D. Intumescent Latex Sealant:
 - 1. Biostop 700 Spray Applied Mastic, Bio Fireshield, Inc.;
 - 2. LBC Latex Based Caulk; Nelson Firestop Products; Tulsa, OK;
 - 3. Metacaulk 950; The RectorSeal Corporation;
 - 4. Metacaulk 1000 Spray Applied Mastic; The RectorSeal Corporation;
 - 5. SSS-100 Firestop Sealant; Specified Technologies, Inc.;
 - 6. 3M CP 25 WB+; 3M Company, Construction Markets Division;
 - 7. Tremstop WBM G; Tremco, Inc.; Cleveland, OH.
- E. Intumescent Putty:
 - 1. Biostop Fire Rated Putty Stix/Pads; Bio Fireshield, Inc.;
 - 2. FSP Firestop Putty; Nelson Firestop Products;
 - 3. Metacaulk Fire-Rated Putty Sticks/Pads; The RectorSeal Corporation;
 - 4. SSP-100 Firestop Putty; Specified Technologies, Inc.;
 - 5. 3M Moldable Putty+ (Stix/Pads); 3M Company, Construction Markets Division;
 - 6. Tremco Flowable Putty; Tremco, Inc.; Cleveland, OH.
- F. Intumescent Wrap Strips:
 - 1. Biostop Pipe Collars; Bio Fireshield, Inc.;

2. WRS Wrap Strip; Nelson Firestop Products;
3. Metacaulk Wrap Strip; The RectorSeal Corporation;
4. SSW-12 Wrap Strips; Specified Technologies, Inc.;
5. 3M FS 195+ Wrap Strips; 3M Company, Construction Markets Division;
6. Tremco Wrap Strips; Tremco, Inc.; Cleveland, OH.

G. Job-Mixed Vinyl Compound:

1. USG Firecode Compound, United States Gypsum Co.; Chicago, IL.

H. Mortar:

1. K-2 Firestop Mortar, Bio Fireshield, Inc.;
2. Novasit K-10 Firestop Mortar, Bio Fireshield, Inc.;
3. CMP Firestop Compound; Nelson Firestop Products;
4. SSM-228 Firestop Mortar; Specified Technologies, Inc.;
5. 3M Fire Barrier Mortar; 3M Company, Construction Markets Division;
6. Tremstop Mortar System; Tremco, Inc.; Cleveland, OH.

I. Pillows/Bags:

1. Firestop Pillows, Bio Fireshield, Inc.;
2. PLW Firestop Pillows; Nelson Firestop Products;
3. SSB Series Firestop Pillows; Specified Technologies, Inc.;
4. Tremstop Pillow System; Tremco, Inc.; Cleveland, OH.

J. Silicone Sealants:

1. BioTherm 100/200; Bio Fireshield, Inc.;
2. CLK Firestop Caulk; Nelson Firestop Products;
3. SSB Series Firestop Pillows; Specified Technologies, Inc.;
4. Pensil 300 Firestop Sealant, GE Silicones; Waterford, NY;
5. Metacaulk 835, The RectorSeal Corporation;
6. Metacaulk 880, The RectorSeal Corporation;
7. 3M Fire Barrier 2000, 2000+ and 2003; 3M Company, Construction Markets Division;
8. Fyre Sil and Fyre Sil/SL; Tremco, Inc.; Cleveland, OH.

2.02 MATERIALS

- A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

- B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "Design and Performance Requirements" Article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:
1. Permanent forming/damming/backing materials including the following:
 - a. Semirefractory fiber (mineral wool) insulation.
 - b. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated formboard.
 - d. Joint fillers for joint sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.
- C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.
- D. Fill Materials For Through-Penetration Firestop Systems
1. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.
 2. Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.
 3. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.
 4. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum foil on one side.
 5. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.
 6. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.
 7. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
 8. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant, nonsag grade. Unless otherwise shown on the Contract Drawings, firestop system shall use nonsag grade for both vertical and horizontal surfaces.

2.03 MIXING

- A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application shown on the Contract Drawings.

PART 3. EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
 1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
 2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form release agents from concrete.
- B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.03 INSTALLING THROUGH-PENETRATION FIRESTOPS

- A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications shown on the Contract Drawings.

- B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not shown on the Contract Drawings as permanent components of firestop systems.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
 - 1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

- A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications shown on the Contract Drawings.
- B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.
- C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.
- D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration shown on the Contract Drawings or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.05 FIELD QUALITY CONTROL

- A. Inspecting agency employed and paid by Engineer may examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.
- B. Inspecting agency will report observations promptly and in writing to Contractor and Engineer.
- C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.

- D. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.06 CLEANING

- A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
- B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of issuance of Certificate of Final Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION

SECTION 07270

FIRESTOPPING

APPENDIX "A"

SUBMITTALS

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

Shop Drawings

- 07270A01 Shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition shown on the Contract Drawings.

Product Data

- 07270D01 Product data for each type of product specified.

Certificates

- 07270E01 Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.
- 07270E02 Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.

Manufacturer Test Reports

- 07270F01 Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.

END OF APPENDIX "A"

DIVISION 7

SECTION 07720

PREFABRICATED CURB AND EQUIPMENT SUPPORT UNITS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for prefabricated curb and equipment support units.

1.02 REFERENCES

Not Used.

1.03 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements specified in this Section, furnish and install prefabricated curbs/equipment supports by one of the following, or approved equal:

Custom Curb, Inc.; Chattanooga, TN
The Pate Company; Broadview, IL
S & L Manufacturing Company; Newark, NJ
ThyCurb Div./ThyBar Corp.; Addison, IL

2.02 MATERIALS

A. Zinc-Coated Steel

Commercial quality with 0.20 percent copper, hot-dip galvanized, mill phosphatized.

B. Insulation

Manufacturer's standard rigid or semi-rigid board of glass fiber.

C. Wood Nailer

Softwood lumber, pressure treated with water-borne preservatives for aboveground use.

D. Fasteners

Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by the manufacturer.

2.03 CONSTRUCTION FEATURES

A. General

Comply with loading and strength requirements as shown on the Contract Drawings where units support other Work. Coordinate dimensions with approved rough-in sheets of shop drawings of equipment to be supported. Fabricate with welded or sealed mechanical corner joints, and with cant strips and base profile coordinated with roof insulation thickness. Provide wood nailers at tops of curbs, coordinate with thickness of insulation and roof flashings as shown on the Contract Drawings, and tapered where necessary to compensate for roof deck slopes of 1/4 inch per ft. and more to provide horizontal top. Except as otherwise required for strength, fabricate units of minimum 14-gage (0.0747 inch) metal, and to minimum height of 12 inches unless otherwise shown on Contract Drawings.

B. Provide manufacturer's standard units. Shop-fabricate each unit.

PART 3. EXECUTION

3.01 INSTALLATION

A. General

Comply with the manufacturer's instructions and recommendations. Coordinate with installation of roof deck and other substrates to receive accessory units, vapor barriers, roof insulation, and roofing and flashing, as required to ensure that each element of the Work performs properly, and that combined elements are waterproof and weathertight. Anchor units securely to supporting structural substrate, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

B. Isolation

Where metal surfaces of units are to be installed in contact with incompatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation.

C. Cap Flashing

Where cap flashing is required as component of accessory, install to provide adequate waterproof overlap with roofing or roof flashing as counterflashing. Seal with thick bead of mastic sealant.

END OF SECTION

SECTION 07720
PREFABRICATED CURB AND EQUIPMENT SUPPORT UNITS

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

- 07720D01 Submit the manufacturer's technical product data, and dimensioned drawings indicating fastening method and installation instructions all in accordance with the requirements of Shop Drawings, Catalog Cuts, and Samples of Division 1 - GENERAL PROVISIONS.

END OF APPENDIX "A"

DIVISION 7

SECTION 07811

SPRAY-APPLIED FIRE RESISTIVE MATERIALS

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for spray-applied fire resistive materials (SFRMs) applied to steel surfaces to be fireproofed in one or more of the following conditions, where shown on the Contract Drawings:
1. Bare, unprimed steel.
 2. Previously painted steel.
 3. Steel that has been sprayed with an encapsulant, specified in a Division 2 Section on asbestos removal.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

<u>American Society for Testing and Materials (ASTM)</u>	
ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials.
ASTM E 119	Test Methods for Fire Tests of Building Construction and Materials.
ASTM E 605	Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
ASTM E 736	Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
ASTM E 759	Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members.
ASTM E 760	Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.
ASTM E 761	Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.
ASTM E 859	Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members.
ASTM E 937	Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.
<u>Association of the Wall and Ceiling Industry (AWCI)</u>	
AWCI Technical Manual 12-A	Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials; An Annotated Guide.

Underwriters Laboratories Inc. (UL)

Fire Resistance Directory.

United States Environmental Protection Agency (USEPA)

40 CFR Part Interim Method of the Determination of Asbestos in Bulk Insulation
763, Subpart E, Samples - Section 1- Polarized Light Microscopy.
Appendix E

1.03 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply SFRMs when the ambient temperature or the temperature of the substrate is below 40 degrees F, or below the temperature recommended in the SFRM manufacturer's printed instructions, whichever is higher. Maintain such minimum ambient temperature for a minimum of 24 hours after application.
- B. In areas without natural ventilation, provide temporary equipment to mechanically circulate and exhaust interior air to the outside.
- C. In addition to safety requirements specified elsewhere in this Section, provide protection as follows:
 - 1. Provide approved temporary enclosures to prevent spray from contaminating air in adjacent areas.
 - 2. Protect all adjacent surfaces and equipment from damage by overspray, fall-out and dusting of SFRMs.
 - 3. Clean up and remove all fall-out and debris prior to removal of protective enclosures.
 - 4. Notify the Engineer at least one week in advance of the type and number of heaters to be used, if any, and of safety measures to be employed in handling and using fuel for heaters.

1.04 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics

SFRMs shall be identical to those used in assemblies tested for the following characteristics, per test method indicated below. Identify packages (bags) containing SFRM with appropriate classification markings.

1. Fire-Resistance Ratings

As indicated by reference to fire-resistive designs listed in UL "Fire Resistance Directory," tested per ASTM E 119.

2. Surface-Burning Characteristics

As indicated for each SFRM required, tested per ASTM E 84.

B. Installer Qualifications

The entity performing Work of this Section shall be an installer certified or approved by the SFRM manufacturer as having the necessary experience, staff and training to install manufacturer's products per specified requirements.

C. Single Source Responsibility

Provide SFRMs from a single manufacturer for each product required.

D. SFRM products shall contain no asbestos as determined according to the method specified in 40 CFR Part 763, Subpart E, Appendix E, Section 1, Polarized Light Microscopy.

E. Sequence and coordinate application of SFRMs with related Work specified in other Sections of these Specifications to comply with the following requirements:

1. Provide temporary enclosures to prevent deterioration of SFRMs for interior applications due to exposure to unfavorable environmental conditions.
2. Avoid unnecessary exposure of SFRM to abrasion and other damage likely to occur during construction operations subsequent to its application.
3. Do not apply SFRM to metal roof decking substrates until roofing has been completed and all mechanical units have been installed. Prohibit roof traffic during application and drying of SFRM.
4. Do not begin applying SFRM until clips, hangers, supports, sleeves and other items penetrating SFRM are in place.
5. Defer installing ducts, piping and other items, or remove all existing construction that would interfere with the application of SFRM until the SFRM has been installed.
6. Do not install enclosing or concealing construction, or reinstall removed construction, until after SFRM has been applied, inspected, tested and approved by the Engineer, and corrections have been made to all defective SFRM.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver material in original unopened packages, containers or bundles bearing brand name and identification of the manufacturer.
- B. Use materials with limited shelf life within the shelf life period indicated. Remove from the construction site and discard any materials whose shelf life has expired.
- C. Store SFRMs inside, under cover, above ground, so they are kept dry until ready for use. Remove from the construction site and discard any materials that have deteriorated and are unsuitable for use due to exposure to water.

1.06 WARRANTY

- A. Submit a written warranty, executed by Contractor and cosigned by installer, agreeing to repair or replace spray-applied fire resistive material that has failed within the specified warranty period. Failures include, but are not limited to, the following, as determined solely by the Engineer:
 1. Cracking, flaking, eroding in excess of specified requirements, peeling and delaminating of spray-applied fire resistive material from substrates due to defective materials and workmanship within the specified warranty period.

2. Not covered under the warranty are failures attributable to damage by occupants and the Authority's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and to other causes not reasonably foreseeable under conditions of normal use.

B. Warranty Period

Two (2) years from the date of the issuance of the Certificate of Final Completion.

PART 2. PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, furnish and install products of one of the following, or approved equal, where shown on the Contract Drawings:

1. Light Density (15 pcf) - Gypsum Plaster Base
 - "CAFECO 300", Isolatek International
 - "Monokote Type MK-6/HY", W.R. Grace & Co.-Conn.
 - "Southwest Type 5 GP", Carbolite Co.
2. Medium Density (22 pcf) - Portland Cement Base
 - "CAFECO 400", Isolatek International
 - "Monokote Type Z-106", W.R. Grace & Co.-Conn.
 - "Southwest Type 7 GP", Carbolite Co.
3. High Density (40 pcf)* - Portland Cement Base
 - "CAFECO Fendolite M-II", Isolatek International
 - "Monokote Type Z-146", W.R. Grace & Co.-Conn.
 - "Pyrocrete 240HY", Carbolite Co.

* Meets UL 263 for Exterior Use

2.02 MATERIALS

- A. Material Composition of Spray-Applied Fire Resistive Materials

SFRMs shall consist of factory-mixed, dry formulations of gypsum or portland cement binders and lightweight mineral or synthetic aggregates mixed with potable water at the construction site to form a slurry or mortar for conveyance and application.

- B. Auxiliary Spray-Applied Fire Resistive Materials

1. Substrate Primers and Encapsulants
 - a. Where primer or encapsulant is shown on the Contract Drawings, furnish and install as specified in the applicable Division 2 or Division 9 Section of the Specifications.

- b. Ensure that paint or prime on steel surfaces will not impair proper adhesion. Obtain determination of the compatibility of paint or primer with the SFRM from the SFRM manufacturer.
 - c. For use on each different substrate and with each different SFRM product, primer or encapsulant shall comply with one or more of the following requirements:
 - (1) Bond strength complies with requirements specified in UL's "Fire Resistance Directory" for coating materials based on a series of bond tests per ASTM E 736.
 - (2) Primer or encapsulant is identical to those used in assemblies tested for the fire-test-response characteristics of SFRM, per ASTM E 119 or by UL.
2. Bonding Materials
- a. Bonding Agent

Product shall be identical to those used in assemblies tested for the fire-test-response characteristics of SFRMs, per ASTM E 119.
3. Sealer
- Clear-drying water-dispersable protective coating recommended by SFRM manufacturer for application(s) shown on the Contract Drawings.
4. Topcoats
- Type as recommended by the SFRM manufacturer required for application(s) shown on the Contract Drawings.
5. Metal Lath
- Expanded metal lath fabricated from material of weight, configuration and finish required to comply with fire-resistance ratings shown on the Contract Drawings and SFRM manufacturer's recommendations. Include clips, lathing accessories and other anchorage devices required to attach lath to substrate(s).
- a. Metal studs with galvanized discs or other similar approved devices may be used as a mechanical break as an alternative to metal lath.

2.03 CONSTRUCTION FEATURES

- A. Light Densities
 - 1. Flame Spread: 0, as determined in accordance with ASTM E 84.
 - 2. Smoke Developed: 0, as determined in accordance with ASTM E 84.
 - 3. Cohesion/Adhesion (Bond Strength): 150 lb per sq. ft. or as stated in the manufacturer's data sheet, whichever is greater, as determined in accordance with ASTM E 736.
 - 4. Compressive Strength: 5.2 lb per sq. inch as determined in the laboratory in accordance with ASTM E 761. Minimum sprayed on SFRM thickness tested shall be 0.75 inch and the minimum dry density shall be as specified, but not less than 15 pcf.

5. Corrosion Resistance

No evidence of corrosion as determined in accordance with ASTM E 937.

6. Deflection

No cracking, spalling or delamination as determined in accordance with ASTM E 759.

7. Effect of Impact on Bonding

No cracking, spalling or delamination as determined in accordance with ASTM E 760.

8. Air Erosion

Maximum weight loss of 0.000 grams per sq. ft. as determined in accordance with ASTM E 859.

9. Dry Density

15 pcf for average and individual densities regardless of density indicated in referenced fire-resistive design, or greater if required to attain fire-resistance ratings shown on the Contract Drawings as determined per ASTM E 605 or Appendix A "Alternate Method for Density Determination" of AWC's "Technical Manual 12-A".

B. Medium and High Densities

1. Flame Spread: 0, as determined in accordance with ASTM E 84.

2. Smoke Developed: 0, as determined in accordance with ASTM E 84.

3. Cohesion/Adhesion (Bond Strength): 1,000 lb per sq. ft. for medium density and 2,000 lb per sq. ft. for high density, or as stated in the manufacturer's data sheets, whichever is greater, as determined in accordance with ASTM E 736.

4. Compressive Strength

51 lb per sq. inch for medium density and 300 lb per sq. inch for high density, as determined in accordance with ASTM E 937.

5. Corrosion Resistance

No evidence of corrosion as determined in accordance with ASTM E 760.

6. Deflection

No cracking, spalling or delamination as determined in accordance with ASTM E 759.

7. Effect of Impact on Bonding

No cracking, spalling or delamination as determined in accordance with ASTM E 760.

8. Dry Density

Values of average and individual densities as required for fire-resistance ratings indicated on the Contract Drawings, as determined per ASTM E 605 or Appendix A "Alternate Method for Density Determination" of AWCI's "Technical Manual 12-A", but with an average density of not less than 22 pcf for medium density and not less than 40 pcf for high density.

9. Air Erosion

Maximum weight loss of 0.000 grams per sq. ft. as determined per ASTM E 859.

10. For exterior SFRM applications, furnish and install manufacturer's formulation approved for exterior surfaces.

2.04 MIXES

Furnish and install materials to achieve the hourly SFRM rating(s) for the building construction classification shown on the Contract Drawings.

PART 3. EXECUTION

3.01 PREPARATION

- A. Attend a preinstallation meeting after review and approval by the Engineer of all required submittals. The Engineer will hold a meeting at the construction site. Arrange for representatives of the Contractor, the SFRM manufacturer and the entity performing the application Work of this Section to attend this meeting. Prepare a report of the determinations made at the meeting and submit a copy to the Engineer.
 - 1. With the other representatives inspect the substrate and determine what repairs and preparations have to be employed to ensure an adequate bond. Repairs and preparations may include scraping loose, defective paint and loose rust and removal of grease, oil, dirt and other foreign materials.
 - 2. When Work requires patching areas that abut existing areas of fireproofing, identify the existing fireproofing. Submit a letter from an independent laboratory or SFRM manufacturer identifying the existing fireproofing. For patching and/or abutting fireproofing use the same as the existing and apply according to a tested system design. Indicate this design number in the fireproofing schedule.
- B. Sequence and coordinate application of SFRM with related Work specified in other Sections of these Specifications in accordance with 1.04 E herein.

3.02 SURFACE PREPARATION

Verify that surfaces are clean and dry. Remove all oil, grease, dust, dirt, loose scale and other foreign materials that may interfere with adhesion.

3.03 APPLICATION

- A. Mix and apply SFRM materials in compliance with SFRM manufacturer's printed instructions.
- B. Apply by sprayed-on method with thickness and density not less than that required to achieve required fire-resistance ratings.
- C. Where concrete, masonry or other surfaces subject to overspray need protection, protect these surfaces with masking, dropcloths or other effective covering.
- D. Verify that all finished surfaces are free of cracks, holes and pits.
- E. Secure metal lath, or other similar devices, if required under the UL System Design, or as stated in UL's "Fire Resistance Directory", General Section II, Part 9 entitled "Coating Materials", to substrate in position required for support and reinforcement of SFRM.
- F. Surfaces that will be exposed in the finished construction, including the top surfaces of bottom flanges of beams, shall be given a smooth trowelled finish and shall be free of all bumps, drips and sags.
- G. Masking and Filling of Voids
 - 1. Apply SFRM to beams and girders under steel decking or concrete slabs that will be exposed in the finished construction so as to provide a minimum of two-inch coverage of the deck beyond the limits of the top flange of beam or girder. Accomplish by masking the portions of decking or slab not to be covered so as to provide straight lines parallel to the flanges.
 - 2. Completely fill voids between metal deck ribs directly above the upper edge of steel beams or girders running perpendicular to the ribs with SFRM or other approved method to achieve the required hourly protection of the upper flanges of beams and girders.
- H. Where shown on the Contract Drawings, after application of SFRM, apply sealer with a fugitive dye.

3.04 FIELD INSPECTION AND TESTING

- A. Secure the services of an independent testing agency for Quality Control Testing as specified in AWCI Technical Manual 12-A Section 4.3 to perform the Physical and Visual Tests therein enumerated in accordance with ASTM E 605 and ASTM E 736. All inspectors must be ICC (International Code Council) certified SFRM inspectors.
- B. The Engineer will perform Quality Acceptance testing including, but not limited to, replicating measurement thickness, density and bond strength; and auditing of the independent testing agencies measurements, testing results and daily narratives.
- C. Inspect for compliance with all other requirements in this Section.
- D. Furnish all labor, materials and equipment required to assist the Engineer in the above described inspection and testing including, but not limited to, the following:
 - 1. Make scaffolding and other equipment available as necessary to permit access to all portions of the installation.

2. Cut samples from completed installation(s) and prepare wet sample, when and as directed by the Engineer.

E. Repair or replace SFRM at all test areas, and within area(s) where test results indicate SFRM does not comply with requirements, at no additional cost to the Authority. Repair or replace to match existing.

3.05 CLEANING, REPAIR AND PROTECTION

A. Cleaning

Immediately after completion of spraying operations in each containable area of Work, remove material overspray and fall-out from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofed construction at all times so that SFRM will be without damage or deterioration at the time of issuance of the Certificate of Final Completion.

C. Coordinate installation of SFRM with other construction to minimize the need to cut or remove SFRM. As installation of other construction proceeds, inspect SFRM and patch any areas where SFRM was removed or damaged.

D. Repair or replace Work that has not been successfully protected, at no additional cost to the Authority.

END OF SECTION

SECTION 07811
SPRAY-APPLIED FIRE RESISTIVE MATERIALS

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

07811A01 Complete details of metal lath reinforcement, steel studs and other similar devices, if any.

Catalog Cuts

07811B01 Manufacturer's technical data sheets, printed instructions and specifications for handling, mixing, methods and techniques including masking and protection of adjacent surfaces, heating requirements, cleanup and type of equipment required for installation of the SFRM.

Samples

07811C01 Product certificates from SFRM manufacturer that each SFRM complies with specified requirements including those for fire-test-response characteristics and compatibility with adhesives, primers, and other surface coatings on substrates as shown on Contract Drawings to receive SFRM.

Product Data

07811D01 1. Certified test reports verifying that SFRM's meet the requirements of the ASTM standards cited in this section.
2. Test results demonstrating conformance to 2.03 herein.

Certificates

07811E01 Submit warranty in accordance with 1.06 herein.

Manufacturer Test Reports

- 07811F01
1. Submit a schedule certified by SFRM manufacturer, showing minimum thicknesses of SFRM's required to satisfy hourly ratings shown on the Contract Drawings for all members and areas to be coated. Include the applicable system design numbers from UL's "Fire Resistance Directory".
 2. All steel shall be fireproofed to achieve a stated hourly rating as per UL "Fire Resistance Directory". All steel to receive SFRM shall be considered thermally unrestrained unless otherwise indicated. Any diagonal or horizontal member exposed on all sides shall be considered a column for the determination of the required SFRM thickness to meet the stated rating.

Construction and Installation Procedures

- 07811G01
- Submit to Engineer: Manufacturer's notification of acceptance of the entity performing the application Work of this Section as stipulated in 1.04 B. herein.

Calculations

- 07811H01
1. Site Report as required by 3.01 A.
 2. Results from tests and inspections shall be reported promptly to the Engineer.

END OF APPENDIX "A"

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DIVISION 7
SECTION 07920
SEALANTS

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies interior and exterior cold liquid-applied sealants, as shown on the Contract Drawings with the following designations:
 - 1. ES-1: One-part non-acid curing silicone.
 - 2. ES-2: One-part acid curing, mildew-resistant silicone.
 - 3. ES-3: One-part or two-part non-sag polyurethane.
 - 4. ES-4: One-part or two-part pourable polyurethane.
 - 5. ES-5: Latex sealant for interior locations.
 - 6. ES-6: One-part non-sag silyl-terminated polyether.
- B. Horizontal joint sealants in concrete and asphalt roads and sidewalks (hot and cold liquid-applied) are specified in Division 2 Section on pavement joint sealing.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	<u>American Architectural Manufacturers Association (AAMA)</u>
AAMA CW-13	Structural Sealant Glazing Systems.
	<u>American Society for Testing and Materials (ASTM)</u>
ASTM C 834	Specification for Latex Sealants.
ASTM C 920	Specification for Elastomeric Joint Sealants.
ASTM C 1021	Practice for Laboratories Engaged in Testing of Building Sealants.
ASTM C 1193	Guide for Use of Joint Sealants.
ASTM C 1330	Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
ASTM D 1056	Specification for Flexible Cellular Materials – Sponge or Expanded Rubber.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Elastomeric joint sealants designated as ES-1 through ES-4, and E-6 shall establish and maintain watertight and airtight continuous seals without staining or deteriorating joint substrates when installed.

B. Nonelastomeric joint sealants designated as ES-5 shall establish and maintain airtight continuous seals that are water-resistant without staining or deteriorating joint substrates when installed.

C. Adhesion Test

When directed by the Engineer, perform preconstruction field adhesion test of each sealant per AAMA CW-13. Perform such tests in the presence of the Engineer and a qualified technical representative of the sealant manufacturer.

1. Notify Engineer and sealant manufacturer 7 days in advance of the dates and times when field adhesion tests are to occur.
2. Produce written report on test results.
3. Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with the above requirements, will be considered satisfactory. Sealants that fail to adhere to joint substrates during testing shall not be used in the Work.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Do not proceed with the Work of this Section under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by sealant manufacturer.
2. When joint substrates are wet due to rain, frost, condensation or other causes.
3. Where joint widths are less than or greater than widths allowed by sealant manufacturer for applications shown on the Contract Drawings.
4. When contaminants capable of interfering with sealant adhesion are present on joint substrates.

1.05 QUALITY ASSURANCE

A. Installer Qualifications

Verify that the entity performing sealant installation has successfully completed within the last 3 years at least 3 joint sealant installations involving quantities and complexities at least equal to those required for Work of this Section.

B. Testing Laboratory Qualifications

Use an independent testing laboratory that demonstrates to Engineer's satisfaction, based on evaluation of laboratory submitted criteria conforming to ASTM C 1021, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying progress of the Work.

C. Single Source Responsibility

Obtain sealant and primer materials from a single manufacturer for each different required product.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to construction site in original unopened containers or bundles with labels clearly identifying the manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multicomponent materials.
- B. Store and handle materials to prevent deterioration or damage due to moisture, temperature changes, contaminants or other causes.

1.07 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements of this Section, furnish and install products of the following manufacturers, or approved equal:

- A. ES-1 (One-part non-acid curing silicone)

Dow Corning 795; Dow Corning Corp., Midland, MI
SilPruf NB SCS9000; GE Sealants & Adhesives, Waterford, NY
Bondaflex 295; May National Associates, Inc., Clifton, NJ
Spectrem 2; Tremco Inc., Beechwood, OH
- B. ES-2 (One-part acid curing, mildew-resistant silicone)

Dow Corning 786; Dow Corning Corp., Midland, MI
Sanitary SCS1700; GE Sealants & Adhesives, Waterford, NY
Bondaflex Sil 100 WF; May National Associates, Inc., Clifton, NJ
Proglaze; Tremco Inc., Beechwood, OH
- C. ES-3 (One-part or two-part non-sag polyurethane)

Dynatrol I-XL or II; Pecora Corp., Harleysville, PA
Sikaflex 15LM or Sikaflex 2c NS; Sika Corp., Lyndhurst, NJ
Vulkem 921 or Dymeric 240; Tremco Inc., Beechwood, OH
- D. ES-4 (One-part or two-part pourable polyurethane)

Sonolastic SL 1 or SL 2; Degussa Building Systems, Shakopee, MN
Urexpan NR-201 or NR-200; Pecora Corp., Harleysville, PA
Vulkem 45 or 245; Tremco Inc., Beechwood, OH
- E. ES-5 (Latex sealant for interior locations)

AC-20 FTR; Pecora Corp., Harleysville, PA
Tremflex 834; Tremco Inc., Beechwood, OH
SHEETROCK Acoustical Sealant; United States Gypsum Co., Chicago, IL

F. ES-6 (One-part non-sag silyl-terminated polyether)

Sonolastic 150; Degussa Building Systems, Shakopee, MN
Bondaflex STP 25; May National Associates, Inc., Clifton, NJ
Pro-Sil^{sc} 1; Pecora Corp., Harleysville, PA
Sikaflex-721 UV; Sika Corp., Lyndhurst, NJ

2.02 MATERIALS

A. Sealants (except designation ES-5)

1. Cold-applied elastomeric joint sealants shall conform to the following requirements of ASTM C 920:
 - a. Type: S, except Type S or M for sealant designations ES-3 and ES-4.
 - b. Grade: NS, except Grade P for sealant designation ES-4.
 - c. Movement Class: 25 for sealant designations ES-2 and ES-4; 50 for sealant designations ES-1 and ES-3. Not applicable for sealant designation ES-5.
 - d. Use: T, NT, M, G, A or O as applicable to joint substrate type shown on the Contract Drawings.
2. Sealant designation ES-5: Cold-applied nonelastomeric joint sealant; ASTM C 834.
3. Color
 - a. At stone or masonry joints: Sealant color shall match adjacent mortar color, unless otherwise shown on the Contract Drawings, subject to Engineer's approval.
 - b. At other locations: As shown on the Contract Drawings, or if not shown, as selected by the Engineer from manufacturer's standard colors.

B. Sealant Backing

Furnish sealant backings of material and type which are nonstaining and are compatible with joint substrates, sealants, primers and other joint filler materials. Sealant backing shall be as approved by sealant manufacturer, based on field experience and laboratory testing, for applications shown on the Contract Drawings and shall be one of the following types:

1. Cylindrical Foam Sealant Backing (backer rod): ASTM C 1330; preformed, compressible, resilient, non-exuding lengths of polyethylene or polyolefin foam of size and density required to control sealant depth and contribute to producing optimum sealant performance.
 - a. Type B (bi-cellular) or Type C (closed cell), non-gassing foam, as recommended by sealant manufacturer for use with each sealant type and location.
2. Elastomeric Tubing Sealant Backing: Neoprene, butyl or EPDM tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to minus 26 degrees F. Furnish products with low compression set and of size and shape to provide a secondary seal, to control sealant depth and contribute to producing optimum sealant performance.

2.03 ACCESSORIES

A. Primer

Types recommended and furnished by joint sealant manufacturer and as required based on results of preconstruction field adhesion testing for adhesion of sealant to joint substrates shown on the Contract Drawings.

B. Bond Breaker Tape

Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing bond between sealant and joint filler or other materials at back (third) surface of joints. Furnish self-adhesive tape where applicable. Duct tape is not acceptable.

C. Masking Tape

Removable, nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

D. Cleaners for Nonporous Surfaces

Nonstaining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials that is not harmful to substrates and adjacent nonporous materials.

E. Vent Tubes (Weep Holes)

Heat-bendable clear acrylic or polypropylene tubes, of proper diameter and approved by the sealant manufacturer, where shown on the Contract Drawings and as required to direct moisture to the outside of the building.

PART 3. EXECUTION

3.01 EXAMINATION

Inspect joints shown on the Contract Drawings to receive joint sealants for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealant performance. Do not allow joint sealant Work to proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints

Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:

1. Remove foreign material from joint substrates which could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), oil, grease, waterproofing, water repellents, water, surface dirt and frost.

2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading or a combination of these methods to produce a clean, sound substrate capable of developing optimal bond with joint sealants. Remove loose particles remaining after cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form oil or release agents from concrete.
4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile and similar nonporous joint substrate surfaces with chemical cleaners or by other means that are not harmful to substrates and that do not leave residue capable of interfering with adhesion of joint sealants.

B. Joint Priming

Prime joint substrates where recommended by joint sealant manufacturer and where required based on results of preconstruction field adhesion testing. Apply primer and allow to cure in compliance with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking

Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION

A. General

Comply with joint sealant manufacturer's printed installation instructions and recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications and conditions shown on the Contract Drawings.

B. Sealant Backings

1. Install sealant backing of type shown on the Contract Drawings, or if not shown, in accordance 3.03 A, for support of sealants during application. Install sealant backing in position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths to allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of sealant backings.
 - b. Do not stretch, twist, puncture or tear sealant backings.
 - c. Remove absorbent sealant backings that have become wet prior to sealant application and replace with dry material.
2. Install bond breaker tape between sealants and sealant backings, joint fillers, compression seals or back of joints where required to prevent third-side adhesion of sealant to back of joint.
3. Install compressible seals serving as sealant backings to comply with requirements of 3.03 B.1 for sealant backings.

C. Sealants

Follow sealant manufacturer's installation instructions so that installed sealants directly contact and fully wet joint substrates, completely fill recesses provided for each joint configuration and provide uniform, cross-sectional shapes and depths relative to joint widths to allow optimum sealant movement capability.

D. Tooling

1. Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint.
2. Do not use tooling agents that discolor sealants or adjacent surfaces, or tooling agents that are not approved by sealant manufacturer.
3. Joint Configuration: Concave per ASTM C 1193, Figure 8A, unless otherwise shown on the Contract Drawings to be flush per Figure 8B or to be recessed per Figure 8C.
 - a. Recessed joint depth shall be as shown on the Contract Drawings. Use masking tape to protect adjacent surfaces of recessed, tooled joints.

- E. Clean off excess sealants or sealant smears adjacent to joints immediately as Work progresses by methods and with cleaning materials approved by manufacturer of joint sealant.

3.04 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of issuance of the Certificate of Final Completion.
- B. If despite such protection, damage or deterioration occurs, including bubbling, cut out and remove damaged or deteriorated joint sealants and backings immediately and reseal joints with new materials to produce joint sealant installations with repaired areas indistinguishable from original Work, at no cost to the Authority.

END OF SECTION

SECTION 07920

SEALANTS

APPENDIX "A"

SUBMITTALS

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

Samples

07920C01 When required by 2.02 A.5 of this Section, submit two separate bead sample strips of manufacturer's standard colors showing full range of colors available, for each product exposed to view.

Product Data

07920D01 Manufacturer's product data for each joint sealant product, joint sealant backing and accessory required - including primers and including instructions for joint preparation and joint sealer application.

07920D02 One copy of U.S. Department of Labor Material Safety Data Sheets (MSDS) for hazardous or toxic chemicals, if any proposed for use during Work of this Section.

Certificates

07920E01 Certificates from joint sealant manufacturer(s) attesting that their products comply with the requirements specified in this Section and are suitable for the use shown on the Contract Drawings.

07920E02 When required by 1.03 A of this Section, submit specified manufacturer's certifications.

Manufacturer Test Reports

07920F01 Compatibility and adhesion test reports from sealant manufacturer(s) indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance, and recommendations for primers and substrate preparation needed to obtain adhesion.

END OF APPENDIX "A"

07920 - B

DIVISION 8**SECTION 08110****CUSTOM HOLLOW METAL****PART 1. GENERAL****1.01 SUMMARY**

- A. This Section specifies the requirements for custom hollow metal Work for doors, frames and related openings; and metal panels and louvers installed therein.
- B. Building in of anchors and grouting of frames in masonry construction, if any, is specified in a Division 4 Section of these Specifications.
- C. Finish hardware installation for doors is specified in the Section of these Specifications entitled "Finish Hardware".
- D. Glazing, if any, of Work of this Section is specified in another Division 8 Section of these Specifications.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	<u>American Nationals Standards Institute, Inc. (ANSI)</u>
ANSI A 115	Series Door and Frame Preparation
	<u>American Society for Testing and Materials (ASTM)</u>
ASTM A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 167	Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 366	Steel, Carbon, Cold-Rolled Sheet, Commercial Quality
ASTM A 525	General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process
ASTM A 526	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
ASTM A 569	Steel, Carbon (0.15 maximum percent), Hot-rolled Sheet and Strip, Commercial Quality
ASTM B 117	Method of Salt Spray (Fog) Testing
ASTM C 236	Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
ASTM E 90	Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions
ASTM E 152	Methods for Fire Tests of Door Assemblies
ASTM E 413	Classification for Determination of Sound Transmission Class

ASTM F 476	Test Methods for Security of Swinging Door Assemblies <u>Door and Hardware Institute (DHI)</u> Recommended Locations for Builders Hardware for Custom Steel Doors and Frames <u>National Fire Protection Association (NFPA)</u>
NFPA 80	Fire Doors and Windows <u>Steel Structures Painting Council (SSPC)</u>
SSPC - PT-2	Cold Phosphate Surface Treatment
SSPC - PT-4	Hot Phosphate Surface Treatment <u>Underwriters Laboratories, Inc. (UL)</u> Building Materials Directory

1.03 QUALITY ASSURANCE

- A. All materials for Work of this Section shall be from a single manufacturer.
- B. Entities performing installation Work of this Section shall have not less than 5 years experience in installation of hollow metal doors, frames and associated fabrications.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal Work in cartons or crates to provide protection during transit and storage at the construction site. Inspect hollow metal Work upon delivery for damage. Field repair minor damage provided refinished items are equal in all respects to new Work and acceptable to the Engineer; otherwise, remove and replace items.
- B. Store doors and frames at the construction site under cover. Place units on minimum 4-inch high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create a humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inch spaces between stacked doors to promote air circulation.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements specified in this Section, provide products of one of the following or approved equal:

- A. Hollow Metal and Thermal Rated Doors, Frames and Panels

American Welding & Mfg. Co., Amweld Building Products Division, Niles, OH
Ceco Corporation, Oak Brook, IL
Curries Mfg., Inc., Mason City, IA
Pioneer Industries/Div. CORE Industries, Inc., Carlstadt, NJ

B. Sound Rated Door and Frame Assemblies

Allied Steel Products, Inc., Miami, FL.
Pioneer Industries/Div. CORE Industries, Inc.
Superior Fireproof Door, Inc., Scranton, PA.

2.02 MATERIALS

A. Provide the following, where shown on the Contract Drawings.

1. Interior Hollow Metal Doors, Panels and Frames Commercial quality, cold rolled carbon steel conforming to ASTM A 366; or hot rolled, commercial quality carbon steel, pickled and oiled conforming to ASTM A 569.

2. Exterior Hollow Metal Doors, Panels and Frames

Commercial quality zinc-coated carbon steel conforming to ASTM A 526 with ASTM A 525, G 90, zinc coating, mill phosphatized.

3. Interior and Exterior Hollow Metal Doors, Panels and Frames - Stainless Steel

Commercial-quality stainless steel, AISI Type 302/304, complying with ASTM A 167, exposed finish No. 4 polish.

B. Insulating Material for Hollow Material Doors

Fiberglass, mineral wool, urethane, or similar type material, approved by the Engineer, resistant to fire, vermin, mildew and rot to meet requirements of 2.03 D, E and F of this Section. Provide required cores for fire-rated doors.

C. Supports and Anchors

Fabricate of not less than 16 gage sheet metal. For units to be built into exterior walls, galvanize after fabrication in conformance with ASTM A 153, Class B.

D. Inserts, Bolts and Fasteners

Manufacturer's standard units, except hot-dip galvanize those items to be built into exterior walls in conformance with ASTM A 153, Class C or D, as applicable.

E. Shop Applied Prime Paint

Baked-on-rust inhibiting prime paint capable of passing a 500 hour salt spray and 1000 hour humidity test in accordance with ASTM B 117 as certified by an independent laboratory and suitable as base for finish paint as specified in Section 09910 of these Specifications. Do not prime surfaces of stainless steel, if any.

2.03 CONSTRUCTION FEATURES

A. Provide hollow metal doors which have been pretested and certified by the manufacturer to conform to ASTM F 476 Door Impact Test, Grade 40, Table X5.1.

B. Fire Rated Door Assemblies

Where fire-rated door assemblies are shown on the Contract Drawings, provide fire-rated door and frame assemblies that comply with NFPA No. 80; and have been tested, listed and labeled in accordance with ASTM E 152 by UL or other independent testing, inspection and labeling agency approved by the Engineer.

C. Oversize Fire-Rated Door Assemblies

For door assemblies required by the Contract Drawings to be fire-rated and exceeding sizes of tested assemblies, provide certificate of label construction from UL or other independent testing and inspection agency approved by the Engineer, indicating that door and frame assembly conforms to the requirements of design, materials and construction as established by individual listings for tested assemblies.

D. Temperature Rise Rating

For stairwell enclosure doors shown on the Contract Drawings, provide doors which have a temperature rise rating of 450 degrees F maximum in 30 minutes of fire exposure.

E. Sound Rated (Acoustical) Assemblies

Where acoustical doors are shown on the Contract Drawings, provide door and frame assemblies which have been fabricated as sound-reducing type, tested in accordance with ASTM E 90 and STC classified in accordance with ASTM E 413. Unless otherwise shown on the Contract Drawings, provide acoustical assemblies with sound ratings of STC 33 or better.

F. Thermal-Rate (Insulating) Assemblies

For exterior doors and other locations where shown on the Contract Drawings, provide hollow metal doors which have been fabricated as thermal insulating units and tested in accordance with ASTM C 236.

1. Unless otherwise shown on the Contract Drawings, provide unit "U-value" rating of 0.24 BTU/hr./sq. ft./degree F, or better.

2.04 FABRICATION

A. General

1. Fabricate hollow metal units rigid and free from defects, warps or buckles. Accurately form metal to sizes and profiles shown on the Contract Drawings. Factory fit and assemble units where possible. Identify Work that cannot be permanently factory assembled before shipment and provide required connector splines or plates to assure proper assembly at the construction site. Weld exposed joints continuously; grind and make smooth, flush and invisible. Do not use metallic filler to conceal manufacturing defects.

2. Fasteners

Unless otherwise shown on the Contract Drawings, provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.

B. Finish Hardware Preparation

1. Prepare hollow metal doors and frames to receive mortised and concealed finish hardware including cutouts, reinforcing, drilling and tapping in accordance with approved finish hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications.
2. Reinforce hollow metal units to receive surface-applied hardware. At the Contractor's option, drilling and tapping for surface-applied finish hardware may be done at the construction site.
3. Unless otherwise shown on the Contract Drawings, locate finish hardware in accordance with "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" published by DHI.

C. Shop Painting (except at stainless steel doors and frames)

1. Clean steel surfaces of mill scale, rust, oil, grease, dirt and other foreign materials before application of paint.
2. Apply pretreatment to cleaned metal surfaces using cold phosphate solution (SSPG-PT-2) or hot phosphate solution (SSPC-PT-4).
3. Apply shop coat of prime paint within time limits recommended by pretreatment manufacturer.
 - a. Full immersion dip coat on frames.
 - b. Smooth, even, full coverage spray coat on doors, panels and louvers to a uniform dry film thickness of not less than 2.0 mils.

D. Doors and Panels

1. Unless otherwise shown on the Contract Drawings, provide flush design doors 1 3/4 inch thick, fully welded seamless construction. Provide hollow metal panels, if any, of same materials, construction and finish as hollow metal doors.
 - a. Interior Doors: Minimum 18 gage face sheets
 - b. Exterior Doors: Minimum 16 gage face sheets
 - c. For single-acting swing doors, bevel vertical edge 1/8 inch in 2 inches. For double-acting swing doors, round vertical meeting edge with 2 1/8 inch radius.
2. Reinforce inside of doors with continuous vertical formed steel sections not less than 22 gage spaced 6 inches o.c. Spot weld at not more than 5 inches o.c. to both face sheets.
3. Reinforce tops and bottoms of doors with 16 gage horizontal steel channels welded continuously to outer sheets. At exterior doors, close top and bottom edges with additional 16 gage steel channels as integral part of door construction to provide weather seal. Provide weep hole openings in door bottoms to permit escape of entrapped moisture.
4. Unless otherwise required for acoustical or thermal assemblies, provide filler of fiberboard, mineral wool board or other insulating material solidly packed to the full door height, to fill voids between inner core reinforcing members.

5. Fit non-fire-rated hollow metal doors in their respective frames, with the following clearances:
 - a. Jamb and head: 1/8 inch
 - b. Meeting edges, pairs of doors: 1/8 inch
 - c. Bottom: 3/8 inch, where no threshold or carpet
 - d. Bottom: 1/8 inch, at threshold or carpet
6. Fit fire-rated doors with clearances as specified in NFPA 80.
7. Stainless Steel Doors

Stainless Steel doors shall be fabricated of single sheets of stainless steel, gage as specified above, with seamless construction and honeycomb cores. Provide labeled stainless steel door assemblies, in the required fire ratings - where fire-rated assemblies are shown. Provide #4 polish on exposed surfaces with vertical grain direction unless shown otherwise.

- a. Reinforce tops and bottoms of doors with stainless steel 16 gage, horizontal channels, welded continuously to core faces. For exterior stainless steel doors, close top and bottom edges to provide weather seal.

E. Frames

1. Provide hollow metal frames for doors, transoms, side-lights and other openings as shown on the Contract Drawings.
2. Fabricate frames of full-welded unit construction with corners mitered, reinforced and continuously welded the full depth and width of frame. Terminate bottom of frames at finished floor surface. Knock-down type frames are not permitted.
 - a. Interior openings: Minimum 16 gauge
 - b. Exterior openings: Minimum 14 gauge
 - c. For openings over 4 feet wide, provide continuous 12-gauge steel channel stiffener for full width of opening, welded to back of frame at head.
3. Provide removable spreader bar across bottom of frames, tack weld to jambs and mullions.
4. Except on interior doors listed in Section 08715 Appendix "A" Finish Hardware Schedule of these Specifications to receive acoustic, weather or smoke seals, drill stop in frame strike jamb to receive 3 silencers on single-door frames and drill frame head stop to receive 2 silencers on double-door frames. Install plastic plugs to keep holes clear until installation of silencers.
5. Provide 26 gage steel plaster guards welded to frame at back of hardware mortise on frames to be set in mortar or plaster construction.
6. Mullions and Transom Bars

Provide closed or tubular mullions and transom bars where shown on the Contract Drawings. Reinforce joints between frame members with concealed clip angles of same metal thickness as frame. At removable units provide exposed fasteners; at fixed units, fasten by butt welding.

7. Form frames of stainless steel sheets with #4 polish for openings indicated to receive stainless steel doors, gage as specified above.

F. Frame Anchors

1. Floor Anchor

Provide 14 gage galvanized steel sheet clip anchor welded to jambs, with 2 holes to receive fasteners and provision for 2 inch height and adjustment.

2. Jamb Anchors

- a. Masonry construction

Adjustable, flat, corrugated or perforated, T-shaped to suit frame size, with leg not less than 2 inches wide by 10 inches long. Furnish minimum 3 anchors per jamb up to 7 feet - 6 inches high; 5 anchors for greater than 7 feet - 6 inches and up to 8 feet - 0 inches; over 8 feet - 0 inches one additional anchor for each 24 inches or part thereof.

- b. Metal stud partitions

Insert type with notched clip to engage stud, welded to back of frames. Provide at least 4 anchors each jamb up to 7 feet - 6 inches height; 5 anchors for greater than 7 feet - 6 inches and up to 8 feet - 0 inches; over 8 feet - 0 inches one additional anchor for each 24 inches or part thereof.

- c. In-place concrete or masonry

Anchor jambs with a minimum 3/8-inch concealed bolts into expansion shield or inserts at 6 inches from top and bottom and 26 inches o.c.

G. Finish Hardware Reinforcement

1. Reinforce doors and frames for required finish hardware as follows:

- a. Hinges and Pivots

Steel plate 3/16 inch thick by 1 1/2 inch wide; 6 inches longer than hinge or pivot, secured by not less than 6 spot-welds.

- b. Mortise Locksets and Dead Bolts: 14 gauge steel sheet, secured with not less than 2 spot-welds.

- c. Strike plate clips: Steel plate 3/16 inch thick by 1 1/2 inch wide by 3 inches long.

- d. Flush Bolts: 12 gauge steel sheet, secured with not less than 2 spot-welds.

- e. Surface-Applied Closers and Coordinators

12-gauge steel sheet, secured with not less than 6-spot welds. Provide reinforcement for surface closers on all doors and frames.

- f. Concealed Closers

Removable steel access plate, 12-gauge internal reinforcement of size and shape required, and enclosing housing to keep closer pocket free of mortar or other materials.

g. Push Plates and Grab Bars

16-gauge steel sheet (except when sex screws are scheduled), secured with not less than 2 spot welds.

h. Surface Panic Devices

14-gauge sheet steel (except when sex screws are scheduled), secured with not less than 2 spot welds.

H. Door Louvers

1. Unless otherwise shown on Contract Drawings, for interior doors provide sightproof, stationary type of inverted V-shaped blades formed of 18 gage cold-rolled steel. Prime painted after fabrication - except for stainless steel doors (where shown on the Contract Drawings). At stainless steel doors, provide 18 gage stainless steel blades, finish to match door.
2. For fire-rated doors, provide tightly fitted, spring-loaded automatic closing louvers with operable blades retained by fusible links. Rating label shall be the same as door units.
3. Mount louvers flush into doors without overlapping moldings on surface of door facing sheets.

I. Louvered Panels

1. Provide for installation in hollow metal or stainless steel frames, where shown on the Contract Drawings.

2. Interior

Not less than 18-gauge cold-rolled steel sheet, sightproof inverted V-shaped blades and U-shaped frames. Space blades not more than 3 inches o.c. with internal support as required. Assemble units by welding. Prime paint after fabrication - except for panels in stainless steel frames. Panels in stainless steel frames shall be constructed of 18 gage stainless sheet, finish to match frame.

3. Exterior

Not less than 16 gage galvanized steel sheet, stationary, weatherproof Z-shaped blades and U-shaped frames. Space blades not more than 1-1/2 inches o.c. with internal support as required. Provide removable 14 x 18-inch bronze wire mesh insect screens on interior side of frame with rigid formed galvanized steel frame surround - except for panels in stainless steel frames. Panels in stainless steel frames shall be constructed of 16 gage stainless sheet, finish to match frame.

J. Transom Panels

1. Provide for installation in hollow metal or stainless steel frames, where shown on the Contract Drawings.

2. Interior

Not less than 18 gage cold-rolled steel, prime painted after fabrication - except for transoms in stainless steel frames. Panels in stainless steel frames shall be constructed of 18 gage stainless sheet, finish to match frame.

3. Exterior

Not less than 16 gage cold-rolled steel, prime painted after fabrication - except for transoms in stainless steel frames. Panels in stainless steel frames shall be constructed of 16 gage stainless sheet, finish to match frame.

K. Astragals

Install Z-shape on double-door active leaf 3/4-inch x 1-3/4-inch wide, 12-gauge. Furnish with countersunk holes located at 12 inches o.c., fastened with flat head machine screws. Weld fill screw heads after installation and grind smooth. Tack welding may be substituted for machine screws.

L. Vision Panel

Minimum 20-gauge glazing stops with butt corner joints, flush with face of door or frame, secured with countersunk tamperproof machine screws spaced at a maximum of 8 inches on centers on security side of door or frame.

PART 3. EXECUTION

3.01 PREPARATION

Prior to frame installation, clean damaged areas of prime coat and apply touch-up of compatible air-drying primer at surfaces which will be concealed.

3.02 INSTALLATION

- A. Install in accordance with approved shop drawings, manufacturer's data and as specified in this Section.

- B. Provide anchorage devices where required for securing hollow metal frames to in-place construction. Use drilled-in anchorage devices and machine screws. Do not set floor anchors with powder-actuated fasteners.

- C. Placing Frames

1. Set in position shown on the Contract Drawings, plumbed, aligned and braced until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
2. Place frames at fire-rated openings in accordance with NFPA 80.

3. Grout solid all door frames shown to be installed in CMU walls and partitions.
 4. Make field splices in frames, if any, as detailed on approved shop drawings. Weld and finish to match shop Work.
- D. Door Installation: Maintain door clearances in accordance with 2.04 D.5 and D.6 of this Section.

3.03 FIELD ADJUSTMENTS

- A. Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
- B. Check and readjust operating finish hardware items. Remove and replace doors or frames which are warped, bowed or otherwise unacceptable to the Engineer.
- C. Stainless Steel Touch-Up

Immediately after erection, smooth any abraded areas of stainless steel and polish to match undamaged finish.

END OF SECTION

SECTION 08110
CUSTOM HOLLOW METAL

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

08110A01 Include details of each frame type, elevation of door design, types, hardware reinforcement, details of construction, anchorage details, and door schedules covering doors and frames using same opening reference number shown on the Contract Drawings.

08110A02 Samples:
a. Door One 1 foot 0 inch x 1 foot 0 inch corner section with hinge mortise and reinforcement showing internal construction.
b. Frame One 1 foot 0 inch x 1 foot 0 inch corner section showing welded joint of head to jamb. Include hinge mortise, reinforcement and plaster guard in one rabbet.
c. Samples submitted shall be of the production type and represent the quality of Work to be installed.

Qualifications

08110K01 Evidence of installer qualifications as required by 1.03 of this Section.
2. Laboratory certification of prime paint, as required by 2.02 E this Section.
3. Certification of the following as required by 2.03 of this Section.
a. Door impact test
b. Oversize fire-rated door assemblies, if any
c. Sound transmission class (STC), if any d. Insulating (U-value), if any.

END OF APPENDIX "A"

08110-11

DIVISION 8**SECTION 08306****ACCESS DOORS - FLOOR TYPE****PART 1. GENERAL**

1.01 SUMMARY

This Section specifies requirements for floor type access doors.

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.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Capable of supporting a live load of not less than 300 pounds per square foot, unless otherwise shown on the Contract Drawings.
- B. Capable of being opened and closed by one person.
- C. Size as shown on the Contract Drawings.

1.04 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements of this Section, furnish and install Type J single leaf or Type JD double leaf unit(s) as manufactured by The Bilco Co., New Haven, CT, or approved equal.

2.02 MATERIALS

- A. Door leaves shall be not less than one-quarter inch thick steel, with a diamond pattern plate.
- B. Channel frame shall be not less than one-quarter inch thick steel with an anchor flange around the perimeter.

- C. Steel frame and leaves shall conform to the requirements of ASTM A 36.
- D. Furnish doors with:
 - 1. Heavy forged brass hinges.
 - 2. Stainless steel pins.
 - 3. Spring operations.
 - 4. Automatic hold-open arm with release handle.
 - 5. Snap lock with removable handle.
 - 6. Safety chain.
- E. Drainage coupling, 1-1/2 inch, for drain pipe.
- F. Hardware: Cadmium plated.
- G. Steel protective coating shall be hot-dip galvanizing, G90, conforming to the requirements of ASTM A 123.

PART 3. EXECUTION

3.01 INSTALLATION

Install in accordance with approved shop drawings and manufacturer's printed instructions.

END OF SECTION

SECTION 08306
ACCESS DOORS - FLOOR TYPE

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

08306A01 Shop drawings indicating dimensions, material thickness, finish, operating hardware and installation details.

Product Data

08306D01 Manufacturer's product literature.

END OF APPENDIX "A"

08306 -3

SECTION 08306

ACCESS DOORS - FLOOR TYPE

APPENDIX "A"

SUBMITTALS

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

A. Product Data

Manufacturer's technical data and installation and care instructions for each access door assembly, including dimensioned installation drawings and templates.

A. Shop Drawings

Shop drawings indicating dimensions, material thickness, finish, operating hardware and installation details.

END OF APPENDIX "A"

DIVISION 8**SECTION 08330****OVERHEAD COILING DOORS AND FIRE DOORS****PART 1. GENERAL****1.01 SUMMARY**

- A. This Section specifies requirements for complete operating overhead coiling door assemblies, including insulated overhead doors and overhead fire doors.
- B. Electrical connections for powered operators, if any, are specified in Division 16 of these Specifications.

1.02 REFERENCES

- A. The following is a listing of the publications referenced in this Section:
 - 1. American Society for Testing and Materials (ASTM)
 - ASTM A 36 Carbon Structural Steel
 - ASTM A 123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - ASTM A 653 Single Sheet Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - ASTM E 152 Methods of Fire Tests of Door Assemblies
 - 2. National Fire Protection Association (NFPA)
 - a. NFPA 80 Standard for Fire Doors and Windows
 - b. For electrically operated doors:
 - (1) NFPA 70 National Electric Code
 - (2) NFPA 72 National Fire Alarm Code
 - 3. Underwriters Laboratories (UL)
 - UL 217 Single and Multiple Station Smoke Detectors
 - UL 325 Door, Drapery, Gate Louver, and Window Operators and Systems
 - 4. National Electrical Manufacturers Association (NEMA)
 - NEMA ICS 1 General Standards for Industrial Control and Systems
 - NEMA ICS 2 Industrial Control Devices, Controllers and Assemblies
 - NEMA ICS 6 Enclosures for Industrial Controllers and Systems
 - NEMA MG 1 Motors and Generators

1.03 QUALITY ASSURANCE

Furnish each overhead coiling door, including hardware, accessories, mounting and installation components, as a complete unit produced by one manufacturer unless otherwise approved by the Engineer.

1.04 DESIGN AND PERFORMANCE REQUIREMENTS

A. Wind Loading

Exterior overhead coiling doors shall be constructed to withstand wind loading pressure, as required by applicable codes.

B. Deflection along the spindle shall not exceed $1/360$ x the span of the door or applicable code requirements--whichever is more stringent.

C. Maximum opening sizes of overhead coiling doors and fire doors as listed in the manufacturer's printed literature, shall not be exceeded.

D. Doors shall be designed and constructed in such a manner that possible vibration in supporting structure will not cause the door to close.

E. Fire Door Assemblies

Where shown on the Contract Drawings, furnish fire door assemblies which comply with NFPA No. 80 and have been fire tested, rated and labeled by UL. Furnish each door with a metal UL label indicating rating in hours of duration of exposure to fire and letter designation of location for which assembly is designed.

1. Oversize Fire Doors

Where fire door assemblies shown on the Contract Drawings exceed size for which UL testing and labeling service is offered, furnish a UL "Certificate of Inspection" for oversize doors, in lieu of label, certifying that design, materials and construction are at least equivalent to UL Standard size door requirements.

2. Automatic Closing

On all door assemblies provide an automatic closing device and governor, which operates when activated by temperature rise and melting of 160 degree F fusible link. Construct governor unit to be inoperative during normal door operations. Design release mechanism for easy resetting.

3. Where shown on the Contract Drawings, provide UL labeled ionization type smoke detectors, electromechanical door holder release devices and necessary mounting brackets in accordance with UL 217. Fabricate such door units to permit manual lifting of curtain for emergency exit after automatic closing, with curtain returning to closed position when released.

1.05 SUBMITTALS

For Submittal requirements see Appendix "A".

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements of this Section, provide products of one of the following, or approved equal:

Cornell Iron Works Inc., Mountaintop, PA
J. G. Wilson Corp., Norfolk, VA
McKeon Rolling Steel Door Co., Brooklyn, NY

2.02 MATERIALS

A. Door Curtain

Fabricate overhead door curtain of interlocking slats designed to withstand required wind loading, of continuous length for width of door without splices. Unless shown otherwise on the Contract Drawings, provide slats of gage recommended by door manufacturer for size and type of door required, but not less than 22 gage for un-insulated doors fabricated of structural quality, cold-rolled galvanized steel sheets with G90 zinc coating, complying with ASTM A 653, and phosphate treated before fabrication.

B. Endlocks

Malleable iron casting galvanized after fabrication, secured to curtain slats with galvanized rivets. Provide locks on alternate curtain slats.

C. Windlocks

Malleable iron castings secured to curtain with galvanized rivets. Unless otherwise recommended by door manufacturer, provide windlocks on exterior doors exceeding 16 feet wide. Space windlocks approximately 24 inches o.c. on both edges of curtain.

D. Bottom Bar

Consisting of 2 angles, each not less than 1 1/2 inch x 1-1/2 inch x 1/8 inch thick, galvanized.

E. For manually operated doors provide a replaceable gasket of flexible vinyl or neoprene between angles as a weather seal and cushion floor bumper.

F. Curtain Jamb Guides

Fabricate curtain jamb guides of steel angles, or channels and angles with sufficient depth and strength to retain curtain loading. Build-up units with minimum 3/16-inch thick steel sections, galvanized after fabrication. Slot bolt holes for track adjustment.

1. Secure continuous wall angle to wall framing by 3/8-inch minimum bolts at not more than 30 inches o.c., unless closer spacing is recommended by door manufacturer. Extend wall angles above door opening head to support coil brackets, unless shown otherwise on the Contract Drawings. Place anchor bolts on exterior wall guides so they are concealed when door is in closed position. Provide removable stops on guides to prevent over-travel of curtain, and continuous bar for holding windlocks.

G. Vision Panels (if any)

Panels shall consist of 1/4 inch thick (minimum), cast thermoplastic, methyl methacrylate flat glazing sheet with smooth mirror finish as shown on the Contract Drawings. Set panels in neoprene or vinyl glazing channel, secured in curtain slats.

H. Weather Seals

Vinyl or neoprene weather-stripping for exterior exposed doors. At door heads, use 1/8-inch thick continuous sheet secured to inside of curtain coil hood. At doorjamb, use 1/8-inch thick continuous strip secured to exterior side of jamb guide.

I. Counterbalance doors by means of adjustable steel helical torsion spring, mounted around a steel shaft and mounted in a spring barrel and connected to door curtain with barrel rings as required by the manufacturer. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

J. Counterbalance Barrel

Fabricate spring barrel of hot-formed structural quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support roll-up of curtain without distortion of slats and limit barrel deflection to not more than 0.03 inch per ft. of span under full load.

K. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast steel barrel plugs to secure ends of springs to barrel and shaft.

L. Fabricate torsion rod for counterbalance shaft of case-hardened steel, of required size to hold fixed spring ends and carry torsional load.

M. Brackets

Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate with bell mouth guide groove for curtain.

N. Hood

Form to entirely enclose coiled curtain and operating mechanism at opening head, and act as weather seal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods, and any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.

1. Fabricate steel hoods for doors of not less than 24 gage hot-dip galvanized steel sheet with G 90 zinc coating, complying with ASTM A 653. Phosphate-treat before fabrication.

- O. Provide sheet metal protective enclosures for main gear and motor assembly: form to entirely enclose main gear, spring adjuster, and motor assembly (where applicable), with a removable enclosure. Frame out with steel bars or angles, ASTM A 36, hot-dip galvanized in accordance with ASTM A 123. Fabricate enclosure panels of hot-dip galvanized steel as specified in Paragraph 2.02 N. above. Leave gap for chain and other moving items that may protrude. Provide access panels for easy accessibility for servicing. For exterior applications, the metal enclosure shall be weather tight, with vinyl or neoprene gaskets.

2.03 CONSTRUCTION FEATURES

A. Manual Doors

Provide manual operators as shown on the Contract Drawings except where electric door operators are shown otherwise:

1. Manual Push-Up Operation

Provide counter-balance mechanism so that required lift or pull for door operation does not exceed 25 lb. Adjust operating mechanism so that curtain can be easily stopped at any point in its travel and to remain in position until movement is resumed.

- a. Provide galvanized steel lifting handle and slide bolt lock on inside bottom bar.

2. Chain Hoist Operator

Provide manual chain hoist operator consisting of endless steel hand chain, chain pocket wheel and guard, and geared reduction unit with maximum 35 lb. pull for door operation. Design chain hoist with self-locking mechanism allowing curtain to be stopped at any point in its travel and to remain in position until movement is resumed. Furnish alloy steel hand chain with chain holder secured to operator guide.

3. Crank Hoist Operator

Provide crank hoist operator consisting of crank and crank gear box, steel crank drive shaft and gear reduction unit. Size gear to require no more than 25-lb. effort to turn crank. Fabricate gearbox to completely enclose operating mechanism and be oil-tight. Design unit so that curtain may be stopped at any point in its travel and to remain in position until movement is resumed. Provide manufacturer's standard crank locking device.

B. Electric Door Operators

- 1. Where shown on the Contract Drawings, provide electric door operator in accordance with the following:

- a. Assembly conforming to NEMA Standards ICS1, ICS2, ICS6 and MG1;
- b. Approved in accordance with UL 217 and UL 325, of size and capacity recommended and provided by door manufacturer;

- c. Complete with electric motor and factory-prewired motor controls, gear reduction unit, solenoid operated brake, remote control stations, control devices, conduit and wiring from controls to motor and central stations in accordance with Division 16 of these Specifications; and
 - d. Accessories required for proper operation.
2. Provide Auto-Set Fire Door Model FSFD, as manufactured by McKeon Rolling Steel Door Co., or M-100 Fire Guard System, as manufactured by Cornell Iron Works, or approved equal.
 3. Provide hand-operated disconnect or a mechanism for automatically engaging a sprocket and chain operator and releasing brake for emergency manual operation. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
 4. Provide operator that will enable motor to be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
 5. Coordinate electric door operators with the requirements of 1.04 E of this Section.
 6. Door Operator Type

Provide wall or bracket-mounted door operator units conforming to NEMA requirements, consisting of electric motor, worm gear drive from motor to reduction gear box, chain or worm gear drive from reduction box to gear wheel mounted on counterbalance shaft, and a disconnect-release for manual operation.

7. Electric Motors

High-starting torque, reversible, constant duty, class A insulated electric motors with overload protection, sized to move door in either direction, from any position, at not less than 2/3 foot nor more than 1 foot per second.

- a. Unless shown otherwise on the Contract Drawings provide open-drip proof type motor and controller with NEMA Type 1 enclosure.
 - b. Where shown on the Contract Drawings provide totally enclosed, nonventilated type motors, fitted with plugged drain, and controller with NEMA Type 4 enclosure.
8. Remote Control Station

Provide momentary-contact, 3-button control station with push button controls labeled "Open", "Close" and "Stop".

- a. Interior units, full-guarded, surface-mounted heavy-duty, with general purpose NEMA Type 1 enclosure.
- b. Exterior units, full-guarded type, standard duty, surface-mounted, weatherproof type, NEMA Type 4 enclosure, key-operated.

9. Automatic Reversing Control

Furnish each door with electrically actuated automatic safety switch, extending full width of door bottom, and located within bottom door rail. Contact with switch before fully closing will immediately stop downward travel and reverse direction to fully opened position. Connect to control circuit through retracting safety cord and reel, or self-coiling cable.

10. Provide automatic reset feature, controlled rate of decent, and internal governors.

- C. Where exterior overhead coiling doors are shown on the Contract Drawings, provide an insulated system, with interior and exterior facing sheets and a non-combustible core insulation of R value shown on the Contract Drawings or as required by code.

2.04 SHOP FINISHING

- A. Finish the door assemblies with one of the following systems, where shown on the Contract Drawings:
1. Shop clean and prime ferrous metal and galvanized surfaces, exposed and unexposed, except faying and lubricated surfaces, with rust inhibitive primer, which is compatible with finish painting, if any, as specified in Division 9 Section on painting.
 2. Galvanized steel slats, bottom bars, guides, miscellaneous enclosure panels, and hoods shall receive a baked-on minimum 0.8-mil thick polyester topcoat over a minimum 0.2-mil thick epoxy primer.

PART 3. EXECUTION

3.01 INSTALLATION

- A. Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts hangers, and equipment supports in accordance with approved shop drawings, manufacturer's instruction, and as specified in this Section.
- B. Install fire-rated doors, where shown on the Contract Drawings, in accordance with NFPA 80.
- C. Install electrically operated doors in accordance with NFPA 70 and 72.

3.02 FIELD TESTS

- A. Upon completion of installation including associated Work by other trades, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and which fit weathertight for entire perimeter.
- B. On door assemblies, test door closing when activated by operation of smoke detector fire release system and/or fusible link. Reset door-closing mechanism after successful test.

END OF SECTION

SECTION 08330
OVERHEAD COILING DOORS AND FIRE DOORS

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

- 08330A01 Shop drawings for components and installations, which are not fully dimensioned or detailed on the manufacturer's data sheets. Include sheet metal protective enclosures for main gear and motor, if any.

Product Data

- 08330D01 Manufacturer's product data, roughing-in diagrams, and installation instructions for each type and size of overhead coiling door. Provide operating instructions and maintenance information, and complete information describing fire-release system including electrical rough-in instructions.

Certificates

- 08330E01 UL certification for oversize fire-rated doors and frames certifying that each assembly has been constructed with materials and methods equivalent to UL requirements.

END OF APPENDIX "A"

08330-8

DIVISION 8

SECTION 08715

FINISH HARDWARE

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for finish hardware for doors scheduled in Appendix "B" to this Section.
- B. Establish keying; furnish keys and key control system in accordance with Keying Appendix "C" to this Section.
- C. If required by Appendix "D" to this Section, furnish extra stock and specialized tools and maintenance instructions.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American National Standards Institute, Inc. (ANSI)/Builders Hardware
Manufacturers Association, Inc. (BHMA)

- A 156.1 Butts and Hinges
- A 156.2 Locks and Lock Trim
- A 156.3 Exit Devices
- A 156.4 Door Controls – Closers
- A 156.5 Auxiliary Locks
- A 156.7 Template Hinge Dimensions
- A 156.8 Door Controls - Overhead Holders
- A 156.13 Mortise Locks and Latches
- A 156.14 Sliding and Folding Door Hardware
- A 156.18 Materials and Finishes
- A 117.1 Providing Accessibility and Usability of Physically Handicapped People

Underwriters Laboratories Inc. (UL)

Building Materials Directory

UL 228 "Door Closers-Holders, With or Without Integral Smoke Detectors"

UL 437 "Key Locks"

National Fire Protection Association (NFPA)

Standard No. 80 "Fire Doors and Windows"

Door and Hardware Institute (DHI)

"Recommended Locations for Builders Hardware for Custom Steel Doors and Frames"

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Fire Rated Openings

Furnish and install hardware for fire-rated openings in compliance with NFPA No. 80 which has been tested and listed by UL Building Materials Directory or other nationally recognized independent testing, inspection and labeling agencies acceptable to the Engineer.

Exemption (4)

G. Cylinders

Conform to the requirements of ANSI A 156.5 Grade 1, UL listed, and tested for drill and pick resistance requirements of UL 437.

H. Strikes

Manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set. Furnish and install dust-proof strikes for foot-bolts, except where threshold provides non-recessed strike for bolt.

I. Sliding and Folding Door Hardware: Conform to ANSI A 15.

J. Template Hinges

Conform to ANSI A 156.1 and A 156.7. All hinges shall be full-mortise type, ball-bearing function, unless otherwise indicated on Hardware Schedule Appendix "B" to this Section.

K. Materials and Finish

Conform to ANSI A 156.18, do not furnish products of Type 0 "optional" materials or forming methods. Furnish and install matching finishes for hardware units at each door or opening to the greatest extent possible. Reduce color and texture differences as much as commercially possible.

1.04 QUALITY ASSURANCE

A. Verify that the entity performing Work of this Section has a minimum of 5 years of experience involving quantities and complexities at least equal to those required for the work of this Section, and that it employs an architectural hardware consultant who shall be available for consultation at the construction site if requested by the Engineer.

B. Provide instruction for the management of the key control system, if any, as required by 1.04 of Appendix "C" to this Section.

- C. Manufacturers for various products are listed in Finish Hardware Schedule Appendix "B" to this Section. Except as otherwise shown on Appendix "B", products of equivalent quality, design and function by other manufacturers may be used subject to approval of the Engineer in accordance with 1.06 A hereof.
 - 1. Provide each type of hardware (latch and locksets, mortise locks, mortise cylinders, hinges, closers, or other items) from a single manufacturer.
 - 2. Where finish hardware provided as Work of this Section is to be installed within an existing Authority facility, provide such items from the same manufacturer as presently installed unless otherwise shown on Appendix "B" to this Section.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Tag or package each item separately, with identification related hardware schedule required in 1.06 B.1.a of this Section set number. Include manufacturer's basic installation instructions with each item or package.
- B. Pack and deliver all locks and cylinders less keys.
- C. Provide secure lock-up for hardware delivered to the construction site, but not yet installed.
- D. Deliver keys as required by Appendix "C" to this Section.
- E. If extra stock is required by Appendix "D" to this Section, deliver materials to the Engineer in accordance with 1.05 A and B hereof; and deliver keys in accordance with Appendix "C" hereof.

1.06 SUBMITTALS

- A. See Appendix "A" for submittal requirements.

1.07 WARRANTY

- A. All items, except as noted below, shall be warranted to the Authority in writing by the manufacturer against failure due to defective materials and workmanship for a minimum period of one year commencing on the date of issuance of the Certificate of Final Completion. In the event of product failure, promptly repair or replace item with no additional cost to the Authority.
 - 1. Mortise locksets: Five years
 - 2. Exit Devices: Five years

- 3. Door closers: Ten years

PART 2. PRODUCTS

2.01 MANUFACTURERS

- A. Finish hardware manufacturers, or approved equal, are listed in Appendix "B" to this Section.
- B. Key control system manufacturers, if required by 1.04 of Appendix "C" to this Section, as follows:

Best Lock Corp., Indianapolis, IN
 Telke Inc., Glen Riddle, PA
 Key Control Systems Inc., Bechtelsville, PA

2.02 MATERIALS

A. SCREWS AND FASTENERS

- I. All required screws shall be supplied as necessary for securing finish hardware in the appropriate manner. Thru-bolts shall be supplied for exit devices and door closers where required by code and where the appropriate blocking or reinforcing is not present in the door to preclude their use.

B. HANGING DEVICES

1. BUTTS AND HINGES

- a. Acceptable Manufacturers and Types:

Type	McKinney	Hager	Stanley
Type 1	T4A3795	BB1262	FBB268
Type 2	TA2714	BB1279	FBB179
Type 3	TA2314	BB1191	FBB191
Type 4	T4A3786	BB1168	FBB168
Type 5	T4A3386	BB1199	FBB199

- b. Application:

- 1) Exterior out swinging doors Type 5 x NRP
- 2) Exterior in swinging doors and vestibule doors Type 4
- 3) Interior doors with closers Type 2 or 4
- 4) Interior doors over 36 inches wide Type 4
- 5) Interior doors 36 inches or less without closer Type 2
- 6) Furnish NRP (non-removable pins) at out-swinging lockable doors.

- c. Size:

- 1) 2-1/4 inch Doors 5 inch by 5 inch
- 2) 1-3/4 inch Doors 4-1/2 inch by 4-1/2 inch
- 3) 1-3/8 inch Doors 3-1/3 inch by 3-1/2 inch

d. Quantity:

- 1) 2 - hinges per leaf for openings through 60 inches high.
- 2) 1 - additional hinge per leaf for each additional 30 inches in height or fraction thereof.
- 3) 4 - Dutch doors up to 90 inches in height.

- e. Drill 5/32 inch hole and use No. 12, 1-1/4 inch steel threaded to the head wood screws for hinges on wood doors.

C. CYLINDERS AND KEYING

1. CYLINDERS

- a. Furnish Small format interchangeable core cylinders as directed.

- 1) Specified Manufacturer: BEST
- 2) Approved Substitutes: Schlage Everest "B", Medeco Keymark.

2. KEYING

- a. All locks and cylinders shall be construction master-keyed. All locks and cylinders to be master-keyed or grandmaster-keyed as directed by the Engineer. Have the factory key all locks and cylinders. Furnish the following key amounts:

- 1) Three change keys per lock
- 2) Three grand master keys
- 3) Six master keys per master level
- 4) Fifteen construction/temporary keys

- b. Master keys and all high-security or restricted keyway blanks shall be sealed in tamper-proof packaged boxes when shipped from the factory. The boxes shall be shrink wrapped and imprinted to ensure the integrity of the packaging.

3. KEY CABINET

- a. Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall expansion capacity of 150% of the number of locks required for the project.

- 1) Specified Manufacturer: Telkee
- 2) Approved Substitutes: Lund

D. LOCKING DEVICES

1. MORTISE LOCKSETS

- a. All Locksets shall meet the requirements of ANSI/BHMA A156.13-1994, Operational Grade 1, and Security Grade 1 certified. All functions shall be manufactured in a single sized case formed from 12 gauge steel minimum. The lockset shall have a field-adjustable, beveled armored front, with a .125" minimum thickness and shall be reversible without opening the lock body. The lockset shall be 2 3/4" backset. The deadbolt shall be a full 1" throw made of stainless steel. All strikes shall be non-handed with a curved lip. All locks shall be provided with strike boxes. To ensure proper alignment, all trim shall be thru-bolted.

- 1) Specified Manufacturer: Schlage L9000 Series
- 2) Approved Substitutes: BEST 37H Series, Yale 8800 Series

E. EXIT DEVICES

1. CONVENTIONAL DEVICES

- a. All exit devices shall be certified to meet ANSI/BHMA A156.3 Grade 1 requirements and shall be listed by Underwriters Laboratories and bear the UL label for life safety in full compliance with NFPA 80 and NFPA 101. Mounting rails shall be formed from a solid single piece of stainless steel, brass or bronze no less than 0.072" thick. Push rails shall be constructed of 0.062" thick material. Painted or anodized aluminum will not be considered heavy duty and are not acceptable. Hex key dogging shall be standard for all life safety panic hardware. Lever trim shall be available in finishes and designs to match that of the specified locksets.

- 1) Specified Manufacturer: Von Duprin 98 Series
- 2) Approved Substitutes: Sargent 80 Series, Yale 7100 Series

F. DOOR CLOSERS

1. SURFACE MOUNTED CLOSERS - HEAVY DUTY

- a. All closers shall be ANSI/BHMA 156.4 certified and shall have non-ferrous covers, aluminum alloy bodies, forged steel arms, and separate valves for adjusting backcheck, closing and latching cycles and adjustable spring to provide up to 50% increase in spring power. Closers shall be constructed with a one-piece body. Closers shall be furnished with parallel arms mounting on all doors opening into corridors or other public spaces

and shall be mounted to permit 180 degrees door swing wherever wall conditions permit. Furnish with non-hold open arms unless otherwise indicated. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

- 1) Specified Manufacturer: LCN 4041 Series
- 2) Approved Substitutes: Norton 7500 Series, Yale 4400 Series

G. DOOR TRIM AND PROTECTIVE PLATES

1. Kick plates shall be .050 gauges and two inches less full width of door, or as specified. Push plates, pull plates, door pulls and miscellaneous door trim shall be as shown in the hardware schedule.
 - a. Specified Manufacturer: Ives
 - b. Approved Substitutes: Burns, Trimco

H. DOOR STOPS AND HOLDERS

1. WALL MOUNTED DOOR STOPS
 - a. Where a door is indicated on the Contract Drawings to strike flush against a wall, furnish and install wall bumpers. Provide convex or concave design as indicated.
 - 1) Specified Manufacturers: Ives
 - 2) Approved Substitutes: Burns, Trimco

I. GASKETING AND THRESHOLDS

1. Furnish and install continuous weatherseal on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Furnish and install intumescent seals as required to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies. Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.
2. Furnish and install threshold units not less than 4" wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames. All threshold units shall comply with the Americans with Disabilities Act (ADA.)
 - a. Specified Manufacturers: McKinney
 - b. Approved Substitutes: Zero, Pemko

J. SILENCERS

1. Furnish rubber door silencers equal to McKinney S1M for all new interior hollow metal frames, two (2) per pair and three (3) per single door frame up to 7'-6" and one additional for every 30" in door height, and McKinney S2W for all wood frames.

2.03 CONSTRUCTION FEATURES

- A. Furnish and install hardware for machine screw installation. Do not furnish and install hardware prepared for self-tapping sheet metal screws, unless specifically scheduled otherwise in Appendix "B" to this Section.
- B. Furnish and install screws for installation with each hardware item. Furnish and install Phillips flat-head screws unless specifically scheduled otherwise in Appendix "B" to this Section. Finish exposed screws (exposed under any condition) to match hardware finish or, if exposed in surfaces of other Work, to match finish of such other Work, including "Prepared for Paint" on surfaces to receive paint finish.
- C. Furnish and install concealed fasteners for hardware units that are exposed when door is closed. Do not use through bolts; provide set screw fastener.
- D. Hinges

Furnish and install stainless steel pins on non-ferrous hinges, steel pins on steel hinges; non-removable at exterior and out-swinging corridor doors, non-rising for interior non-security exposure, flat button with matching plugs.
- E. Closers
 1. Furnish and install parallel arms, unless otherwise scheduled in Appendix "B" to this.
 2. No corner mounting brackets permitted.
 3. Mount closers on interior of building, and within stairwells.
 4. Where parallel arm closers are scheduled at exterior doors in Appendix "B" to this Section, furnish units one size larger than manufacturer's recommendations for standard arm units.
- F. Furnish and install coordinator device for pairs of doors equipped with closers and astragal, prepared for vertical rod exit device.
- G. Furnish and install metal threshold unit of type, size and profile as shown on the Contract Drawings or scheduled on Appendix "B" to this Section. Include butyl rubber or polyisobutylene mastic sealant for exterior doors.

- H. Furnish and install resilient silencers for all interior metal doorframes, 3 per single doorframe, 2 per double doorframe, unless acoustic or smoke seal is scheduled on Appendix "B" to this Section.
- I. Furnish and install protection plates where scheduled on Appendix "B" to this Section, sized as follows:
 - 1. Armor plates: 36 inches high
 - 2. Mop plates: 4 inches high
 - 3. Kick plates: 8 inches high
 - 4. Kick plates for barrier free doors: 16 inches high
 - 5. Width
 - a. 1-1/2 inches less than door opening on doorstop side; 1/2 inch less than door opening opposite stop side.

2.04 FINISHES

- A. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

PART 3. EXECUTION

3.01 EXAMINATION

- A. Ensure that the building is secured and free from weather elements prior to installing interior door hardware. Examine hardware before installation to ensure it is free of defects.

3.02 INSTALLATION

- A. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with the governing regulations.
 - 1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute (DHI.)

2. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."

- B. All hardware shall be applied and installed in accordance with best trade practice by an experienced hardware installer. Care shall be exercised not to mar or damage adjacent work.
- C. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.
- D. Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.03 FIELD QUALITY CONTROL

- A. Provide the services of an Architectural Hardware Consultant duly certified by the Door and Hardware Industry prior to building completion to ensure that all hardware was correctly installed and is in proper working order.

3.04 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.
- B. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore to proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- C. Instruct Authority's personnel in the proper adjustment and maintenance of door hardware and hardware finishes and usage of any electronic devices.

3.05 PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

END OF SECTION 08715

SECTION 08715
FINISH 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

- 08715A01 Submit templates to each fabricator of doors and frames as required for preparation to receive hardware. Submit to the Engineer notification of such transmittals to door fabricator(s).

Samples

- 08715C01 Concurrent with submittal of Appendix "A" to this Section, submit to the Engineer one sample of each type of hardware unit, tagged with full description. Samples shall be retained by and become the property of the Authority.

Product Data

- 08715D01 Product Data - a. Hardware Schedule Based on the manufacturers approved in accordance with 1.06 A of this Section. Organize schedule by hardware sets and include the following:
1. Name and manufacturer of each item.
 2. Type, style function, size and finish of each item.
 3. Location of hardware set cross-referenced to Contract Drawing door opening numbers.
 4. Door and frame sizes, and materials.
 5. Wiring diagrams of electronic hardware items.
 6. Explanation of all abbreviations, codes and symbols contained in schedule.
 7. UL label designation.

- 08715D02 Submit a finish hardware data sheet listing manufacturers of finish hardware to be furnished and installed as Work of this Section in accordance with the requirements "Inspections and Rejections" of Division 1 - GENERAL PROVISIONS.

Schedules

- 08715J01 Keying Schedule shall be in accordance with 1.02 of Appendix "B" to this Section.

Spare Parts List

08715-12

08715N01

If required by Appendix "C" to this Section submit extra stock and one complete set of specialized tools for maintenance to the Engineer in accordance with 1.05 E of this Section.

END OF APPENDIX "A"

08715-13

APPENDIX "B"

FINISH HARDWARE SCHEDULE

The following schedule contains a listing of hardware for each door (and roof hatch and locker, if any) by set number which corresponds with hardware set number shown on the Contract Drawings.

* Denotes manufacturers scheduled for Work of this Section, or approved equal.

** Denotes manufacturers scheduled for Work of this Section, with no substitution permitted.

Insert * or ** adjacent to manufacturers below as appropriate for the Contract.

Item	Manufacturer	Symbol
Locks/Latches	Best	B
	Corbin	C
	Schlage	S
Cylinders	Best	B
	Corbin	C
	Yale	Y
Butts/Hinges	Hager	H
	McKinney	MC
	Stanley	ST
Exit/Panic Devices	Von Duprin	V
	Yale	Y
	Sargent	SA
Door Bolts	Builders Brass Works	BW
	Ives	I
	Stanley	ST
Overhead Closers	Norton	NO
	LCN	LCN
	Yale	Y
Smoke-activated Closures	Corbin	C
	Dorma	D
	Rixon Firemark	RF
Floor Closers	Door O Matic	DM
	Dorma	D
	Rixon Firemark	RF
Overhead Stop	Corbin	C
	Glynn-Johnson	GJ
	Rixon Firemark	RF
Door Stripping, Drop Seal & Threshold	A.J. May	M
	Pemko	P
	Zero	Z
Silencers	McKinney Weatherstrip	MW
	Builders Brass Works	BW
	Ives	I
	Quality	Q

Push/Pull Units and Protection Plates	Builders Brass Works Tremco Quality Hardware Co.	BW T QH
Sliding/Bi-fold Hardware Sets	Grant Lawrence Stanley	GR LA ST
Door Trim/Stops	Builders Brass Works Glynn-Johnson Ives	BW GJ I

HARDWARE SETS

Insert * or ** adjacent to manufacturers below as appropriate for the Fill-in below and add or delete set numbers as appropriate for Contract.

SPECWORKS # 109808-B7WR44HWX

Hardware Group No. 01: Provide each SGL door(s) with the following:

Quantity	Description	Model Number	Finish	Mfr
3	EA HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA POWER TRANSFER	EPT-10	689	VON
1	EA FIRE EXIT HARDWARE	RX-LC-98L-F E996L X 17 LEVER FS 24VDC	626	VON
1	EA RIM CYLINDER	1E72 X KEYED CONST CORE	626	BES
1	EA SURFACE CLOSER	4041 EDA	689	LCN
1	EA WALL STOP	WS407CCV	630	IVE
1	SET SEALS	188FS	BLK	ZER
1	EA DOOR POSITION SWITCH	679-05		SCE
2	CARD READER	BY SECURITY CONTRACTOR		
1	POWER SUPPLY	BY SECURITY CONTRACTOR		

OPERATIONAL DESCRIPTION:

1. DOORS NORMALLY CLOSED AND LOCKED
2. ENTRY BY VALID CREDENTIAL AT CARD READER WHICH SIGNALS TRIM OF EXIT DEVICE TO OPEN AND ALLOW AUTHORIZED ENTRY. ENTRY CAN ALSO BE ACHIEVED BY USE OF KEY.
3. FREE EGRESS AT ALL TIMES VIA THE EXIT DEVICE. EXIT HAS BUILT IN "RX SWITCH" (REQUEST TO EXIT) WHICH WILL SIGNAL ACCESS CONTROL SYSTEM OF VALID RELEASE.
3. TIE EXIT DEVICES INTO THE BUILDING FIRE-ALARM SYSTEM UPON ACTIVATION DOORS WILL UNLOCK AND ALLOW RE-ENTRY. (FAIL-SAFE).

Hardware Group No. 02: Provide each SGL door(s) with the following:

Quantity	Description	Model Number	Finish	Mfr
3	EA HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA POWER TRANSFER	EPT-10	689	VON
1	EA FIRE EXIT HARDWARE	RX-LC-98L-F E996L X 17 LEVER FS 24VDC	626	VON
1	EA RIM CYLINDER	1E72 X KEYED CONST CORE	626	BES
1	EA SURFACE CLOSER	4041 SCUSH	689	LCN
1	SET SEALS	188FS	BLK	ZER
1	EA DOOR POSITION SWITCH	679-05		SCE
1	CARD READER	BY SECURITY CONTRACTOR		
1	POWER SUPPLY	BY SECURITY CONTRACTOR		

OPERATIONAL DESCRIPTION:

1. DOORS NORMALLY CLOSED AND LOCKED
2. ENTRY BY VALID CREDENTIAL AT CARD READER WHICH SIGNALS TRIM OF EXIT DEVICE TO OPEN AND ALLOW AUTHORIZED ENTRY. ENTRY CAN ALSO BE ACHIEVED BY USE OF KEY.
3. FREE EGRESS AT ALL TIMES VIA THE EXIT DEVICE. EXIT HAS BUILT IN "RX SWITCH" (REQUEST TO EXIT) WHICH WILL SIGNAL ACCESS CONTROL SYSTEM OF VALID RELEASE.
3. TIE EXIT DEVICES INTO THE BUILDING FIRE-ALARM SYSTEM UPON ACTIVATION DOORS WILL UNLOCK AND ALLOW RE-ENTRY. (FAIL-SAFE).

Hardware Group No. 02A: Provide each SGL door(s) with the following:

Quantity	Description	Model Number	Finish	Mfr
3	EA HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA PANIC HARDWARE	98L 996L X 17 LEVER	626	VON
1	EA RIM CYLINDER	1E72 X KEYED CONST CORE	626	BES
1	EA ELECTRIC STRIKE	6111 FSE EB 24VDC	630	VON
1	EA SURFACE CLOSER	4041 SCUSH	689	LCN
1	SET WEATHERSTRIPPING	429A	AL	ZER
1	EA RAIN DRIP	142A	AL	ZER
1	EA DOOR SWEEP	8198AA	AL	ZER
1	EA THRESHOLD	566A	AL	ZER
1	EA DOOR POSITION SWITCH	679-05		SCE
1	CARD READER	BY SECURITY CONTRACTOR		
1	POWER SUPPLY	BY SECURITY CONTRACTOR		

OPERATIONAL DESCRIPTION:

1. DOOR NORMALLY CLOSED AND LOCKED.
2. ENTRY BY VALID CREDENTIAL AT CARD READER WHICH SIGNALS ELECTRIC STRIKE TO OPEN AND ALLOW ENTRY.
3. UPON LOSS OF POWER ELECTRIC STRIKE WILL REMAIN LOCKED (FAIL-SECURE).

Hardware Group No. 03: Provide each SGL door(s) with the following:

Quantity	Description	Model Number	Finish	Mfr
3	EA HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA CLASSROOM LOCK	L9070L 17A	626	SCH
1	EA MORTISE CYLINDER	1E74 X KEYED CONST CORE	626	BES
1	EA SURFACE CLOSER	4041 EDA	689	LCN
1	EA WALL STOP	WS407CCV	630	IVE
3	EA SILENCER	SR64	GRY	IVE

Hardware Group No. 04: Provide each SGL door(s) with the following:

Quantity	Description	Model Number	Finish	Mfr
3	EA HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA CLASSROOM LOCK	L9070L 17A	626	SCH
1	EA MORTISE CYLINDER	1E74 X KEYED CONST CORE	626	BES
1	EA SURFACE CLOSER	4041	689	LCN
1	EA WALL STOP	WS407CCV	630	IVE
3	EA SILENCER	SR64	GRY	IVE

Hardware Group No. 05: Provide each RU door(s) with the following:

Quantity	Description	Model Number	Finish	Mfr
1	EA MORTISE CYLINDER	1E74 X KEYED CONST CORE	626	BES
1	EA BALANCE OF HARDWARE	BY DOOR MANUFACTURER		

Hardware Group No. 06: Provide each SGL door(s) with the following:

Quantity	Description	Model Number	Finish	Mfr
3	EA HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA STOREROOM LOCK	L9080L 17A	626	SCH
1	EA MORTISE CYLINDER	1E74 X KEYED CONST CORE	626	BES
1	EA SURFACE CLOSER	4041 EDA	689	LCN
1	EA WALL STOP	WS407CCV	630	IVE
1	SET SEALS	188FS	BLK	ZER

Hardware Group No. 07: Provide each SGL door(s) with the following:

Quantity	Description	Model Number	Finish	Mfr
3	EA HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA FIRE EXIT HARDWARE	98L-F 996L X 17 LEVER	626	VON
1	EA MORTISE CYLINDER	1E74 X KEYED CONST CORE	626	BES
1	EA SURFACE CLOSER	4041 EDA	689	LCN
1	EA WALL STOP	WS407CCV	630	IVE
1	SET SEALS	188FS	BLK	ZER

Hardware Group No. 08: Provide each PR door(s) with the following:

Quantity	Description	Model Number	Finish	Mfr
6	EA HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA MULLION	KR9954	689	VON
2	EA FIRE EXIT HARDWARE	98L-F 996L X 17 LEVER	626	VON
2	EA RIM CYLINDER	1E72 X KEYED CONST CORE	626	BES
1	EA MORTISE CYLINDER	1E74 X KEYED CONST CORE	626	BES
2	EA SURFACE CLOSER	4041 EDA	689	LCN
2	EA WALL STOP	WS407CCV	630	IVE
1	SET SEALS	188FS	BLK	ZER

Hardware Group No. 09: Provide each PR door(s) with the following:

Quantity	Description	Model Number	Finish	Mfr
6	EA HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
2	EA MANUAL FLUSH BOLT	FB458	626	IVE
1	EA DUST PROOF STRIKE	DP2	626	IVE
1	EA CLASSROOM LOCK	L9070L 17A	626	SCH
1	EA MORTISE CYLINDER	1E74 X KEYED CONST CORE	626	BES
1	EA SURFACE CLOSER	4041 SCUSH	689	LCN
1	SET SEALS	188FS	BLK	ZER

END OF APPENDIX "B"

SECTION 08715

APPENDIX "C"

KEYING

1.01 Construction Key System

- A. Construction key system is not required.

1.02 Keying System

- A. General: Meet with the Engineer and the facility manager to finalize keying requirements and obtain final instructions in writing. Reuse existing keys with new locks.
 - 1. Submit detailed keying schedule as required by 1.06 C.2 of this Specification Section to indicate final keying of locks. Include:
 - a. Keying system schematic diagram and floor plan(s) with corresponding key symbols indicated for each door.
 - b. Copy of final keying schedule as transmitted to lock manufacturer.
 - c. When keying is an extension of an existing system, include all references and registry numbers of existing keying.

END OF APPENDIX "C"

SECTION 08715

APPENDIX "D"

MAINTENANCE PROVISIONS

1.01 Extra Stock

- A. Extra stock for finish hardware items is not required.
- B. Furnish and deliver to the Engineer in accordance with 1.06F. of this Section one complete set of specialized tools complete with instructions for continued adjustment, maintenance, and removal and replacement of finish hardware items by the Authority.

END OF APPENDIX "D"

DIVISION 9
SECTION 09250
GYP SUM DRYWALL

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for interior non-load-bearing steel framing, interior gypsum board assemblies and finishing, and cementitious backer units installed with gypsum board assemblies.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American National Standards Institute (ANSI)

- ANSI A 108.11 Specifications for Interior Installation of Cementitious Backer Units.
 ANSI A 118.9 Test Methods and Specifications for Cementitious Backer Units.

American Society for Testing and Materials (ASTM)

- ASTM A 653 Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 ASTM C 473 Test Methods for Physical Testing of Gypsum Panel Products.
 ASTM C 475 Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 ASTM C 645 Specification for Nonstructural Steel Framing Members.
 ASTM C 665 Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 ASTM C 754 Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 ASTM C 834 Specification for Latex Sealants.
 ASTM C 840 Specification for Application and Finishing of Gypsum Board.
 ASTM C 919 Practice for Use of Sealants in Acoustical Applications.
 ASTM C 954 Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 ASTM C 1002 Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 ASTM C 1047 Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 ASTM C 1177 Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

ASTM C 1178	Specification for Glass Mat Water-Resistant Gypsum Backing Panel.
ASTM C 1396	Specification for Gypsum Board.
ASTM D 226	Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
ASTM D 3273	Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
ASTM E 90	Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
ASTM E 119	Test Methods for Fire Tests of Building Construction and Materials.
ASTM E 413	Classification for Rating Sound Insulation.
	<u>Gypsum Association (GA)</u>
GA-216	Specifications for the Application and Finishing of Gypsum Board.
GA-600	Fire Resistance Design Manual.
	<u>Underwriters Laboratories Inc. (UL)</u>
	Fire Resistance Directory.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings

Where gypsum drywall assemblies with fire-resistance ratings are shown on the Contract Drawings, installed assemblies shall be identical to those indicated by reference to GA File Numbers in GA-600 or to design designations in UL's *Fire Resistance Directory*, tested per ASTM E 119.

B. Sound Transmission Ratings

Where gypsum drywall assemblies with sound transmission ratings (STC rated) are shown on the Contract Drawings, installed assemblies shall be identical to those tested per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing agency, and identical to those assemblies where indicated by reference to GA File Numbers in GA-600.

1.04 ENVIRONMENTAL REQUIREMENTS

A. General

Comply with the following ASTM C 840 requirements for environmental conditions before, during and after application of gypsum board:

1. Room Temperatures

For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F. For adhesive attachment and for finishing of gypsum board, maintain not less than 50 deg F for 48 hours before application and continuously after until dry. Do not exceed 95 deg F room temperature when using temporary heat sources.

2. Ventilation

Ventilate building spaces as required to remove excess water for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too-rapid drying.

- B. Install gypsum drywall products after installation areas are enclosed and meet requirements of 1.04 A.1 and 2.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility

1. Obtain steel framing members for gypsum board assemblies from a single manufacturer.
2. Obtain each type of gypsum board and other panel products, including joint treatment materials, from a single manufacturer.
3. Obtain trim accessories from either the same manufacturer that supplies gypsum board or from a manufacturer acceptable to gypsum board manufacturer.

B. Mock-ups

Prior to finishing gypsum board assemblies, prepare field mock-up for review and acceptance by the Engineer. Mock-ups shall demonstrate qualities of materials and execution. Mock-ups accepted by the Engineer may be incorporated into the finished Work.

1. Prepare mock-ups of the following:
 - a. Exposed Locations: Each level of gypsum board finish in accordance with 3.03 H.
2. Mock-up Size: Minimum 100 sq. ft. in surface area.
3. Simulate finished lighting conditions for review of in-place Work to receive a Level 4 or 5 finish.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original unopened packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside, under cover and in a manner to keep them dry, protected from weather, freezing, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
- C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect trim accessories from being bent or damaged.

1.07 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements, furnish and install products by one of the following, or approved equal:

A. Non-Load-Bearing Steel Framing and Accessories

Clark Steel Framing Systems, Middletown, OH
Deitrich Metal Framing, Inc., div. of Worthington Industries Co., Pittsburgh, PA
Marino\WARE, South Plainfield, NJ
Super Stud Building Products, Inc., Astoria, NY

B. Gypsum Board and Related Products

BPB America Inc., Tampa, FL
G-P Gypsum Corp., Atlanta, GA
National Gypsum Co., Charlotte, NC
United States Gypsum Co., Chicago, IL

2.02 MATERIALS

A. Wall/Partition Framing Materials

1. General

Sizes and spacing of steel framing members shall be as shown on the Contract Drawings, but not less stringent than required to comply with ASTM C 754 under the following deflection and uniform lateral loading conditions:

- a. Maximum Deflection: $L/240$ at 5 lbf per square foot; except $L/360$ at 5 lbf per square foot where framing supports panels products finished with tile, stone, lath, plaster or similar inflexible materials.
- b. Material: Corrosion resistant steel complying with ASTM C 645; 0.0179 inch minimum base metal thickness (25 gage), unless otherwise required for abuse-resistant assemblies or other special purposes shown on the Contract Drawings.
- c. Protective Coating: G40 hot-dip galvanized per ASTM A 653, unless otherwise specified.

2. Steel Studs and Runners (Track)

- a. Studs: ASTM C 645; size (web depth) as shown on the Contract Drawings.
- b. Runners (Track): ASTM C 645; match studs.

- (1) Deflection Track: 0.0312 inch minimum base metal thickness (20 gage) with 2 inch flanges, for use as top runner abutting underside of floor construction where double runner is shown on the Contract Drawings.

3. System Accessories

- a. Steel Rigid Furring Channels

Hat-Shaped Channel: ASTM C 645.

b. Steel Resilient Furring Channels

Manufacturer's standard product designed to reduce sound transmission through wall partitions and ceilings; 1/2 inch deep channel of configuration shown on the Contract Drawings.

c. Cold-Rolled Furring Channels

U-shaped channel; 0.0538 inch minimum base metal thickness (16 gage), minimum 1/2 inch wide flanges; of depth as shown on the Contract Drawings.

d. Furring Brackets

Serrated-arm type, adjustable; 0.0329 inch minimum base metal thickness (20 gage), designed for screw attachment of steel studs used for furring and steel rigid furring channels to interior side of exterior masonry walls.

e. Z-Furring Members

Z-shaped channel for attachment of gypsum board to concrete or masonry walls; G60 hot-dip galvanized coating per ASTM A 653; of depth required to accommodate insulation of thickness shown on the Contract Drawings.

f. Flat Strap and Backing Plate

Manufacturer's standard sheet steel products for blocking and bracing, in lengths and widths as shown on the Contract Drawings.

B. Gypsum Board

1. General

Type, thickness and edge configuration as indicated below, for use where shown on the Contract Drawings, in maximum lengths available to minimize end-to-end butt joints.

a. Thickness: As shown on the Contract Drawings.

b. Edges: Tapered and featured (rounded or beveled) for prefilling.

c. Gypsum board used as backing board or in multi-layer applications shall be board type as shown on the Contract Drawings, 5/8 inch thick, unless otherwise shown, with square, non-tapered or V-tongue and groove edges.

2. Regular Gypsum Wallboard: ASTM C 1396.

3. Type X: ASTM C 1396; for use in fire-resistant rated assemblies and where shown.

4. Special Type X: ASTM C 1396; with improved fire protection qualities over standard Type X, for use in fire-resistant rated assemblies and where shown.

5. Flexible Type: ASTM C 1396; more flexible than regular gypsum wallboard, 1/4 inch thick, for forming curved walls.

6. Water-Resistant Gypsum Backing Board: ASTM C 1396, core type as required by fire-resistance rated assembly indicated.

7. Moisture- and Mold-Resistant Type: ASTM C 1396, or ASTM C 1396 and ASTM C 1177; for use at interior of exterior walls and where shown, with Type X core where required or where shown; ASTM C 473 average water absorption maximum of 5 percent by weight after 2 hour immersion; ASTM D 3273 mold resistance average panel score minimum of 8.

- a. Products: Subject to compliance with requirements, furnish and install one of the following products, or approved equal:

DensArmor Plus Interior Guard; G-P Gypsum Corp., Atlanta, GA
Gold Bond XP Wallboard; National Gypsum Co., Charlotte, NC
Humitek; United States Gypsum Co., Chicago, IL

8. Abuse-Resistant Type: ASTM C 1396; with improved resistance to surface abrasion, indentation and through-penetration impact over regular gypsum board, for use where shown, with Type X core where required or where shown.

- a. Products: Subject to compliance with requirements, furnish and install one of the following products, or approved equal:

ToughRock Abuse-Resistant; G-P Gypsum Corp., Atlanta, GA
Hi-Abuse; National Gypsum Co., Charlotte, NC
Sheetrock Abuse-Resistant; United States Gypsum Co., Chicago, IL

C. Tile Backer Units

1/2 inch thick, in manufacturer's standard width but not less than 32 inches, in maximum lengths available to minimize end-to-end butt joints. Subject to compliance with requirements, furnish one of the following products, or approved equal:

1. Cementitious Backer Products: ANSI A118.9:

WonderBoard; Custom Building Products, Seal Beach, CA
Util-A-Crete Concrete Backer Board; FinPan, Inc., Hamilton, OH
Hardibacker 500; James Hardie Building Products, Inc., Mission Viejo, CA
DUROCK Brand Cement Board; United States Gypsum Co., Chicago, IL

2. Gypsum Panel Products: ASTM C 1178, or ASTM C 1178 and ASTM C 1278:

DensShield Tile Guard; G-P Gypsum Corp., Atlanta, GA
Fiberock Aqua-Tough; United States Gypsum Co., Chicago, IL

D. Drywall Trim Accessories

1. Cornerbead, edge trim and control joints: ASTM C 1047.
2. Materials: Formed, steel sheet zinc-coated by the hot-dip process or rolled zinc; may be fabricated in combination with paper for use with paper-faced gypsum board only.
3. Configuration: Face flanges formed to receive joint compound and as indicated by reference to accessories depicted in ASTM C 1047, Fig. 1.

E. Joint Treatment Materials

Comply with ASTM C 475 for gypsum board installation and with the recommendations of both the manufacturers of panel products and of joint treatment materials for each application shown on the Contract Drawings.

1. Joint Tape
 - a. Paper-Faced Gypsum Board: Paper reinforcing tape.
 - b. Glass Mat Gypsum Board: Glass mesh tape, mesh size 10 by 10.
 - c. Cementitious Backer Units: Polymer-coated, alkali-resistant, open glass fiber mesh.
2. Joint Compound
 - a. Setting-Type Joint Compound for Gypsum Board: Factory packaged, job-mixed, chemical-hardening powder product formulated for uses indicated.
 - (1) Where setting-type joint compound is indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compound applied over it.
 - (2) For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer.
 - (3) For filling joints and treating fasteners of moisture-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer.
 - (4) For topping compound, use sandable formulation.
 - b. Drying-Type Joint Compound for Gypsum Board: Factory packaged vinyl based product complying with the following requirements for formulation and intended use:
 - (1) Ready-Mixed Formulation: Factory mixed product.
 - (2) Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
 - (3) Topping compound formulated for fill (second) and finish (third) coats.
 - (4) All-purpose compound formulated for both taping and topping compounds.
 - c. Joint Compound for Glass-Mat Faced Gypsum Board: Setting type, for use with glass mesh joint tape.
 - d. Joint Compound for Cementitious Backer Units: Material recommended by cementitious backer unit manufacturer.

F. Acoustical Sealant

1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard non-sag, skinning, paintable, nonstaining, gunnable latex sealant complying with ASTM C 834 and the following requirements:
 - a. Product shall be effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by test representative assemblies per ASTM E 90.

2. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.
3. Products: Subject to compliance with sound transmission and fire-resistance rating requirements, furnish and install one of the following, or approved equal:
 - a. Acoustical Sealant for Exposed and Concealed Joints

AC-20 FTR; Pecora Corp., Harleysville, PA
Tremflex 834; Tremco Inc., Beachwood, OH
SHEETROCK Acoustical Sealant; United States Gypsum Co., Chicago, IL
 - b. Acoustical Sealant for Concealed Joints

BA-98; Pecora Corp, Harleysville, PA
Tremco Acoustical Sealant; Tremco Inc., Beachwood, OH
SHEETROCK Acoustical Sealant; United States Gypsum Co., Chicago, IL

G. Miscellaneous Materials

1. Isolation Strips

ASTM D 226, Type 1, nonperforated 15 lb. asphalt saturated organic felt, or 1/8 inch thick, adhesive-backed, closed-cell vinyl foam gasket in widths as required to suit stud size.
2. Fasteners for Steel Framing

Type, material, size, corrosion resistance, pull-out resistance and other properties as required to fasten steel framing and furring members securely to each other and to substrates; complying with the recommendations of steel framing manufacturer for applications shown on the Contract Drawings.
3. Fasteners for Gypsum Board
 - a. ASTM C 1002: Type S steel drill screws for fastening gypsum board to steel members less than 0.033 inch thick and for fastening gypsum board to gypsum board.
 - b. ASTM C 954: Steel drill screws for fastening gypsum board to steel members from 0.033 to 0.112 inch thick.
 - c. For Fastening Cementitious Backer Units: Corrosion resistant coated steel drill screws of size and type recommended by unit manufacturer.
4. Laminating Adhesive

Special adhesive or joint compound specifically recommended by gypsum board manufacturer for laminating gypsum boards.
5. Spot Grout

ASTM C 475, setting-type joint compound recommended by joint compound manufacturer for spot-grouting hollow metal door frames.

6. Fastening Adhesive for Metal

Special adhesive recommended by gypsum board manufacturer for laminating gypsum boards to steel framing.

7. Sound Attenuation Blankets

Unfaced mineral fiber blanket insulation produced by combining mineral fibers manufactured from glass, slag or rock with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing). Comply with product flame resistance requirements where used in fire-resistance rated assemblies.

PART 3. EXECUTION

3.01 EXAMINATION

Examine substrates to which gypsum board assemblies attach or abut, including installed hollow metal frames and structural framing for compliance with requirements for installation tolerances and other conditions affecting gypsum board assembly performance. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Before sprayed-on fireproofing is applied, attach offset anchor plates or ceiling runners (tracks) to surfaces shown on the Contract Drawings to receive sprayed-on fireproofing.
1. Where offset anchor plates are required, install continuous units formed from hot-dip galvanized steel plate of thickness shown, attached to building structure with fasteners spaced not more than 24 inches on center. Secure ceiling runners to offset plates with screws spaced not more than 24 inches on center.

3.03 INSTALLATION

A. General

1. Steel Framing Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
2. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.
3. Do not bridge building expansion joints with framing system; frame both sides of joints with furring and other support as shown on the Contract Drawings.
4. Construct fire-resistance rated partitions, and column, beam, girder and truss enclosures when required, to meet or exceed the rating shown on the Contract Drawings. Protect openings, perimeters and joints
5. Construct sound transmission rated partitions, when required, to meet or exceed the STC rating shown on the Contract Drawings.

B. Wall/Partition Framing Systems Installation

1. Installation Tolerances

Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing members.

2. Install supplementary framing, blocking and bracing at end terminations in the Work and to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings and similar items to comply with details shown or, if not otherwise shown, to comply with applicable printed recommendations of gypsum board manufacturer.
3. Where steel studs are installed directly against exterior walls, install 15 lb. asphalt felt or 1/8 inch thick foam gasket isolation strips between studs and wall.
4. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Install slip or cushioned type joints to attain lateral support and avoid axial loading.
5. Install runner tracks at floors and overhead supports.
6. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue partition framing over doors and openings, and around ducts penetrating partitions above ceiling.
7. Space studs 16 inches on center.
8. Frame door openings to comply with details shown or, if not shown, to comply with applicable written recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for jack studs) at head and secure to jamb studs. Install 2 studs at each jamb.
9. Extend vertical jamb studs through suspended ceilings and attach to underside of structural support system above or to substrates above suspended ceilings.
10. Frame openings other than door openings to comply with details shown or, if not shown, in the same manner as required for door openings or as recommended by gypsum board manufacturer. Install framing below sills of openings to match framing required above door heads.
11. Space wall furring members 16 inches on center. Fasten to concrete or masonry walls with special screws or other fasteners designed for attachment to masonry, spaced 24 inches on center.

C. Gypsum Board Installation

1. Install sound attenuation blankets, where shown on the Contract Drawings and where required for sound transmission rating, prior to installing gypsum boards unless blankets are readily installed after boards have been installed on one side of partition.
2. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.

3. Locate either edge or end joints over supports. Position boards so that like edges abut; do not place tapered edges against mill-cut or field-cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
4. Install wall/partition boards vertically without horizontal end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
5. Locate exposed end-butt joints as far from center of walls as possible, and stagger not less than 12 inches in alternate courses of board.
6. Form control joints and expansion joints with space between edges of adjoining boards, prepared to receive trim accessories. Make only control type joints where joints occur at corners of framed openings.
7. Attach gypsum board to supplementary framing and blocking where installed for additional support at openings and cutouts.
8. Spot grout hollow metal door frames for all doors. Apply spot grout at each jamb anchor clip and immediately insert gypsum boards into frames.
9. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above finished ceiling line), except in chase walls that are braced internally.
 - a. Concealed coverage may be accomplished with gypsum board pieces of not less than 8 sq. ft. in area, except where concealed application is required for sound transmission or fire ratings, or for smoke barriers.
 - b. Where partitions intersect open concrete coffers, concrete joists and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum boards to fit profile formed by structural members; allow 1/4 to 3/8 inch joint width for sealant installation. Fit boards around all through penetrations.
10. Isolate perimeter of drywall partitions at structural abutments. Provide 1/4 inch to 1/2 inch space and trim edge with J-type, semi-finishing edge trim. Seal joints with acoustical sealant.

D. Methods of Gypsum Drywall Application

1. Single-Layer Application
 - a. Partitions/Walls: Apply gypsum board vertically (parallel to framing), in sheet lengths that will minimize end joints. At stairwells and other high, multistory walls, install boards horizontally.
 - b. Z-Furring Members: Apply gypsum board vertically (parallel to framing) with a minimum of end joints. Locate edge joints of base layer over furring members.
 - c. Fastening Method: Apply gypsum boards to supports with screws.
2. Multilayer Application
 - a. Partitions/Walls: Apply gypsum board base layers as shown on the Contract Drawings and apply gypsum board face layer vertically (parallel to framing), with joints of base layers located over stud or furring member and joints of face-layer offset at least one stud or furring member from base-layer joints. Stagger joints on opposite sides of partitions.

- b. Z-Furring Members: Apply base layer vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - c. Fastening Method: Fasten base layer with screws and secure face layer with adhesive and supplementary fasteners; or fasten base and face layers separately with screws to comply with fire-resistance rated assembly requirements.
3. Wall Tile Substrates: On substrates to receive thin-set ceramic tile and similar rigid applied wall finishes, install cementitious backer units to comply with ANSI A 108.11 and install gypsum panel products to comply with manufacturer's instructions.

E. Direct-Bonding to Substrate

Comply with gypsum board manufacturer's recommendations where gypsum boards are indicated as directly adhered to a substrate (other than studs, furring members or base layer of gypsum board). Temporarily brace or fasten gypsum boards until fastening adhesive has set.

F. Acoustical Sealant Installation

Apply acoustical sealant where sound transmission rated drywall Work is shown (STC rating), including multiple-layer and resilient furring Work, in compliance with sealant manufacturer's written instructions.

1. Clean substrate surfaces by brushing and remove loose particles to produce a clean, sound substrate capable of developing optimal bond with joint sealant
2. Seal perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of beads. Close off sound-flanking paths around or through the Work, including sealing of partitions above acoustical ceilings.
3. Tool joints flush, clean excess material and allow sealant to cure per sealant manufacturer's recommendations prior to final decoration.

G. Installation of Drywall Trim Accessories

1. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Install type with face flange to receive joint compound. Install L-type trim where Work is tightly abutted to other Work.
2. For trim with flanges intended for fasteners, anchor trim with same fasteners used to attach gypsum board to framing supports. Otherwise, anchor trim flanges in accordance with gypsum board manufacturer's instructions and recommendations.
3. Install metal cornerbead at outside corners of drywall Work.
4. Install metal control joint where shown on the Contract Drawings per ASTM C 840 requirements.

H. Finishing of Gypsum Drywall

1. General

- a. Finish Level Standard: ASTM C 840.
- b. Apply compound treatment at gypsum board joints (vertical and horizontal), flanges of trim accessories, penetrations, fastener heads and elsewhere as required to prepare Work for final decoration. Prefill open joints and rounded or beveled edges, if any, using type of compound recommended by gypsum board manufacturer.
- c. Apply joint tape at joints between gypsum boards using taping joint compound, except where trim accessories are shown on the Contract Drawings.

2. Finish Levels

Finish gypsum boards to the levels shown on the Contract Drawings, performed in accordance with ASTM C 840.

3.04 PROTECTION

- A. Furnish protection and maintain conditions, in a manner acceptable to the Engineer, to ensure that gypsum drywall Work shall be without damage or deterioration at time of issuance of the Certificate of Final Completion.
- B. Remove and replace wet or otherwise damaged board products.

END OF SECTION

**SECTION 09250
GYPSUM DRYWALL**

**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

- 09250D01 Manufacturer's product specifications and installation instructions for each steel framing system and gypsum drywall component, and other data showing compliance with the requirements of this Section.

Certificates

- 09250E01 Fire Test Response Reports: Manufacturer's certification from a qualified independent testing and inspecting agency substantiating each gypsum board assembly's required fire-resistance rating.

END OF APPENDIX "A"

09250 p 14

DIVISION 9

SECTION 09503

LAY-IN PANEL ACOUSTICAL CEILINGS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for exposed grid lay-in panel acoustical ceilings, including suspension systems and accessories.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

- | | |
|-------------|---|
| | <u>American Society for Testing and Materials (ASTM)</u> |
| ASTM C 423 | Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method. |
| ASTM C 635 | Specification for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings. |
| ASTM C 636 | Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels. |
| ASTM E 84 | Test Method for Surface Burning Characteristics of Building Materials. |
| ASTM E 119 | Test Methods for Fire Tests of Building Construction and Materials. |
| ASTM E 413 | Classification for Rating Sound Insulation. |
| ASTM E 1110 | Classification for Determination of Articulation Class. |
| ASTM E 1111 | Test Method for Measuring the Interzone Attenuation of Ceiling Systems. |
| ASTM E 1264 | Classification for Acoustical Ceiling Products. |
| ASTM E 1414 | Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum. |
| ASTM E 1477 | Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers. |
| | <u>Ceilings and Interior Systems Construction Association (CISCA)</u> |
| | Acoustical Ceilings Use & Practice. |
| | <u>Underwriters Laboratories Inc. (UL)</u> |
| | Fire Resistance Directory. |

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Fire Performance Characteristics

1. Fire-Resistance Ratings

When required, hourly-rated fire-resistant acoustical ceiling systems are shown by reference to design designation in UL's *Fire Resistance Directory*, or in the listing of another qualified testing and inspecting agency for floor, roof or beam assemblies in which acoustical ceilings function as a fire protective membrane.

- a. Test Standard: ASTM E 119.
- b. Furnish and install protection materials for lighting fixtures and air ducts to comply with requirements of rated assembly shown on the Contract Drawings.

2. Surface Burning Characteristics

Acoustical ceiling units shall comply with ASTM E 1264 for Class A, as determined by testing identical products in accordance with ASTM E 84 by a testing and inspecting agency acceptable to the Engineer. Components shall display appropriate marking of applicable testing and inspecting agency.

- a. Flame Spread: 25 or less.
- b. Smoke Developed: 50 or less.

B. Design Criteria and Standards for Suspension System

1. For Work in New York City, metal suspension systems shall conform to the Building Code of the City of New York except that metal deck tabs shall not be used for top hanger attachment.

- a. In addition, the ceiling suspension system shall conform to the seismic design requirements contained in the Building Code of the City of New York, Local Law 17-95, using an effective peak velocity-related acceleration of 0.15, except revise Table 23-P by adding after II.3:

4. Anchorage for suspended ceilings weighing more than 4 psf [Value of C_p]
without the weight of light fixtures. .75

2. For Work in New Jersey, metal suspension systems shall conform to ASTM C 635 and ASTM C 636 except for design and installation of hangers and their top and bottom connections. For the design and installation of hangers and their top and bottom connections, the above ASTM standards shall be revised as follows:

- a. The hanger and its connections shall safely carry the total supported load plus 200 pounds located at midspan.
- b. Hangers for suspending carrying channels or main runners shall be 1/4 inch diameter galvanized steel rods, or 1/8 inch by 1 inch galvanized steel flat bars or No. 9 gage galvanized, soft annealed, mild steel wire.
- c. In addition, the ceiling suspension system shall conform to the seismic design requirement contained in the NJ Uniform Construction Code and its subcode the IBC/2000. Seismic Design Category shall be as shown on the Contract Drawings.

1.04 ENVIRONMENTAL REQUIREMENTS

- A. Ensure that the following space enclosure conditions have been met before installing interior acoustical ceilings:
 - 1. Space is enclosed and weatherproof.
 - 2. Wet-work in space, including concrete, terrazzo, plastering and painting, is completed and nominally dry.
 - 3. Work above ceilings is complete.
 - 4. Ambient conditions of temperature and humidity are continuously maintained at values near those to be used for final occupancy.
 - 5. When a pressurized return air plenum is used, operate the ventilation system 48 hours before installing acoustical ceiling panels to cleanse ducts.

1.05 QUALITY ASSURANCE

- A. When required by Appendix "A" or when required by the Contract Drawings, submit calculations for the ceiling suspension system. Calculations shall be prepared and sealed by a professional engineer, licensed in the state where the Work is to be performed, indicating compliance with the Design Criteria.
- B. Single Source Responsibility

Obtain acoustical panel units through one source from a single manufacturer. Obtain suspension system components through one source from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical ceiling units to construction site in original, unopened packages. Store them in a fully enclosed space, protected against damage from moisture, direct sunlight, surface contamination and other causes.
- B. Before installing acoustical ceiling units, allow them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical ceiling units carefully to avoid chipping.

1.07 MAINTENANCE

- A. Extra Materials

Where requirement for extra materials is shown on the Contract Drawings, deliver to the Engineer, prior to issuance of the Certificate of Final Completion, extra materials described below matching products installed. Package with protective covering for storage and identify with appropriate labels.

- 1. Acoustical Ceiling Units: Full size units in quantity equal to 2 percent of installed quantity.
- 2. Exposed Suspension System Components: Each component in quantity equal to 2 percent of installed quantity of each component.

1.08 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements of this Section, furnish and install products of the following manufacturers, or approved equal:

A. Acoustical Ceiling Panels

Armstrong World Industries, Inc., Lancaster, PA
BPB America Inc., Tampa, FL
USG Interiors Inc., Chicago, IL

B. Metal Suspension Systems

Armstrong World Industries, Inc., Lancaster, PA
BPB America Inc., Tampa, FL
Chicago Metallic Corp., Chicago, IL
USG Interiors, Inc., Chicago, IL

2.02 MATERIALS

A. Standards for Acoustical Ceiling Panels

1. Manufacturer's standard units complying with ASTM E 1264 classifications as designated by reference to criteria for type, pattern, edge and joint details, and the following:
 - a. Noise Reduction Coefficient (NRC) Ratings: Established in accordance with ASTM C 423.
 - b. Articulation Class (AC) Ratings for open-plan spaces, if any: Established in accordance with ASTM E 1111, classified per ASTM E 1110.
 - c. Ceiling Attenuation Class (CAC) Ratings: Determined in accordance with ASTM E 1414, classified per ASTM E 413, with ceilings continuous at partitions and supported by a metal suspension system of type appropriate for ceiling unit of configuration shown.
 - d. Light Reflectance (LR) Coefficient: Determined in accordance with ASTM E 1477.
2. Colors, Textures and Patterns

Furnish products to match appearance characteristics shown or, if not otherwise shown, as selected by Engineer from manufacturer's standard colors, surface textures and patterns available for acoustical ceiling units of quality designated.

3. Acoustical Ceiling Panels

See Contract Drawings for acoustical ceiling unit criteria for panel size, thickness, type, texture, pattern, finish, NRC or AC range, CAC range, light reflectance, edge details and antimicrobial treatment, if any. Acoustical ceiling panel configuration shall be as shown on the Contract Drawings.

B. Metal Suspension Systems

1. Manufacturer's standard system roll-formed from hot-dip galvanized cold rolled steel sheet, or as otherwise shown on the Contract Drawings. Suspension system type and details shall be as shown on the Contract Drawings.

2. Finish

Manufacturer's standard factory-applied finish for type of system shown on the Contract Drawings. For exposed members and accessories with painted finish, color shall be as shown on the Contract Drawings or, if not shown, as selected by the Engineer from the manufacturer's full range of standard colors.

a. High Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high humidity locations are shown on the Contract Drawings.

C. Accessories

1. Edge Moldings and Trim

Metal or extruded aluminum of types and profiles as shown on Contract Drawings or, if not shown, manufacturer's standard molding for edges and penetrations of ceiling which fits with type of edge detail and suspension system shown.

- a. For circular penetrations of ceilings, if any, furnish edge moldings fabricated to diameter required to fit penetration exactly.
- b. For narrow faced suspension systems, furnish suspension system manufacturer's standard edge moldings which match width and configuration of exposed runners.
- c. For lay-in panels with reveal edge details, provide stepped edge molding which forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

2. Hold-Down Clips

Where shown on the Contract Drawings, furnish manufacturer's standard hold-down clips spaced system spaced per manufacturer's recommendations, design to prevent ceiling panel flutter.

3. Impact Clips

Where shown on the Contract Drawings, furnish manufacturer's standard impact clip system design to absorb impact forces against lay-in panels.

4. Acoustical Sealant: As recommended by manufacturer of acoustical ceiling panel.

PART 3. EXECUTION

3.01 PREPARATION

A. Coordination

Furnish layouts for inserts, clips or other supports required to be installed by other trades for support of acoustical ceilings. Coordinate layout and installation of acoustical ceiling units and suspension system components with other Work supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system components, if any, and partition system, if any.

B. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other Work.

C. Measure each ceiling area and establish layout of acoustical ceiling units to balance border widths at opposite edges of each ceiling, avoiding use of less-than-half-width panels at borders. Comply with approved reflected ceiling plan Shop Drawings.

3.02 INSTALLATION

A. General

1. Install materials in accordance with the manufacturer's printed instructions, and in compliance with governing regulations, fire-resistance rating requirements shown on Contract Drawings and CISCA Standards applicable to the Work.
2. Suspension System Installation Standard: ASTM C 636.
3. Arrange acoustical units and orient directionally-patterned units, if any, in manner shown on approved of reflected ceiling plan Shop Drawings.

B. Suspended Lay-In Panel Acoustical Ceiling Installation

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum which are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions; offset resulting horizontal force by bracing, countersplaying or other equally effective means.
 - a. Locate hangers not less than 6 inches from each end and spaced 4 feet along each carrying channel or direct-hung runner, unless otherwise shown. Support hangers only from building structural members. Do not attach hangers to steel deck tabs, to steel roof deck or permanent metal forms. Level to tolerance of 1/8 inch in 12 feet.
 - b. Secure hangers by bolting either directly to structures or to inserts, eye-screws or other devices which are secure and appropriate for substrate, and which will not deteriorate or fail with age, corrosion or elevated temperatures.
2. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent or kinked suspension members.

3. Install edge moldings at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units. Miter corners and connect securely where moldings intersect.
 - a. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 - b. Screw-attach moldings to substrate at intervals not exceeding 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12 feet. Use concealed fasteners on moldings and trim.
4. Install acoustical panels in coordination with suspension system, with edges undamaged, resting on and concealed by support suspension members, and supported by wall moldings. Scribe and cut panels to fit accurately at borders and at penetrations.
 - a. Install hold-down clips in areas where shown on the Contract Drawings, or required by governing regulations or for fire-resistance ratings. Space as recommended by ceiling panel manufacturer.
 - b. Install impact clips in areas where shown on the Contract Drawings. Space as recommended by ceiling panel manufacturer.
5. Finished Work shall be free from dents, tool marks, warpage, buckles, open joints, misaligned joints, edge damage, soiling, smudges, discolorations or other defects.

3.03 FIELD QUALITY CONTROL

Site Inspection

Lighting shall be in place and operational prior to inspection of acoustical panel ceiling systems so that lighting conditions upon inspection correspond to final building occupancy conditions.

3.04 ADJUSTING AND CLEANING

Clean exposed surfaces of acoustical ceilings, including trim, edge moldings and suspension members. Comply with the manufacturer's written instructions for cleaning and touch-up of minor finish damage. Remove and replace Work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, at no cost to the Authority.

END OF SECTION

SECTION 09503
LAY-IN PANEL ACOUSTICAL CEILINGS

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

- 09503A01 Reflected ceiling plans, prepared for installation purposes, drawn accurately to 1/4 inch = 1 foot - 0 inches scale and coordinated with related mechanical, electrical, communication fire suppression and other Work above, penetrating, or connected to acoustical ceiling. Show ceiling suspension members, method of anchorage to building structure of hangers and ceiling-mounted Work including light fixtures, diffusers, grilles and special moldings. Show trim configuration, molding details and material type.

Samples

- 09503C01 Minimum 12-inch square corner samples of each acoustical panel type, pattern and color.
- 09503C02 Set of 12-inch long samples of exposed runners and moldings for each color and system type required

Product Data

- 09503D01 Manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

Certificates

- 09503E01 Submit certificates from manufacturers of acoustical ceiling units and suspension systems certifying that their products comply with the requirements of this Section.

Calculations

- 09503H01 Where required, submit structural calculations for suspension system and connections, signed and sealed by a professional engineer, licensed in the state in which the Work is to be performed.

END OF APPENDIX "A"

09503 - B

DIVISION 9

SECTION 09660

RESILIENT TILE FLOORING

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for vinyl composition floor tile and/or homogenous (solid) vinyl floor tile, vinyl wall base and accessories.
- B. Furnish extra stock in accordance with 2.02 I.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

<u>American Society for Testing and Materials (ASTM)</u>	
ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials.
ASTM E 648	Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
ASTM E 662	Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
ASTM F 1066	Specification for Vinyl Composition Floor Tile.
<u>Federal Specifications (FS)</u>	
SS-W-40	Wall Base: Rubber and Vinyl Plastic.
SS-T-312	Tile, Floor: Asphalt, Rubber, Vinyl, Vinyl Composition.
RR-T-650	Treads, Metallic and Non-Metallic.
<u>National Fire Protection Association (NFPA)</u>	
Standard 253	Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.03 ENVIRONMENTAL REQUIREMENTS

- A. Maintain minimum temperature of 70 deg F (21 deg C) in spaces to receive tiles for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F (13 deg C).
- B. Do not install tiles until they are at the same temperature as the space where they are to be installed.
- C. Close spaces to traffic during tile installation.

1.04 QUALITY ASSURANCE

A. Single-Source Responsibility for Floor Tile

Obtain each type, color, and pattern of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

B. Fire Test Performance

Provide resilient flooring which complies with the following fire test performance criteria as certified by the manufacturer or an independent testing laboratory acceptable to the Engineer.

1. Critical Radiant Flux (CRF): Not less than 0.45 watts per sq. cm. per ASTM E 648, or NFPA 253.
2. Flame Spread: Not more than 75 per ASTM E 84.
3. Smoke Density: Less than 450 per ASTM E 662.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver tiles and installation accessories to the construction site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, contract identification, and shipping and handling instructions.

B. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 50 deg F (10 deg C) and 90 deg F (32 deg C).

C. Store tiles on flat surfaces. Move tiles and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements of this Section, furnish and install products by one of the following, or approved equal:

Armstrong World Industries, Inc.; Lancaster, PA
Azrock Industries, Inc.; San Antonio, TX
Kentile Floors, Inc.; South Plainfield, NJ

2.02 MATERIALS

A. Provide materials, colors and patterns shown on the Contract Drawings. If colors and patterns are not shown, then as selected by Engineer from manufacturer's standards.

- B. Tile Flooring, as listed below, where shown on the Contract Drawings:
1. Vinyl Composition Tile (VCT)
Conform to ASTM F 1066, Composition 1 (asbestos free); 12-inch x 12-inch x 1/8-inch gage, unless otherwise shown on the Contract Drawings.
 2. Vinyl Tile (VT)
Conform to FS SS-T-312, Type III; 12-inch x 12-inch x 1/8-inch gage, unless otherwise shown on the Contract Drawings.
- C. Vinyl Wall Base
Conform to FS SS-W-40, Type II; 4 inches high x 1/8-inch gauge, unless otherwise shown on the Contract Drawings. Vinyl wall base shall be coved at tile areas, toeless at carpet areas, with matching end stops and preformed or molded corner units.
- D. Stair Covering, as listed below, where shown on the Contract Drawings
1. Vinyl Stair Treads
Conform to FS RR-T-650, Type B; nominal 1/4-inch tapered thickness, square nose, single piece for full width and depth of tread.
 2. Vinyl Stair Risers
1/8-inch thick, single piece for full width and height of riser.
 3. Vinyl Stringer Sheet: 0.080-inch thick.
- E. Resilient Edge Strips
1/8-inch thick or as required to match tile thickness, homogeneous vinyl or rubber composition, tapered or bullnose edge, color to match flooring, or as selected by Engineer from standard colors available; not less than 1 inch wide.
- F. Adhesives (Cements)
Water-resistant type recommended by flooring manufacturer to suit material and substrate conditions.
- G. Concrete Slab Primer
Non-staining type as recommended by flooring manufacturer.
- H. Trowelable Underlayments and Patching Compounds
Latex-modified, portland-cement-based formulation provided or approved by tile manufacturer for applications shown on the Contract Drawings.

I. Extra Stock

Unless otherwise shown on the Contract Drawings, deliver to the Engineer prior to issuance of the Certificate of Final Completion, the following materials from the same manufactured lot as materials furnished for the Work of this Section. Deliver in sealed protective packaging marked with Contract Number and identification of contents:

1. Flooring

Not less than one box for each 50 boxes or fraction thereof used in the Work of this Section, for each type, color and pattern.

2. Base, Stair Tread, Stair Riser and Edge Strip

Not less than 15 linear feet of each item.

PART 3. EXECUTION

3.01 EXAMINATION

- A. Inspect subfloor surfaces to determine that they are satisfactory. A satisfactory subfloor surface is defined as one that is smooth and free from cracks, holes, ridges, coatings preventing adhesive bond, and other defects impairing performance or appearance. Report significant defects, if any, and proposed method of repair to the Engineer in writing. If such defects are determined by the Engineer to be attributable to Work performed by the Contractor, they shall be repaired by the Contractor to the satisfaction of the Engineer and at no cost to the Authority.
- B. Perform bond and moisture tests on concrete subfloors to determine if surfaces are sufficiently cured and dry as well as to ascertain presence of curing compounds.
- C. Do not proceed with resilient flooring Work until subfloor surfaces are satisfactory.

3.02 PREPARATION

- A. Use trowelable leveling and patching compounds as recommended by resilient flooring manufacturer for filling small cracks, holes and depressions in subfloors.
- B. Remove coatings from subfloor surfaces that would prevent adhesive bond, including curing compounds, paint, oils, waxes and sealers incompatible with resilient flooring adhesives.
- C. Broom or vacuum clean substrates to be covered by tiles immediately before tile installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.
- D. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

3.03 INSTALLATION

A. General

Comply with tile manufacturer's installation directions and other requirements of this Section that are applicable to each type of tile installation included in this Contract.

- B. Where movable partitions are shown on the Contract Drawings, install resilient flooring before partitions are erected.
- C. Install resilient flooring and accessories after other finishing operations, including painting, have been completed. Do not install resilient flooring over concrete slabs until the latter have been cured and are sufficiently dry to achieve bond with adhesive as determined by resilient flooring manufacturer's recommended bond and moisture test.
- D. Install resilient flooring in strict compliance with manufacturer's printed instructions. Extend resilient flooring into toe spaces, door reveals, and into closets and similar openings.
- E. Scribe, cut and fit resilient flooring to permanent fixtures, built-in furniture and cabinets, pipes, outlets and permanent columns, walls and partitions.
- F. Maintain reference markers, holes, or openings that are in place or plainly marked on subfloor for future cutting by repeating markings on finished flooring. Use chalk or other nonpermanent, marking device.
- G. Install resilient flooring on covers for telephone and electrical ducts, and similar items occurring within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly cement edges to perimeter of floor around covers and to covers.
- H. Tightly cement resilient flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections. Hand roll resilient flooring at perimeter of each covered area to assure adhesion.
- I. Lay tile from center marks established with principal walls, discounting minor offsets, so that tiles at opposite edges of room area are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown on the Contract Drawings.
- J. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged, if so numbered. Cut tile neatly around all fixtures. Broken, cracked, chipped or deformed tiles shall not be used. Lay tile with grain running in one direction, unless otherwise shown on the Contract Drawings.
- K. Adhere tile flooring to substrate using full spread of adhesive applied in compliance with flooring manufacturer's directions.
- L. Hand roll tiles where required by tile manufacturer.

- M. Apply wall base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable, with preformed corner units, or fabricated from base materials with mitered or coped inside corners. Tightly bond base to substrate throughout length of each piece, with continuous contact at horizontal and vertical surfaces.
 - 1. On masonry surfaces, or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
- N. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at edges of flooring which would otherwise be exposed.

3.04 CLEANING AND PROTECTION

- A. Perform the following operations immediately upon completion of resilient flooring:
 - 1. Remove excess adhesive or other surface blemishes, using appropriate cleaner recommended by resilient flooring manufacturer.
 - 2. Vacuum floor thoroughly.
 - 3. Do not wash floor until time period recommended by resilient flooring manufacturer has elapsed to allow resilient flooring to become well-sealed in adhesive.
 - 4. Damp-mop floor, being careful to remove black marks and excessive soil.
 - 5. Protect flooring against damage during construction period to comply with resilient flooring manufacturer's directions.
 - 6. Apply protective floor polish to resilient flooring surfaces free from soil, excess adhesive or surface blemishes. Use commercially available, metal cross-linked, acrylic product acceptable to resilient flooring manufacturer.
 - 7. Protect resilient flooring against damage from rolling loads for initial period following installation by covering with plywood or hardboard. Use dollies to move stationary equipment or furnishings across floors.
 - 8. Cover resilient flooring with undyed, untreated building paper until final cleaning.
- B. Clean resilient flooring prior to issuance of the Certificate of Final Completion by method recommended by resilient flooring manufacturer.
 - 1. Strip protective floor polish, which was applied after completion of installation, prior to cleaning.
 - 2. Reapply floor polish after cleaning.

END OF SECTION

SECTION 09660
RESILIENT TILE FLOORING

APPENDIX "A"

SUBMITTALS

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

Samples

- 09660C01 Samples for initial selection purposes in form of manufacturer's color charts consisting of actual tiles or sections of tiles showing full range of colors and patterns available for each type of resilient floor tile, wall base, and accessory shown on the Contract Drawings.
- 09660C02 Four full-size samples of floor tile for each selected color and pattern for verification. Tile samples shall show the quality, full color range and texture. Two one-foot lengths of each base and stair material for each selected color for verification.

Product Data

- 09660D01 One copy of U.S. Department of Labor Material Safety Data Sheets (MSDS) for all hazardous chemicals utilized during Work of this Section.
- 09660D02 Manufacturer's technical data for each type of resilient flooring, wall base, and accessory, including installation and maintenance instructions.

Certificates

- 09660E01 Certifications required by 1.04 B.
- 09660E02 Certification by tile manufacturer that products supplied for tile installation comply with local regulations controlling use of volatile organic compounds (VOC's).

Spare Parts List

- 09660N01 Extra stock in accordance with 2.02 I.

END OF APPENDIX "A"

DIVISION 9
SECTION 09705
RESINOUS FLOORING

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for troweled and screeded aggregate epoxy mortar flooring.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	<u>American Society for Testing and Materials (ASTM)</u>
ASTM C 307	Tensile Strength of Chemical-Resistant Mortar, Grouts and Monolithic Surfacing
ASTM C 413	Absorption of Chemical-Resistant, Mortars, Grouts, and Monolithic
ASTM C 579	Compressive Strength of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes
ASTM C 580	Flexural Strength and Modulus of Elasticity of Chemical Resistant Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes
ASTM C 811	Surface Preparation of Concrete for Application of Chemical Resistant Resin Monolithic Surfacing
ASTM D 2047	Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine
ASTM D 2240	Rubber Property-Durometer Hardness
ASTM D 4060	Abrasion Resistance of Organic Coatings by the Taber Abraser

Military Specifications

MIL-D-3134 F	Deck Covering Materials
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1.03 ENVIRONMENTAL REQUIREMENTS

Maintain substrate temperature and room temperature before, during and after installation in compliance with flooring manufacturer's printed installation instructions. Provide adequate ventilation during application and curing periods.

1.04 QUALITY ASSURANCE

- A. Installer's qualifications: Resinous flooring shall be installed by an entity that has not less than five years experience and no less than five projects in the installation of flooring systems of an equal or greater complexity than those required for Work of this Section.

- B. Single Source Responsibility: Obtain primary resinous flooring materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer. Provide secondary materials only of type and from source recommended by manufacturer of primary materials.
- C. Pre-Installation Conference
 - 1. Contractor shall arrange a meeting not less than thirty days prior to starting Work.
 - 2. Attendance
 - a. Contractor
 - b. Engineer
 - c. Manufacturer/Installer's Representative

1.05 DELIVERY, STORAGE AND HANDLING

- A. Material shall be delivered to job site in new unopened containers with intact, factory-applied labels and checked by Contractor and entity performing the Work for completeness and shipping damage prior to job start.
- B. All materials used shall be factory, pre-weighed and pre-packaged in single, easy to manage batches to eliminate on-site mixing errors. No on-site weighing or volumetric measurements allowed.
- C. Material shall be stored in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 60 and 90 degrees Fahrenheit.

1.06 WARRANTY

- A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of 5 years from date of installation. Warranty shall insure complete replacement of defective areas without reduction for time and wear.

1.07 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements of this Section, manufacturers of products/systems which may be incorporated in the Work include, but are not limited to, the following:

Stonhard, Inc., USA; Maple Shade, NJ
Master Builders Technologies; Cleveland, OH
Dex-O-Tex Division/Crossfield Products Corp.; Roselle Park, NJ

2.02 MATERIALS

A. Resinous Flooring

Resinous flooring with coating is a nominal 20-25 mil thick membrane system comprised of a penetrating, two-component epoxy primer and a waterproof membrane (where shown on the Contract Drawings); followed by a nominal ¼ inch thick flooring system comprised of a penetrating, moisture tolerant, two-component epoxy primer, a high performance, three-component mortar consisting of epoxy resin, curing agent and selected, graded aggregates blended with inorganic pigments and a two-component, 100 percent solids, general service, epoxy coating.

B. Physical Properties:

Provide flooring system in which physical properties of topping including aggregate, when tested in accordance with standards or procedures referenced below, equal to or exceed the following:

1. Compressive Strength (ASTM C-579): 10,000 psi
2. Tensile Strength (ASTM C-307): 1,750 psi
3. Flexural Strength (ASTM C-580): 3,000 psi
4. Hardness (ASTM D-2240/Shore D. Durometer): 80-90
5. Indentation (MIL-D-3134F): No Indentation
6. Abrasion Resistance (ASTM D-4060, Taber Abrader CS-17 wheel; 1,000 gm load; 1,000 cycles): 0.11 gm. max. weight loss
7. Coefficient of Friction (ASTM D-2047): 0.6
8. Water Absorption (ASTM C-413): 0.3%

C. Waterproofing Membrane

Where shown on the Contract Drawings, provide manufacturer's neoprene or other similar waterproof membrane.

D. Joint Sealant Materials

Type produced by manufacturer of resinous flooring system for type of service and joint condition shown on the Contract Drawings.

E. Epoxy Grout Material

Grout or approved manufacturer's equal used for repairing deep holes, ruts and erosions in concrete floors and to change the level or pitch of floors in preparation for coating or over layer.

F. Provide silicon sand, as required by manufacturer, for use as grit.

2.03 CONSTRUCTION FEATURES

- A. Definitions: Resinous flooring includes a penetrating, moisture tolerant, two-component epoxy primer; a waterproof membrane (where shown on the Contract Drawings); and a three-component epoxy mortar, consisting of epoxy resin, curing agent and selected graded aggregates blended with inorganic pigments.

PART 3. EXECUTION

3.01 PREPARATION

- A. General: Perform preparations and cleaning procedures in, compliance with flooring manufacturer's printed instructions for particular substrate conditions shown on the Contract Drawings, and as herein specified.
- B. Concrete Substrate: Concrete preparation shall be by mechanical means and include use of a scabber, scarifier or shot blast machine for removal of bond inhibiting materials such as curing compounds or laitance.

3.02 APPLICATION

- A. General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at divider strips, sawn joints or other types of joints, where shown on the Contract Drawings or where required.
- B. Carefully mix and prepare materials used in resinous flooring to comply with manufacturer's printed instructions.
- C. For Applications Where Water Proof Membrane is Shown on the Contract Drawings:
 - 1. Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rate.
 - 2. Mix and apply membrane over previously primed substrate with strict adherence to manufacturer's installation procedures and coverage rates.
- D. For Applications Where Waterproof Membrane Is Not Shown on the Contract Drawings:

Mix and apply primer over properly prepared substrate, with strict adherence to manufacturer's installation procedures and coverage rates. Coordinate timing of primer application with application of troweled mortar to ensure optimum-adhesion between membrane and mortar.
- E. Troweled Mortar: Mix mortar material according to manufacturer's recommended procedures. Uniformly spread mortar over substrate using manufacturer's specially designed screed box adjusted to manufacturer's recommended height. Hand trowel apply mixed material over freshly primed substrate using stainless steel finishing trowels.
- F. Coating: Remove any surface imperfections by lightly abrading and vacuuming the floor surface, Mix and squeegee apply coating with strict adherence to manufacturer's installation procedures and coverage rates.

- G. Allow each coat to dry before subsequent applications. Cure Rate (at 77 degrees Fahrenheit): allow 6 hours for foot traffic, 18 hours for light traffic, and 24 hours for normal operations.
- H. For final finish coat, where grit is shown on Contract Drawings, add 20 to 40 pounds of grit, per 100 square feet of floor area.
- I. Cove Base: Apply floor system to wall surfaces at locations shown on the Contract Drawings, to form base with cove of radius shown on the Contract Drawings or, if not shown, as recommended by manufacturer. Extend base to height of four inches, unless otherwise shown on the Contract Drawings. Form coved substrate with grout mix using products recommended by flooring manufacturer.

3.03 FIELD QUALITY CONTROL

- A. The right is reserved to invoke material testing procedures at any time, and any number of times during period of flooring application.
- B. The Engineer will engage service of a testing laboratory to sample materials being used on the construction site. Samples of material will be taken, identified and sealed, and certified in presence of the Contractor.
- C. Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer's product data.
- D. If test results show materials being used do not by comply with specified requirements, Contractor may be directed by the Engineer to stop Work; remove non-complying materials; and reapply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials.

3.04 CURING, PROTECTION AND CLEANING

- A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.
- B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final application.
- C. Cleaning; Remove temporary covering and clean resinous flooring, prior to issuance of Certificate of Partial or Final Completion. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

SECTION 09705
RESINOUS FLOORING

APPENDIX "A"

SUBMITTALS

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

Samples

- 09705C01 Samples for Initial Selection Purposes: Submit manufacturer's standard color charts in form of actual sections of resinous flooring showing full-range of colors available. Include grit in samples.
- 09705C02 Samples for verification purposes: Submit 4-inch square samples of each type of resinous flooring required, applied to a rigid backing, in color and finish selected by the Engineer.
- 09705C03 Submit grit samples for approval of the Engineer.

Product Data

- 09705D01 Manufacturer's product specifications, installation instructions, storage and handling instructions, and cleaning recommendations including precautions against materials and methods which may be detrimental to finish. Include certification indicating compliance of materials with requirements and local laws and regulations.

Manuals, Warrantees/Guarantees

- 09705I01 Maintenance Instructions: The Contractor shall furnish the Engineer with manufacturer's recommended maintenance schedule.

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:

Samples

- 09910C01 On a 12 inch x 12 inch hard board or metal panels, two samples of each paint and coating material, with texture to simulate actual conditions if requested by the engineer. If more than one application method is to be used, submit two samples of each paint and coating material for each application method.
- 09910C02 Identify each sample as to manufacturer, color name and number, location and application.
- 09910C03 Submit in color(s) shown on the Contract Drawings or if not shown in color(s) as selected by the Engineer from manufacturer's color chart

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

09910D02 Submit to the Engineer one copy of U.S. Department of Labor Material Safety Sheets (MSDS) for hazardous chemicals utilized during the Work of this Section.

END OF APPENDIX "A"

09910-16

SECTION 09910

PAINTING

APPENDIX "B"

PAINT SCHEDULE

A. Exterior

Surface	System Designation	Primer	Manufacturer's Product	2nd Coat	Manufacturer's Product	Top Coat	Manufacturer's Product
Concrete Gloss	C-1G	Water Based Primer Sealer	Carboline Carbocrylic 120	Acrylic Gloss	Carboline Carbocrylic 3359 DTM	Acrylic Gloss	Carboline Carbocrylic 3359 DTM
			PPG Perma-Crete 4-603		PPG Pitt-Tech Plus 90-1310		PPG Pitt-Tech Plus 90-1310
			SW Loxon Acrylic Primer A24W8300		SW DTM Acrylic B66-100 Series		SW DTM Acrylic B66-100 Series
Concrete Semi-Gloss	C-1S	Water Based Primer Sealer	Carboline Carbocrylic 120	Acrylic	Carboline Sanitile 155	Acrylic Semi-Gloss	Carboline Sanitile 155
			PPG Perma-Crete 4-603		PPG Pitt-Tech Plus 90-1210		PPG Pitt-Tech Plus 90-1210
			SW Loxon Acrylic Primer A24W8300		SW DTM Acrylic B66-200 Series		SW DTM Acrylic B66-200 Series

09910 - 17

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>
Concrete Masonry Gloss	CM-1G	Water Based Block Filler	Carboline Sanitile 100	Acrylic Gloss	Carboline Carbocrylic 3359 DTM	Acrylic Gloss	Carboline Carbocrylic 3359 DTM
			SW Heavy Duty Block Filler B42W46		SW DTM Acrylic B66-100 Series		SW DTM Acrylic B66-100 Series
			PPG Speedhide 6-15		PPG Pitt-Tech Plus 90-1310		PPG Pitt-Tech Plus 90-1310
Concrete Masonry Semi-Gloss	CM-1S	Water Based Block Filler	Carboline Sanitile 100	Acrylic Semi-Gloss	Carboline Sanitile 155	Acrylic Semi-Gloss	Carboline Sanitile 155
			PPG Speedhide 6-15		PPG Pitt-Tech Plus 90-1210		PPG Pitt-Tech Plus 90-1210
			SW Heavy Duty Block Filler B42W46		SW DTM Acrylic B66-200 Series		SW DTM Acrylic B66-200 Series
Cement Plaster Walls & Soffits Gloss	P-1G	Water Based Primer Sealer	Carboline Carbocrylic 120	Alkyd Gloss	Carboline Carbocoat 30R	Alkyd Gloss	Carboline Carbocoat 30R
			PPG Perma-Crete 4-603		PPG 95-5000 Series		PPG 95-5000 Series
			SW Loxon Acrylic Primer A24W8300		SW Industrial Enamel HS B54Z-400 Series		SW Industrial Enamel HS B54Z-400 Series
Steel Gloss	S-1G*	Organic Zinc Rich	Carboline Carbozinc 859	Epoxy	Carboline Carboguard 888	Aliphatic Polyurethane Gloss	Carboline Carbothane 134 HG
			PPG PMC Amercoat 68 HS		PPG PMC Amercoat 399		PPG PMC Amercoat 450 H
			SW Zinc Clad III HS		SW Macropoxy 646		SW Acrolon 218 B65-600

*Paint system S-1G must be on the current New England Protective Coatings (NEPCOAT) Qualified Product List.

Surface	System Designation	Primer	Manufacturer's Product	2nd Coat	Manufacturer's Product	Top Coat	Manufacturer's Product
Steel Gloss	S-2G	Inorganic Zinc Rich	Carboline Carbozinc 11 HS	Epoxy	Carboline Carboguard 893	Aliphatic Polyurethane Gloss	Carboline Carbothane 134 HG
			PPG PMC Dimetcote 9 HS		PPG PMC Amercoat 385		PPG PMC Amercoat 450 H
			Sherwin-Williams Zinc Clad II		Sherwin Williams Macropoxy 646		Sherwin-Williams Acrolon 218HS B65-600
Steel Semi-Gloss	S-1S*	Organic Zinc Rich	Carboline Carbozinc 859 HS	Epoxy	Carboline Carboguard 888	Aliphatic Polyurethane Semi-Gloss	Carboline Carbothane 133 LH
			PPG PMC Amercoat 68 HS		PPG PMC Amercoat 399		PPG PMC Amercoat 450 HSG
			SW Zinc Clad III HS		SW Macropoxy 646		SW Acrolon 218 HS
*Paint system S-1S must be on the current New England Protective Coatings (NEPCOAT) Qualified Product List.							
Steel Semi-Gloss	S-2S	Inorganic Zinc Rich	Carboline Carbozinc 11 HS	Epoxy	Carboline Carboguard 893	Aliphatic Polyurethane Semi-Gloss	Carboline Carbothane 133 LH
			PPG PMC Dimetcote D9 HS		PPG PMC Amercoat 385		Amercoat 450 HSG
			Sherwin-Williams Zinc Clad II		Sherwin-Williams Macropoxy 646		Sherwin-Williams Acrolon 218 HS

09910-19

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>
Steel Semi-Gloss	S-3S	Aluminum Epoxy Mastic	Carboline Carbomastic 15	Epoxy	Carboline Carboguard 890	Aliphatic Polyurethane Semi-Gloss	Carboline Carbothane 133 LH
			PPG PMC Amerlock 2 AL		PPG PMC Amercoat 385		PPG PMC Amercoat 450 HSG
			SW Epoxy Mastic Aluminum II		SW Macropoxy 646		SW Acrolon 218 HS
Galvanized & Aluminum Gloss	N-1G	Primer	PPG Pitt-Tech Plus 90- 912	N/A	N/A	Acrylic Gloss	PPG Pitt-Tech Plus 90-1310
			SW Pro-Cryl B66 - 310 Series				SW DTM Acrylic B66-100 Series
			Carboline Galoseal WB				Carboline 3359 DTM
Galvanized & Aluminum Semi-Gloss	N-1S	Primer	PPG Pitt-Tech Plus 90- 912	N/A	N/A	Acrylic Semi-Gloss	PPG Pitt-Tech Plus 90-1210
			SW Pro-Cryl B66 - 310 Series				SW DTM Acrylic B66-200 Series
			Carboline Galoseal WB				Carboline 3359
Galvanized & Aluminum (Marine & Bridge)	N-2S	Epoxy Primer	Carboline Carboguard 888	N/A	N/A	Aliphatic Polyurethane	Carboline Carbothane 133 LH
			SW Macropoxy 646				SW Acrolon 218 HS
			PPG PMC Amercoat 385				PPG PMC Amercoat 450 HSG

09910 - 20

Surface	System Designation	Primer	Manufacturer's Product	2nd Coat	Manufacturer's Product	Top Coat	Manufacturer's Product	
Galvanized & Aluminum (Marine & Bridge) Gloss	N-2G	Epoxy Primer	Carboline Carboguard 888		N/A	Aliphatic Polyurethane Gloss	Carboline Carbothane 134 HG	
			PPG PMC Amercoat 385				PPG PMC Amercoat 450 H	
			SW Macropoxy 646				SW Acrolon 218 HS B65-600	
Plywood Semi-Gloss	PW-1S	Acrylic Wood Primer	Carboline Carbocrylic 120	Acrylic Semi-Gloss	Carboline Carbocrylic 3359	Acrylic Semi-Gloss	Carboline Carbocrylic 3359	
			SW A-100 Latex B42W42				SW Metalatex B42 Series	SW Metalatex B42 Series
			PPG Speedhide 6-609				PPG Speedhide 6-900	PPG Speedhide 6-900
Concrete, Brick & Granite Clear Gloss Anti-Graffiti	AG-1	Primer Sealer	Carboline Carboguard 1340		N/A	Aliphatic Urethane	Carboline Carbothane 130	
			Visual Pollution Tech. Crystal Clear				Visual Pollution Tech. Crystal Clear	
Concrete, Brick & Granite Clear Flat Anti-Graffiti	AG-2	Primer Sealer	Degussa Tagguard		N/A	Various	Degussa Tagguard	
			Sivento Protectosil				Sivento Protectosil	
			Tristar Proteus Masonry Sealer				Tristar Proteus 940	

09910 - 21

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>
Steel & Concrete Saltwater Immersion	CT-1	Coal Tar Epoxy (C-200A)	Carboline Bitumastic 300M International Intertuf 702 Sherwin-Williams Targuard		N/A	Coal Tar Epoxy (C-200A)	Carboline Bitumastic 300M International Intertuf 702 Sherwin-Williams Targuard
Steel, Jet Fuel Splash & Spill	S-4	Organic Zinc Rich	Carboline Carbozinc 859 Tnemec 90-97 Tnemec-Zinc SW Zinc Clad III HS	Epoxy	Carboline Carboguard 890 Tnemec Epoxoline II Series N69 SW Macropoxy 646	Polyester Polyurethane	Carboline Carbothane 133 LH Tnemec CRU Series 290 SW Poly-Lon HP
Steel Slip Critical "B"	S-5	Organic Zinc Rich	Carboline Carbozinc 859 PPG PMC Amercoat 68 HS SW Zinc Clad III HS		N/A		N/A
Steel Slip Critical "B"	S-6	Inorganic Zinc Rich (Shop Only)	PPG PMC Dimetcote 9 Carboline Carbozinc 11 HS Sherwin-Williams Zinc Clad II		N/A		N/A

09910 - 22

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>	
Steel (under concrete or grout)	S-7	Epoxy Mastic	Carboline Carboguard 890	N/A		Epoxy (immersion grade)	Carboline Carboguard 890	
			PPG PMC Amerlock 2				PPG PMC Amerlock 2	
			Sherwin-Williams Macropoxy 646				Sherwin-Williams Macropoxy 646	
Steel, Saltwater, Tidal	S-8	Epoxy	Duramar 2510 UW	N/A		Epoxy	Duramar 2510 UW	
			International Interzone 954				International Interzone 954	
			Sherwin-Williams Sher-Glass				Sherwin-Williams Sher-Glass	
Steel, Ultra-Weatherable	S-9	Zinc Rich	Carboline Carbozinc 859	Urethane	Carboline Carbothane 134 HG	Fluorocarbon	Carboline Carboxane 950	
			SW Zinc Clad III HS				SW Acrolon 218 HS	SW FluoroKem
			PPG PMC Amercoat 68 HS				PPG BRP 1000 Series	PPG Corafon ADS
Steel, Rapid Deployment	S-10	Zinc Rich	PPG PMC 68 HS		N/A		PPG PMC PSX 700	
			Sherwin-Williams Corothane I - Galvapak				Sherwin-Williams Fast Clad Urethane	
Aluminum Ultra-Weatherable	N-3	Epoxy	Carboline Carboguard 888	Urethane	Carboline Carbothane 133 LH	Fluorocarbon	Carboline Carboxane 950	
			Sherwin-Williams Macropoxy 646				Sherwin-Williams Acrolon 218 HS	Sherwin-Williams FluoroKem
			PPG PMC Amercoat 385				PPG BRP 1000 Series	PPG Corafon ADS

09910 - 23

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>	
B. Interior								
Steel, water tank	S-11	Epoxy	PPG PMC Amerlock 2	Epoxy	PPG PMC Amerlock 2	Epoxy	PPG PMC Amerlock 2	
			Carboline Carboguard 891		Carboline Carboguard 891		Carboline Carboguard 891	
			SW Duraplate 235 NSF		SW Duraplate 235 NSF		SW Duraplate 235 NSF	
Steel, jet fuel tank	S-12	Epoxy Amine	PPG PMC Amercoat 395 FD	N/A	Epoxy Amine	PPG PMC Amercoat 395 FD	PPG PMC Amercoat 395 FD	
			Carboline Plasite 9060				Carboline Plasite 9060	Carboline Plasite 9060
			SW Shelcote II				SW Shelcote II	SW Shelcote II
Concrete Flat	C-2F	Water Based Sealer	PPG Speedhide 6-2	Acrylic	PPG Speedhide 6-70	Acrylic Flat	PPG Speedhide 6-70	
			ProMar B28W8200		SW ProMar B30W200		SW ProMar B30W200	
			Carboline 120		Carboline 3130		Carboline 3130	
Concrete Semi-Gloss	C-2S	Water Based Sealer	Carboline Carbocrylic 120	Acrylic	Carboline Carbocrylic 3359	Acrylic Semi-Gloss	Carboline Carbocrylic 3359	
			SW ProMar B28W8200		SW ProMar B31W200		SW ProMar B31W200	
			PPG Speedhide 6-2		PPG Speedhide 6-500		PPG Speedhide 6-500	

09910 - 24

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>
Concrete Heavy-Duty Gloss	C-3G	Epoxy	Carboline Carboguard 1340 SW Macropoxy HS Epoxy	Epoxy	Carboline Carboguard 890 SW HP Epoxy B67-200	Epoxy Gloss	Carboline Carboguard 890 SW HP Epoxy B67-200
Concrete Masonry Flat	CM-2F	Block Filler	PPG Speedhide 6-7 SW PrepRite B25W25 Carboline Sanitile 100	Acrylic	PPG Speedhide 6-70 SW ProMar B30W200 Carboline 3130	Acrylic Flat	PPG Speedhide 6-70 SW ProMar B30W200 Carboline 3130
Concrete Masonry Semi-Gloss	CM-2S	Block Filler	Carboline Sanitile 100 SW PrepRite B25W25 PPG Speedhide 6-7	Acrylic	Carboline Carbocrylic 3359 SW ProMar B31W200 PPG Speedhide 6-500	Acrylic Semi-Gloss	Carboline Carbocrylic 3359 SW ProMar B31W200 PPG Speedhide 6-500
Concrete Masonry Heavy-Duty Gloss	CM-3	Epoxy Block Filler	Carboline Carboguard 954HB SW Kern Cati-Coat HS B42W400	Epoxy	Carboline Carboguard 890 SW HP Epoxy B67-200	Epoxy Gloss	Carboline Carboguard 890 SW HP Epoxy B67-200
Cement & Gypsum Plaster Walls & Soffits Flat	P-1F	Acrylic Sealer	SW PrepRite B28W300 PPG Speedhide 6-2 Carboline Sanitile 120	Acrylic	SW ProMar B30W200 PPG Speedhide 6-70 Carboline 3130	Acrylic Flat	SW ProMar B30W200 PPG Speedhide 6-70 Carboline 3130

09910 - 25

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>
Cement & Gypsum Plaster Walls & Soffits Semi-Gloss	P-1S	Acrylic Sealer	Carboline Carbocrylic 120	Acrylic	Carboline Carbocrylic 3359	Acrylic Semi-Gloss	Carboline Carbocrylic 3359
			SW PrepRite B28W300		SW ProMar B31W200		SW ProMar B31W200
			PPG Speedhide 6-2		PPG Speedhide 6-500		PPG Speedhide 6-500
Gypsum Board Flat	GB-1F	Acrylic Sealer	SW PrepRite B28W8200	Acrylic	SW ProMar B30W200	Acrylic Flat	SW ProMar B30W200
			PPG Speedhide 6-2		PPG Speedhide 6-70		PPG Speedhide 6-70
			Carboline Sanitile 120		Carboline 3130		Carboline 3130
Gypsum Board Semi-Gloss	GB-1S	Acrylic Sealer	Carboline Carbocrylic 120	Acrylic	Carboline Carbocrylic 3359	Acrylic Semi-Gloss	Carboline Carbocrylic 3359
			SW PrepRite B28W8200		SW ProMar B31W200		SW ProMar B31W200
			PPG Speedhide 6-2		PPG Speedhide 6-500		PPG Speedhide 6-500
Steel Semi-Gloss	S-13S	Acrylic Steel Primer	PPG Pitt-Tech Plus 90-912	Acrylic	PPG Pitt-Tech Plus 90-1210	Acrylic Semi-Gloss	PPG Pitt-Tech Plus 90-1210
			SW DTM B66 W1		SW Sher-Cryl B66-350		SW Sher-Cryl B66-350
			Carboline 3358		Carboline 3359		Carboline 3359

09910 - 26

Surface	System Designation	Primer	Manufacturer's Product	2nd Coat	Manufacturer's Product	Top Coat	Manufacturer's Product
Steel Gloss	S-14G	Acrylic Steel Primer	Carboline Carbocrylic 3358 SW DTM B66W1 PPG Pitt-Tech Plus 90-912	Acrylic	Carboline Carbocrylic 3359 DTM SW DTM Sher-Cryl B66-300 PPG Pitt-Tech Plus 90-1310	Acrylic Semi-Gloss	Carboline Carbocrylic 3359 DTM SW DTM Sher-Cryl B66-300 PPG Pitt-Tech Plus 90-1310
Steel Heavy-Duty Semi-Gloss (UV Exposure)	S-14S	Organic Zinc Rich	Carboline Carbozinc 859 PPG PMC Amercoat 68 HS SW Zinc Clad III HS	Epoxy	Carboline Carboguard 888 PPG PMC Amercoat 399 SW Macropoxy 646	Aliphatic Polyurethane Semi-Gloss	Carboline Carbothane 133 LH PPG PMC Amercoat 450 HSG SW Acrolon 218 HS
Steel Heavy-Duty	S-15	Organic Zinc Rich	Carboline Carbozinc 859 SW Zinc Clad III HS PPG PMC Amercoat 68 HS	Epoxy	Carboline Carboguard 890 SW Macropoxy 646 PPG PMC Amerlock 2	Epoxy	Carboline Carboguard 890 SW Macropoxy 646 PPG PMC Amerlock 2
Galvanized & Aluminum Gloss	N-4G	Primer	Carboline Carbocrylic 120 PPG Pitt-Tech Plus 90-912 SW Pro-Cryl B66-310 Series	N/A		Acrylic Gloss	Carboline Carbocrylic 3359 DTM PPG Pitt-Tech Plus 90-1310 SW Sher-Cryl B66-300

09910 - 27

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>
Galvanized & Aluminum Semi-Gloss	N-4S	Primer	PPG Pitt-Tech Plus 90-912 SW Pro-Cryl B66-310 Series Carboline Carbocrylic 120		N/A	Acrylic Semi-Gloss	PPG Pitt-Tech Plus 90-1210 SW Sher-Cryl B66-350 Carboline 3359
Galvanized & Aluminum Heavy Duty Semi-Gloss	N-5S	Epoxy	Carboline Carboguard 888 SW Macropoxy 646 PPG PMC Amercoat 385		N/A	Aliphatic Polyurethane Semi-Gloss	Carboline Carbothane 133 LH SW Acrolon 218 HS B65-650 PPG Amercoat 450 HSG
Plywood Flat	PW-2F	Acrylic	Carboline Carbocrylic 120 SW PrepRite ProBlock B51W20 PPG SealGrip 17-921	Acrylic	Carboline 3130 SW ProMar B30W200 PPG Speedhide 6-70	Acrylic	Carboline 3130 SW ProMar B30W200 PPG Speedhide 6-70
Plywood Semi-Gloss	PW-2S	Acrylic	Carboline Carbocrylic 120 SW Preprite ProBlock B51W20 PPG SealGrip 17-921	Acrylic	Carboline Carbocrylic 3359 SW ProMar B31W200 PPG Speedhide 6-500	Acrylic	Carboline Carbocrylic 3359 SW ProMar B31W200 PPG Speedhide 6-500

09910 - 28

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>
Concrete Floor Clear Finish	CF-2	Epoxy	PPG MegaSeal HSPC 99-12700 SW ArmorSeal 33 Carboline Carboguard 1340		N/A	Epoxy	PPG MegaSeal SL 99-12600 SW 650 SL/RC Carboline Sanitile 925
Concrete Floor Color Finish Heavy-Duty Gloss	CF-3	Epoxy	Carboline Semstone 110 SW ArmorSeal 33 PPG MegaSeal HSPC 99-12710	Epoxy	Carboline Sanitile 945 SL SW ArmorSeal 650 SL/RC PPG MegaSeal SL	Epoxy	Carboline Sanitile 945 SL SW ArmorSeal 650 SL/RC PPG MegaSeal SL
Concrete Color Finish Anti-Graffiti	AG-3	Epoxy	Carboline Rustbond Penetrating Sealer SW Macropoxy 920		N/A	Polyester Urethane	Carboline Carbothane 133 LH SW Poylon HP
Concrete Masonry, Color Finish Anti-Graffiti	AG-4	Concrete Block Filler	Carboline Carboguard 954 HB SW Kem Cati-Coat HS		N/A	Polyester Urethane	Carboline Carbothane 133 LH Sherwin-Williams Poylon HP

09910 - 29

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>
C. Overcoat Systems							
Steel	S-16	Alkyd Spot Primer	Carboline Carbocoat 8215C SW Kromik Metal Primer PPG Multiprime 97-680		N/A	Silicone Alkyd	Carboline 30 R SW Steel Master 9500 B56-300 Series PPG Sil-Shield 95-5000
Steel	S-17	MC Urethane Spot Primer	Wasser MC-Prepbond Xymax MonoLock PP SW Corothane I Mio-Aluminum	MC Urethane	Wasser MC-Prepbond Xymax MonoLock PP SW Corothane I Ironox B	MC Urethane	Wasser MC-Luster Xymax Bridge Finish SW Corothane I HS
Galvanized & Aluminum Semi-Gloss	N-6S	Epoxy Spot Primer	Carboline 888 Epoxy SW Macropoxy 646 PPG PMC Amercoat 385	Tie Coat	Carboline Rustbond SW Macropoxy 920 Pre-Prime PPG PMC Amerlock Sealer	Urethane	Carboline 133LH SW Acrolon 218 HS PPG PMC 450 HSG
Steel Semi-Gloss	S-18	Epoxy Mastic Spot Primer	PPG PMC Amerlock 2AL Carboline Carbomastic 615 HS SW Epoxy Mastic Aluminum II	Tie Coat	PPG PMC Amerlock Sealer Carboline Rustbond SW Macropoxy 920 Pre-Prime	Polyurethane	PPG PMC Amercoat 450 HSG Carboline 133 LH SW Acrolon 218 HS

09910 - 30

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>
Concrete Semi-Gloss	C-4S	Spot Primer	Carboline Sanitile 120 PPG Perma-Crete 4-603 SW Loxon A24W8300	Acrylic	Carboline Sanitile 155 PPG Pitt-Tech Plus 90-1210 SW DTM Acrylic B66-200	Acrylic	Carboline Sanitile 155 PPG Pitt-Tech Plus 90-1210 SW DTM Acrylic B66-200
Concrete Masonry Semi-Gloss	CM-4S	Block Filler Spot Primer	Carboline Sanitile 100 SW H.D. Block Filler B42W46 PPG Pitt-Glaze 16-90	Acrylic	Carboline Sanitile 155 SW DTM Acrylic B66-200 PPG Pitt-Tech Plus 90-1210	Acrylic	Carboline Sanitile 155 SW DTM Acrylic B66-200 PPG Pitt-Tech Plus 90-1210

D. Interior - Sustainable Design

Concrete Masonry Flat	CM-5F	Block Filler	PPG 6-7 Speedhide Latex Block Filler SW PrepRite B25W25 Carboline Sanitile 100	Acrylic Flat	PPG 9-100 Pure Performance Flat Interior Latex SW ProGreen B30-600 Carboline 3130	Acrylic Flat	PPG 9-100 Pure Performance Flat Interior Latex SW ProGreen B30-600 Carboline 3130
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09910 - 31

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>
Concrete Masonry Semi-Gloss	CM-5S	Block Filler	PPG 6-7 Speedhide Latex Block Filler	Acrylic	PPG 9-500 Pure Performance Interior Latex Primer	Acrylic Semi-Gloss	PPG 9-500 Performance Interior Latex Finish Semi- Gloss
			SW PrepRite B25W25		SW ProGreen B31-600		SW ProGreen B31- 600
			Carboline Sanitile 100		Carboline 3234		Carboline 3234
Cement & Gypsum Plaster Walls & Soffits Semi-Gloss	P-2S	Acrylic Sealer	PPG 9-900 Pure Performance Interior Latex Primer	Acrylic	PPG 9-500 Pure Performance Interior Latex	Acrylic Semi-Gloss	PPG 9-500 Pure Performance Interior Latex
			SW Loxon A24W8300		SW ProGreen B31-600		ProGreen B31-600
			Carboline Sanitile 120		Carboline 3234		Carboline 3234
Gypsum Board Flat	GB-2F	Acrylic Sealer	PPG 9-900 Pure Performance Latex Primer	Acrylic	PPG 9-100 Pure Performance Latex	Acrylic Flat	PPG 9-100 Pure Performance Latex
			SW ProGreen 200 B28W600		SW ProGreen 200 B30- 600		SW ProGreen 200 B30-600
			Carboline Sanitile 120		Carboline 3130		Carboline 3130
Gypsum Board Semi-Gloss	GB-2S	Acrylic Sealer	PPG 9-900 Pure Performance Latex	Acrylic	PPG 9-500 Pure Performance Latex	Acrylic Semi-Gloss	PPG 9-500 Pure Performance Latex
			SW ProGreen 200 B28W600		SW ProGreen 200 B31- 600		SW ProGreen 200 B31-600
			Carboline Sanitile 120		Carboline 3234		Carboline 3234

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>
Steel Semi-Gloss	S-19S	Acrylic Steel Primer	PPG 90-912 Series Pitt-Tech DTM Industrial Enamel	Acrylic	PPG Pitt-Tech Plus 90-1210	Acrylic Semi-Gloss	PPG Pitt-Tech Plus 90-1210
			Carboline Carbocrylic 3358 MC		Carboline 3234		Carboline 3234
			SW Pro-Cryl Universal Primer		SW Pro Industrial B66-650		SW Pro Industrial B66-650
Steel-Heavy Duty Gloss	S-20G	Organic Zinc-Rich	PPG PMC Amercoat 68 HS VOC	Epoxy	PPG PMC Amercoat 399	Urethane	PPG PMC Amershield VOC
			Carboline Carbozinc 859 VOC		Carboline Carboguard 894		Carboline Carbothane 134 VOC
			SW Zinc Clad III HS-100		SW Macropoxy 646-100		SW Hi-Solids Polyurethane-100
Galvanized & Aluminum Semi-Gloss	N-7S	Primer	PPG 90-912 Series Pitt-Tech DTM Industrial Enamel	N/A	N/A	Acrylic Semi-Gloss	PPG Pitt-Tech Plus 90-1210
			Carboline Galoseal WB				Carboline Carbocrylic 3234
			SW Pro-Cryl Universal Primer				SW Pro Industrial B66-650
Plywood Semi-Gloss	PW-3S	Acrylic	PPG 9-900 Pure Performance Interior Latex Primer	Acrylic	PPG Speedhide 6-500	Acrylic Semi-Gloss	PPG Speedhide 6-500
			SW Wood Primer B28W8111		SW Pro Industrial B66-650		SW Pro Industrial B66-650
			Carboline Carbocrylic 120		Carboline 3234		Carboline 3234

09910 - 33

<u>Surface</u>	<u>System Designation</u>	<u>Primer</u>	<u>Manufacturer's Product</u>	<u>2nd Coat</u>	<u>Manufacturer's Product</u>	<u>Top Coat</u>	<u>Manufacturer's Product</u>
Concrete Floor Clear Finish	CF-4	Epoxy	PPG MegaSeal HSPC 99-12700 Carboline Carboguard 1340 SW ArmorSeal 33 B58CQ33		N/A	Epoxy	PPG MegaSeal SL 99-12600 Carboline Sanitile 925 SW ArmorSeal 650 SL/RC Clear
Concrete Floor Color Finish	CF-5	Epoxy	PPG MegaSeal HSPC Carboline Carboguard 1340 SW ArmorSeal 33 B58 AQ33		N/A	Epoxy	PPG MegaSeal SL Carboline Sanitile 555 SW ArmorSeal 650 SL/RC
Concrete, Heavy Duty	C-5	Epoxy	Carboline Carboguard 1340 PPG PMC Amerlock Sealer	Epoxy	Carboline Carboguard 890 VOC PPG PMC Amerlock 400 VOC	Epoxy	Carboline Carboguard 890 VOC PPG PMC Amerlock 400 VOC
Concrete Masonry, Heavy Duty	CM-6	Epoxy block filler	Carboline Carboguard 954 HB	Epoxy	Carboline Carboguard 890 VOC		Carboline Carboguard 890 VOC

END OF APPENDIX "B"

09910 - 34

DIVISION 10
SECTION 10210
METAL WALL LOUVERS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for fixed and adjustable extruded aluminum wall louvers, wall vents and accessories.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Architectural Manufacturers Association (AAMA)

- AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.
 AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

Air Movement and Control Association International, Inc. (AMCA)

- AMCA 500L Laboratory Methods of Testing Louvers for Rating.
 AMCA 501 Application Manual for Air Louvers.

American Society for Testing and Materials (ASTM)

- ASTM B 209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 ASTM B 221 Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 ASTM C 612 Specification for Mineral Fiber Block and Board Thermal Insulation.

American Welding Society, Inc. (AWS)

- AWS D1.2 Structural Welding Code – Aluminum.

National Association of Architectural Metal Manufacturers (NAAMM)

Metal Finishes Manual for Architectural and Metal Products.

National Electrical Manufacturers Association (NEMA)

Technical Standards.

Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)

Architectural Sheet Metal Manual.

The Society for Protective Coatings (SSPC)

SSPC-Paint 12 Paint Specification No. 12 – Cold-Applied Asphalt Mastic (Extra Thick Film).

Underwriters Laboratories Inc. (UL)

Fire Resistance Directory.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Louver Terminology

Refer to AMCA International's publication AMCA 501 for definitions of terms for metal louvers not otherwise defined in this section or to referenced standards.

B. Structural and Thermal Performance

Installed exterior metal wall louvers shall withstand the effects of loads and stresses from wind and normal thermal movement without evidence of permanent deformation of louver components including blades, frames and supports; without noise or metal fatigue caused by louver blade rattle or flutter; and without permanent damage to fasteners and anchors.

1. Wind Load: Withstand wind loading based on uniform pressures shown on the Contract Drawings, acting inwards or outwards. Louvers shall resist minimum wind loading required by the New York City Building Code or by the New Jersey Uniform Construction Code and its subcode the IBC/2000 (all as though the Authority were a private corporation) as applicable to where the Project is located.
2. Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

C. Air Performance and Water Penetration Ratings

Louvers shall comply with the following performance requirements, as demonstrated by testing manufacturer's stock or custom fabricated units identical to those furnished and installed, unpainted, clean and degreased units without screens, of height and width indicated, in accordance with AMCA 500L.

1. Free area shall not be less than 45 percent on a 48 inch by 48 inch sized louver.
2. Static pressure drop shall not be more than 0.14 inch of water gage at an airflow of 900 fpm free area velocity.
3. Water penetration shall not be more than 0.01 oz. per sq. ft. of free area at an intake airflow of 900 fpm free air velocity when tested for 15 minutes.
4. Louvers shall be licensed to bear, and shall display, AMCA International's Certified Rating Seal.

D. Air Leakage Ratings (adjustable louvers only)

Adjustable louvers shall also comply with performance requirements indicated for air leakage as tested in accordance with AMCA 500L:

1. Air leakage shall not be more than 1.5 cfm per sq. ft. of gross face area that will pass through the louver at static pressure differential of 0.15 inch of water gage, with louver blades in the closed position.
2. Louvers shall be licensed to bear, and shall display, AMCA International's Certified Rating Seal.

1.04 QUALITY ASSURANCE

A. When required by Appendix "A", submit structural calculations for louvers, 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. Engineer Qualifications

Use the services of a professional engineer legally authorized to practice in the jurisdiction where the Work is located. Engineer shall be experienced in providing engineering services of the kind indicated which have resulted in the successful installation of louvers similar to Work of this Section in material, design and extent, and shall have a record of successful in-service performance.

C. Fabrication Standards

Comply with applicable provisions of SMACNA's *Architectural Sheet Metal Manual* for fabrication, construction details and installation procedures, except as otherwise shown on the Contract Drawings.

D. Welding Standards

1. Comply with applicable provisions of AWS D1.2 *Structural Welding Code – Aluminum*.
2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and has undergone recertification if pertinent.

E. Motor Standards

For motor-operated adjustable louvers, motors and related components shall be listed and labeled by UL and shall comply with applicable NEMA standards.

F. Single Source Responsibility

Obtain louvers and vents through one source from a single manufacturer.

G. Field Measurements

Check actual louver openings by accurate field measurements before fabrication and show recorded measurements on final Shop Drawings. Coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments, splicing, mechanical joints and field assembly of units.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements of this Section, furnish and install products of one of the following:
- Airline Products Co., Hagerstown, MD
 - The Airolite Co., Marietta, OH
 - American Warming and Ventilating Co., Holland, OH
 - Construction Specialties, Inc., Cranford, NJ
 - Industrial Louvers Inc., Delano, MN
 - Ruskin Co., Kansas City, MO

2.02 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5, T6 or T52, or alloy 6061-T6.
- B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by louver manufacturer for required finish.
- C. Fasteners: Use same material as items fastened, except fasteners for exterior applications may be hot dip galvanized, stainless steel or aluminum. Types, gages and lengths shall suit unit installation conditions. Use Phillips flat-head machine screws for exposed fasteners.
- D. Anchors and Inserts
1. Use non-ferrous metal or hot-dip galvanized steel anchors. Inserts shall be steel or lead expansion bolt devices for drilled-in-place anchors.
 2. Furnish inserts to be set into concrete or masonry, or furnish flat or angle type wall anchors where shown on the Contract Drawings.
- E. Bituminous Paint: Cold-applied, asphalt mastic complying with SSPC-Paint 12 containing no asbestos fibers.

2.03 ACCESSORIES

- A. Louver Screens
- Removable screens for exterior louvers shall be as follows:
1. Frames
 - a. Same material and finish as louver unit to which secured. Aluminum frames shall have mitered corners with clips.
 - b. Rewireable, consisting of formed or extruded metal with a driven spline or insert for securing screen mesh.
 2. Bird screens shall be 1/2 inch square mesh, of 0.063 inch diameter aluminum wire.
 3. Insect screens, if any, shall be 18 by 18 mesh, of 0.009 inch diameter stainless steel wire.
- B. Sill Extensions or Loose Sills
- Same material and finish as louvers, where shown on the Contract Drawings or where required for drainage to exterior and to prevent water penetrating to interior.

2.04 FABRICATION

A. General

1. Fabricate louvers, blank-off panels, wall vents and accessories of design, dimensions, materials, arrangement and metal finish as shown on the Contract Drawings and as specified in this Section.
2. Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly match-mark units for reassembly and coordinated installation.
3. Frames, including integral sills, shall suit adjacent construction with tolerances for installation, including for application of sealants in joints between louvers and adjoining Work.
4. Include supports, anchorages and accessories required for complete assembly, including metal framing.
5. Locate screens on inside face of louver, secure screen to louver frame with machine screws spaced a maximum of 6 inches from each corner and 12 inches o.c. between corner fasteners.
6. Join frame members to one another and to fixed louver blades by welding, except where field bolted connections between frame members are made necessary by size of louvers.
7. Maintain equal blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
8. Louver Materials
Minimum 0.125 inch thick aluminum extrusions for blades, frames and mullions, if any.
 - a. Louver Frames
Louver frames of size and depth shown on the Contract Drawings and as specified herein.
 - b. Louver Blades
Horizontal fixed or adjustable blades of profile, slope and spacing shown on the Contract Drawings and as specified herein.
 - c. Mullions
Vertical mullions shall be of types and at spacings shown on the Contract Drawings but not further apart than recommended by manufacturer or 72 inches on center, whichever is less. Furnish and install horizontal mullions at horizontal joints, if any, between louver units, except where continuous vertical assemblies are shown.

B. Fixed, Extruded Aluminum Wall Louvers

Fixed louvers shall be of extruded aluminum, with aluminum screens as shown on the Contract Drawings, and as follows:

1. Louver Depth: As shown on the Contract Drawings.
2. Blade Angle: Manufacturer's standard (40-45 degrees), or as shown on the Contract Drawings.
3. Blade Type: Drainable.
4. Screen Type: Bird screen.

C. Adjustable-Blade, Extruded Aluminum Wall Louvers

Adjustable-blade louvers shall be of extruded aluminum, with blade and jamb gaskets, with aluminum screens if shown, with manufacturer's recommended bearings and operating mechanisms to suit louver sizes shown on the Contract Drawings and prewired for motor operation, if any, as described below.

1. Louver Depth: As shown on the Contract Drawings.
2. Preset Blade Angle: Manufacturer's standard (40-45 degrees), or as shown on the Contract Drawings.
3. Blade Type: Drainable.
4. Screen Type: Bird screen.
5. Motor Operation: With 2-position, spring-return application (with power on, motor opens louver; with power off, spring closes louver), 120-V, 60-Hz motor and limit switches, wired for grounding and equipped as follows:
 - a. Terminals for controlling devices.
6. Adjustable-Blade Accessories
 - a. Furnish and install snap-on, blade-edge gaskets for each louver blade to reduce air leakage at blade edges.
 - b. Furnish and install metal jamb seals between adjustable-blade ends and jambs to restrict air leakage.

D. Drainable Blades

Fixed or adjustable louver blades shall be drainable type, designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and channels in jambs and mullions.

E. Blank-Off Panels

Laminated metal-faced panels, if any, shall consist of an insulating core, surfaced on back and front with metal sheets, finished to match louver, and shall comply with the following requirements:

1. Panel Thickness: 2 inches, or as otherwise shown on the Contract Drawings.
2. Metal Facing Sheets: Aluminum sheet 0.032 inch thick.
3. Insulating Core: Unfaced rigid glass fiber board insulation complying with ASTM C 612, Class 1 and 2.
4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded aluminum channel frames (provided they are minimum 0.063 inch thick) with corners mitered and with same finish as panels.
5. Seal perimeter joints between panel faces and louver frames with 1/8 inch by 1 inch polyvinyl chloride compression gaskets.

F. Wall Vents (Brick Vents)

Extruded aluminum wall vents shall comply with the following requirements:

1. Minimum 0.125 inch thick extruded aluminum louvers and frames, welded assembly; incorporating weep holes, continuous drip at sill and integral water stop on inside edge of sill; with 18 by 14 mesh aluminum wire insect screening secured to inside face of wall vent.

2. Dampers: Equip wall vents with dampers where shown on the Contract Drawings. Dampers shall consist of aluminum blades and frame mounted on inside of wall vent; operated from exterior with allen wrench in socket head cap screw. Operating mechanism components shall be Type 304 stainless steel.

2.05 SHOP FINISHING

A. General

1. Comply with NAAMM's Metal Finishes Manual for Architectural and Metal Products for finish designations and application recommendations. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes listed in the NAAMM manual.
2. Factory apply finish to exposed metal surfaces after products are assembled.
3. Remove visible scratches and blemishes from exposed surfaces after completing finishing process. Protect finishes on exposed surfaces prior to shipment with protective coating.
4. Match colors shown on the Contract Drawings or match color sample, if any. If not shown, color shall be as selected by the Engineer from manufacturer's standard colors.

B. Class I Clear Anodic Finish

AA M12-C22-A41 (Mechanical Finish: nonspecular, as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: clear coating, 0.7 mil or thicker), complying with AAMA 611.

C. Class I Color Anodic Finish

AA M12-C22-A42/A44 (Mechanical Finish: nonspecular, as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: integrally colored or electrolytically deposited color coating, 0.7 mil or thicker), complying with AAMA 611.

D. High Performance Organic Coating

AA C12-C42-R1x (Chemical Finish: cleaned with inhibited chemicals, prepared with an acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Ensure that coating is applied in strict accordance with coating manufacturer's instructions by a licensed applicator.

1. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system composed of specially formulated inhibitive primer, fluoropolymer color coat and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene resin by weight; complying with AAMA 2605.
2. Subject to compliance with requirements, fluoropolymer coating systems shall contain resins produced by Atofina Chemicals, Inc. ("Kynar 500") or Solvay Solexis, Inc. ("Hylar 5000").
3. Furnish manufacturer's written warranty covering failure of the fluoropolymer coating system for a period of twenty (20) years after the date of Final Completion.

PART 3. EXECUTION

3.01 PREPARATION

Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.02 INSTALLATION

- A. Install louvers and structural supports and attachment brackets as shown on the Contract Drawings and as required for a complete and proper installation.
- B. Locate and place louver units plumb, level and in proper alignment with adjacent Work.
- C. Use concealed anchorages. Use brass or lead washers fitted to screws to protect metal surfaces, where required, and to make weathertight connections.
- D. Form closely fitted joints with exposed connections accurately located and secured. Provide perimeter reveals and openings of uniform width to accommodate sealants and joint fillers.
- E. Install concealed gaskets, flashings, joint fillers and insulation, as louver installation progresses where required to make louver joints weathertight. Comply with Division 7 Section on Sealants, for sealants applied during installation of louvers.
- F. Install bird screens, insect screens and blank-off panels, if any, as shown on the Contract Drawings.
- G. Install wall vents, including supplementary framing or lintels as required, in accordance with manufacturer's instructions. Build vents into masonry walls with mortar as part of masonry construction. Install vents in other wall openings as shown on the Contract Drawings in accordance with approved Shop Drawings.
- H. Protect aluminum surfaces from corrosion or galvanic action by application of a heavy coating of SSPC-Paint 12 bituminous paint on surfaces that will be in contact with concrete, masonry or dissimilar metals.

3.03 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Repair finishes damaged by cutting, welding, soldering and grinding operations required for fitting and joining. Restore finishes so there is no evidence of corrective work. Return items to the shop that cannot be refinished in field, make required alterations and refinish entire unit, or furnish and install new units.
- C. Periodically clean exposed surfaces of louvers and vents, which are not protected by temporary covering, to remove fingerprints and soil during construction period; do not let soil accumulate until final cleaning.
- D. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Rinse surfaces thoroughly and dry. Remove temporary coverings.

END OF SECTION

SECTION 10210
METAL WALL LOUVERS

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

- 10210A01 For louvers and accessories including plans, elevations, sections, and details showing profiles, angles, and spacing of louver blades; unit dimensions related to wall openings and construction; free areas for each size indicated; profiles of frames at jambs, heads and sills; anchorage details and locations. Indicate materials, finishes, fasteners, joinery and other information to determine compliance with specified requirements.
- 10210A02 Wiring diagrams detailing wiring for power and control systems; differentiate clearly between manufacturer-installed wiring and field-installed wiring, where motorized adjustable louvers are shown on the Contract Drawings.

Samples

- 10210C01 Submit 6 inch square samples of each required finish. Prepare samples on metal of same gage and alloy to be used in Work. Where normal color and texture variations are to be expected, such samples shall show limits of such variations.

Product Data

- 10210D01 For each louver type shown, including catalog cuts showing material types, thicknesses, appropriate AMCA certified rating seal and performance data, and product data for each accessory shown.
- 10210D02 Structural analysis data for installed products indicated to comply with certain design loadings, sealed and signed by the qualified professional engineer who was responsible for their preparation.

END OF APPENDIX "A"

10210-9

DIVISION 10
SECTION 10270
ACCESS FLOORING

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for access flooring, including floor panels, floor covering and understructure.
- B. Electrical service outlets in access flooring, if any, are specified in applicable Section(s) of Division 16 of these Specifications.
- C. Grilles or registers in access flooring, if any, are specified in applicable Section(s) of Division 15 of these Specifications.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

Ceiling and Interior Systems Construction Association (CISCA)

Recommended Test Procedures for Access Floors.

Federal Specification (FS)

FS SS-W-40 Wall Base: Rubber and Vinyl Plastic.

National Fire Protection Association (NFPA)

NFPA 75 Standard for the Protection of Electronic Computer/Data Processing Equipment.

NFPA 99 Standard for Health Care Facilities, Chapter 3, Electrical Systems.

National Electrical Manufacturers Association (NEMA)

NEMA LD3 High-Pressure Decorative Laminate.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

Exemption (4)

Exemption (4)

1.04 ENVIRONMENTAL REQUIREMENTS

- A. Do not proceed with installation of access flooring until installation area is enclosed and has an ambient temperature of between 40 degrees F and 90 degrees F and a relative humidity of not more than 70 percent.
- B. Mark pedestal locations on concrete subfloor so that mechanical and electrical Work can take place without interfering with installation of pedestals.
- C. Do not proceed with installation of access flooring until after substantial completion of other performable Work within affected spaces.

1.05 QUALITY ASSURANCE

A. Installer Qualifications

Entity performing the installation Work of this Section shall be acceptable to access flooring manufacturer and shall have successfully completed within the last 3 years at least 3 access flooring installations similar in type and size to that required by this Contract and who shall assign mechanics from these earlier installations to Work of this Contract, of which one will serve as lead mechanic.

B. Install Work of this Section in the presence of the manufacturer's representative.

C. NFPA Standard

Provide access flooring complying with NFPA 75 requirements for raised flooring.

D. Coordination of Work

Coordinate location of access flooring pedestals to prevent interference with mechanical and electrical Work in underfloor cavity.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver access flooring components in original, unopened packages, clearly labeled with manufacturer's name and item description.

B. Handle and store packages containing access flooring in a manner that avoids overloading building structure.

1.07 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements of this Section, provide products of one of the following manufacturers of systems with formed steel panels, or approved equal:

USG Interiors/Donn; Long Island City, NY
Tate Architectural Products, Inc.; East Rutherford, NJ

2.02 MATERIALS

A. Floor Panels

1. General

Panels shall be 24 inches square, interchangeable with other standard field panels, easily placed and removed without disturbing adjacent panels or understructure by one person using a portable lifting device, free of exposed metal edges in installed position.

2. Formed Steel Panels

Manufacturer's standard all-steel panel construction with die-cut flat cold-rolled steel top sheet welded to die-formed and stiffened cold-rolled steel bottom sheet, fabricated entirely of non-combustible material.

B. Floor Panel Covering

1. Surface Panels with HPL, high wear type, grade HW62 (0.062 inch), conforming to NEMA LD3.

2. Colors and Patterns

Provide floor covering materials complying with colors and patterns shown on the Contract Drawings or, if not shown, as selected by the Engineer from manufacturer's standard colors and patterns.

3. Plastic Edging

Manufacturer's standard plastic edge trim applied by manufacturer's standard method either mechanically or adhesively, or both, to perimeter of each panel, of size and profile to suit floor covering selected, unless otherwise shown on the Contract Drawings.

C. Understructure

1. Pedestals

- a. Provide manufacturer's standard pedestal assembly, including column with provisions for height adjustment, head (cap), and square or circular base with not less than 16 sq. in. of bearing area; made either of steel or aluminum or a combination of both.
- b. Provide vibration-proof mechanism for making and holding fine adjustments in height for leveling purposes over a range of not less than 2 inches. Include means of locking leveling mechanism at a selected height, which requires deliberate action to change height setting and prevents vibratory displacement.
- c. Head

Of type designed for direct, non-bolted support of panels.

2. Stringer Systems

Manufacturer's standard steel modular stringer system, designed and fabricated to interlock with pedestal head and to form a grid pattern with members under each edge of each floor panel and with a pedestal under each corner of each floor panel. Protect steel components against corrosion with manufacturer's standard galvanized or paint finish.

- a. Snap-on Stringers

System of stringers attached to pedestals with non-bolted interlocking connections to provide a stable understructure and to prevent accidental disengagement.

2.03 ACCESSORIES

A. Colors and Finishes

For exposed accessories available in more than one standard color or finish, provide color or finish selected by the Engineer from manufacturer's full range of standard colors and finishes.

B. Cutouts

Fabricate cutouts in floor panels to accommodate cable penetrations and service outlets, if any. Comply with requirements shown on the Contract Drawings for size, shape, number and location. Provide reinforcement or additional support, if needed, to make panels with cutouts comply with standard performance requirements.

1. Fit cutouts with manufacturer's standard grommets in sizes and locations shown on the Contract Drawings or, where size of cutouts exceed maximum grommet size available, trim edge of cutouts with manufacturer's standard plastic molding having tapered top flange.

- a. Furnish removable covers for grommets.

C. Receptacles and Wiring

Electrical receptacles and wiring for service outlets are specified in applicable Section(s) of Division 16 Sections of these Specifications.

- D. Provide two manufacturer's standard lifting devices of the type compatible with the panel covering.

E. Vinyl Base

Vinyl wall base complying with FS SS-W-40, Type II, with matching end stops and preformed or molded corner units, with topset cove, and of height and thickness shown on the Contract Drawings.

F. Perimeter Support

Provide manufacturer's standard aluminum extrusion to support panel edge and form transition between access flooring and adjoining floor covering at same level as access flooring, where shown on the Contract Drawings.

PART 3. EXECUTION

3.01 PREPARATION

A. Field Measurements

To ensure proper fitting of Work, take field measurements prior to preparation of shop drawings and fabrication. Indicate field measurements on shop drawings.

B. Pre-Installation Adhesive Subfloor Field Test

Prior to proceeding with installation of pedestals, field test their adhesion to subfloor surfaces as follows:

1. In areas representative of each subfloor surface condition, set typical pedestal assemblies in same adhesive and methods required for completed Work.
 - a. Allow test installation to cure for 14 days, with a pressure of 25 lbf applied vertically to pedestals during this period.
 - b. After curing, apply lateral loads against a straight steel extension bar inserted 2 inches into pedestal stems. Measure with spring scale the force needed to cause adhesive failure between pedestal base and subfloor.
 - c. Do not proceed with installation until tests evidence compliance with indicated requirement for pedestal's capability to resist overturning bending movement.
- C. Locate each pedestal and complete any necessary subfloor preparation and vacuum clean the subfloor of all dust, dirt and construction debris before starting installation.

3.02 INSTALLATION

- A. Install floor system and accessories in the presence of the manufacturer's authorized representative to ensure rigid, firm installation free of vibration, rocking, rattles, squeaks and other unacceptable performance.
- B. Set pedestals in the test-approved adhesive, as recommended by the floor manufacturer, to provide full bearing of the pedestal base on the subfloor.
- C. Layout floor panel installation to keep the number of cut panels at the floor perimeter to a minimum. Scribe panel assemblies at perimeter to provide a close fit with no voids greater than 1/8 inch where panels abut vertical surfaces.
- D. Secure grid members to pedestal heads in accordance with manufacturer's instructions.
- E. Thoroughly vacuum clean the subfloor area as installation of floor panels proceeds. Extend cleaning under installed panels as far as possible.
- F. Remove cutting and trimming daily and do not permit other dirt or debris-producing operations in the rooms where the floor is being installed.
- G. Level installed access floor to within 0.100 inch of true level over the entire area and within 0.0625 inch in any 10-foot distance.

3.03 PROTECTION

- A. After completion of installation, vacuum clean the entire floor system and cover with continuous sheets of reinforced paper or plastic. Maintain and repair damages to protective covering until directed to be removed by the Engineer.
- B. Replace access floor panels that are chipped, broken, stained, scratched or otherwise damaged, or which do not conform to the requirements specified in this Section.

END OF SECTION

SECTION 10270
ACCESS FLOORING

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

- 10270A01 Drawings showing complete layout of access flooring based on field-verified dimensions; include dimensional relationships to adjoining Work installation tolerances. Include details, with descriptive notes indicating materials, finishes, fasteners, typical and special edge conditions, accessories, understructure and other data to permit a full evaluation of entire access flooring system.

Samples

- 10270C01 Submit samples of each exposed metal finish and each type and color of floor covering and accessory. Submit one complete full-size floor panel, pedestal and grid unit for each type of access floor required.

Product Data

- 10270D01 Manufacturer's technical data for each type of access flooring required.

Certificates

- 10270E01 Submit certificates from manufacturers of access flooring attesting to acceptance of installer and compliance of their products with the requirements herein.

Manufacturer Test Reports

- 10270F01 Submit certified test reports evidencing compliance of access flooring with performance requirements specified in this Section. Such compliance shall be based on comprehensive testing of current products representative of those products to be provided for this Work.
1. Engage an independent inspection and testing agency, acceptable to the Authority and experienced in testing of this kind, to certify and evaluate test results either after performing tests or witnessing tests performed by the manufacturer.

END OF APPENDIX "A"

DIVISION 10

SECTION 10430

ARCHITECTURAL SIGNAGE SYSTEMS

PART 1. GENERAL

1.01 SUMMARY

- A. Work of this Section shall include labor, tools, materials, equipment and services required to engineer, fabricate, construct, pack, ship and install Authority-designed signs, including, but not limited to graphics and sign components as shown on the Contract Drawings, as specified herein and as required to furnish and install a complete installation.
- B. This Section includes the following sign types:
 - 1. Interior
 - a. Ceiling mounted single face and double face signs.
 - b. Wall mounted signs and plaques.
 - c. Pylon signs (free-standing signs).
 - 2. Exterior
 - a. Roadway signs.
 - b. Post and panel signs.
 - c. Suspended and wall mounted signs.
 - d. Pylon signs (free-standing signs).
- C. Coordinate Work of this Section with trades providing structural support systems to which the signs are attached, and cooperate with such trades to assure the steady progress of Work of this Section.

1.02 REFERENCES

- A. The following is a listing of the publications referenced in this Section:

American Architectural Manufacturers Association (AAMA)

- | | |
|-----------|---|
| AAMA 611 | Voluntary Specification for Anodized Architectural Aluminum. |
| AAMA 2605 | Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels. |

American Association of State Highway and Transportation Officials (AASHTO)

- | | |
|--------------|---|
| AASHTO LTS-4 | Standard Specification for Structural Supports for Highway Signs, Luminaires and Traffic Signals. |
|--------------|---|

American Society for Testing and Materials (ASTM)

- | | |
|------------|---|
| ASTM A 167 | Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip. |
| ASTM A 424 | Specification for Steel Sheet for Porcelain Enameling. |

ASTM A 591	Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight [Mass] Applications.
ASTM A 653	Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
ASTM A 780	Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
ASTM A 1008	Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
ASTM B 209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
ASTM B 221	Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
ASTM C 283	Test Method for Resistance of Porcelain Enamelled Utensils to Boiling Acid.
ASTM C 297	Test Method for Flatwise Tensile Strength of Flat Sandwich Constructions.
ASTM C 346	Test Method for 45-deg Specular Gloss of Ceramic Materials.
ASTM C 481	Test Method for Laboratory Aging of Sandwich Constructions.
ASTM C 538	Test Method for Color Retention of Red, Orange and Yellow Porcelain Enamels.
ASTM D 256	Test Method for Determining the Izod Pendulum Impact Resistance of Plastics.
ASTM D 523	Test Method for Specular Gloss.
ASTM D 790	Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
ASTM D 1003	Test Method for Haze and Luminous Transmittance of Transparent Plastics.
ASTM D 1044	Test Method for Resistance of Transparent Plastics to Surface Abrasion.
ASTM D 2244	Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
ASTM D 4802	Poly (Methyl Methacrylate) Acrylic Plastic Sheet.
ASTM G 154	Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

American Welding Society (AWS)

AWS D1.1	Structural Welding Code, Steel.
AWS D1.2	Structural Welding Code, Aluminum. Standard Code for Arc and Gas Welding in Building Construction.

Flat Glass Marketing Association (FGMA)

Sealant Manual.

Glass Association of North America (GANA)

Glazing Manual.

Military Specifications

DOD-P-15328D Primer (Wash), Pretreatment (Formula No. 117 for Metals).

National Association of Architectural Metal Manufacturers (NAAMM)

Metal Finishes Manual for Architectural and Metal Products.

National Fire Protection Association

NFPA 70 National Electrical Code.

Porcelain Enamel Institute (PEI)

PEI-1001 Specifications for Architectural Porcelain Enamel.

The Society for Protective Coatings (SSPC)

SSPC-Paint 12 Paint Specification No. 12 – Cold Applied Asphalt Mastic (Extra Thick Film).

SSPC-Paint 20 Paint Specification No. 20 – Zinc-Rich Primers (Type I, "Inorganic" and Type II, "Organic").

SSPC-SP 1 Surface Preparation Specification No. 1 – Solvent Cleaning.

SSPC-SP 5 Surface Preparation Specification No. 5 – White Metal Blast Cleaning.

SSPC-SP 8 Surface Preparation Specification No. 8 – Pickling.

B. Comply with the following codes and standards to the extent that they would apply if the Authority were a private corporation:

1. American Institute of Graphic Arts (AIGA) guidelines.
2. The Americans with Disabilities Act Accessibility Guidelines (ADAAG).
3. Building Code of the City of New York for New York City contracts.
4. National Fire Protection Association (NFPA) regulations.
5. New Jersey Uniform Construction Code for New Jersey contracts.
6. Occupational Safety and Health Act (OSHA) standards.
7. Society for Environmental Graphic Design (SEGD) Sourcebook.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

Exemption (4)

1.04 QUALITY ASSURANCE

- A. Ensure that entities performing the fabrication and installation Work of this Section have ten (10) years experience in the fabrication and installation of signage involving complexities equal to or greater than those required for the Work of this Section.
- B. Completed Work shall be structurally sound and free from scratches, abrasions, distortions, chips, breaks, blisters, holes, splits and other disfigurement considered as imperfections for the specific material.
- C. Uniformity of Manufacture: For each sign type shown on the Contract Drawings furnish products of a single manufacturer.
- D. Upon request arrange for the Engineer to inspect the sign fabrication facilities to observe fabrication of Work of this Section to ensure conformance to Contract Document requirements. Refer to Division 1 - General Provisions, Article entitled "Inspections and Rejections".

E. Mock-ups

1. Where shown on the Contract Drawings, supply one mock-up of each sign type shown. Mock-ups shall serve as quality standards for the Work of this Section.
2. Install mock-ups at locations identified by the Engineer.
3. Equip illuminated mock-ups with specified luminaries, switches and ballasts and make the mock-ups fully operational.
4. Construct mock-ups to the level and degree of fabrication and finish proposed for Work of this Section. Mock-ups, if approved by the Engineer, may be installed on site as part of the Work.
5. Remove rejected mock-ups from Authority property.

1.05 DELIVERY, STORAGE, AND HANDLING

Deliver signs in protective wrapping and store protected from weather, moisture and soiling. Coordinate on-site storage with the Engineer.

1.06 GUARANTEE

A. Contractor shall execute and submit a Guarantee, acceptable to the Engineer, that Work of this Section is in accordance with the Contract Documents and free from faults and defects in materials and workmanship for a period of five (5) years from the date of issuance of the Certificate of Final Completion.

1. Guarantee shall cover, but not be limited to:
 - a. Color fastness against fading or chalking.
 - b. Non-yellowing of acrylic.
 - c. Assembly, construction and operation.
 - d. No noticeable cracking, chipping, peeling or delamination.
 - e. Uniformity of light in sign illumination.
 - f. Structural failure.

B. Contractor shall submit extended Warranties provided by suppliers of materials and finishes.

1.07 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

See Appendix "B" for manufacturers list.

2.02 MATERIALS

The following materials shall be used, as applicable. Material gages and thicknesses shall be as shown on the Contract Drawings or, if not shown, as specified in this Section. Refer to 2.05 for Shop Finishing.

A. Structural Steel and Miscellaneous Steel Framing and Supports
Sizes and shapes shown on Contract Drawings.

- B. Aluminum Sheet
Alloy and temper recommended by the aluminum producer or finisher for the type of use and finish shown on the Contract Drawings, and with not less than the strength and durability properties specified in ASTM B 209 for alloy 6061-T6.
- C. Aluminum Extrusions
Alloy and temper recommended by the aluminum producer or finisher for the type of use and finish shown on the Contract Drawings, and with not less than the strength and durability properties specified in ASTM B 221 for alloy 6063-T5.
- D. Steel Sheet
 - 1. Commercial quality cold-rolled carbon steel sheet, stretcher leveled, complying with the following requirements as applicable:
 - a. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591, with Class C zinc coating; chemically treated in mill with phosphate solution and light chromate rinse.
 - b. Uncoated Steel Sheet: ASTM A 1008, exposed, matte finish.
 - c. Galvanized Steel Sheet: ASTM A 653, Coating Designation G 90, mill phosphatized.
 - 2. Steel Sheet for Porcelain Enamel Panels: Special purpose "enameling iron or steel" of low metalloïd and copper content, especially manufactured and processed for the production of porcelain enamel panels; ASTM A 424, commercial quality, Type II; thickness as required for structural performances, but not less than manufacturer's recommended minimums for profiles and applications shown on the Contract Drawings, and not less than 16 gage.
- E. Aluminum Honeycomb Core for Porcelain Steel Panels
1-1/2 inch aluminum honeycomb with a foil thickness of 0.003 inch minimum, cell size 3/4 inch, and density of 1.8 lbs. per cubic foot.
- F. Aluminum Backing Sheets for Porcelain Steel Panels
ASTM B 209; alloy, temper and finish as recommended by panel manufacturer. Sheet manufacturer's standard "stucco" embossed sheet finish. Thickness as required for structural performances, but not less than manufacturer's recommended minimums for profiles and applications shown on Contract Drawings, and not less than 18 gage for exterior panels.
- G. Stainless Steel
Type 316L, plate, sheet or strip, complying with ASTM A 167.
- H. Plastic Laminate
High-pressure laminate engraving stock with face and core plies in contrasting colors, scratch resistant, in thickness and color shown.

I. Cast Acrylic Sheet

Cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, ASTM D 4802, classification category A-1, smooth finish, UV absorbing, in sizes and thicknesses indicated on Contract Drawings, minimum flexural strength of 16,000 psi when tested in accordance with ASTM D 790, minimum allowable continuous service temperature of 176 degrees F (80 degrees C), unless otherwise noted.

1. At cutout acrylic lettering and graphics locations: Clear transparent and white translucent sheet of densities required to produce uniform brightness and minimum halation effects.
2. At silk screen graphics locations: White translucent sheet of density required to produce uniform brightness and minimum halation effects.
3. At color sheet graphics locations: Clear transparent facing sheet and white translucent backing sheet, same as sheets specified above for silk screen graphics locations.
4. Where "clear" sheet material is shown, furnish colorless sheet in matte finish.
5. Where "opaque" sheet material is shown, furnish colored opaque acrylic sheet in colors and finishes shown or, if not shown, as selected by the Engineer from the manufacturer's standards.

J. Colored Coatings for Cast Acrylic Sheet:

1. Where silk screen graphics are shown on the Contract Drawings: Colored coatings, including inks and paints for copy and background colors, shall be as recommended by acrylic manufacturers for optimum adherence to acrylic surface and non-fading for application shown on the Contract Drawings.
2. Where color sheet film graphics are shown on the Contract Drawings: Photographic sheet graphics placed between two cast acrylic sheets (specified above). Photographic sheet graphics shall be "Duratrans RA" display material, manufactured by Kodak, or approved equal. Finished sheet shall include a minimum 7.0 mil thick translucent base and shall be produced by using "Ektacolor RA" chemicals, manufactured by Kodak, or approved equal.

K. Polycarbonate Sheet

Clear, cast polycarbonate sheet with abrasion resisting coating both sides, in sizes, types and thicknesses shown on the Contract Drawings.

1. Strength: Minimum flexural strength of 13,500 psi when tested in accordance with ASTM D 790; Izod impact resistance of 16 lbf per inch when tested in accordance with ASTM D 256.
2. Service Temperature: Maximum allowable continuous service temperature of 240 degrees F.
3. Abrasion Resistance: Maximum 3 percent haze increase for 100 revolutions of a 500g Taber abraser when tested in accordance with ASTM D 1044.
4. Light Transmittance: Minimum 84 percent light transmittance for 1/4 inch thick clear sheet when tested in accordance with ASTM D 1003.

L. Vinyl Film

Computer generated electro-cut and die-cut vinyl, pressure-sensitive legends, 3M Company "Scotchcal" sheeting film, or approved equal. Execute die-cutting in such a manner that edges and corners of finished letterforms are true and clean. Letterforms with round positive or negative corners or with niched, cut or ragged edges are not acceptable.

1. Thickness: Maximum 0.003 inch.
2. Adhesive Quality: Minimum 55 oz. per inch width, after curing for 24 hours, required to break adhesive bond.
3. Cut in accordance with manufacturer's printed instructions.

M. Glazing Accessories

Setting blocks, spacers, compressible fillers and gaskets, setting points and other accessories required for the installation as recommended by the GANA's *Glazing Manual* and FGMA's *Sealant Manual*, for dry glazing system with compression gaskets. Gaskets shall be cellular, neoprene custom size and configuration as required, with pressure adhesive on one side. Neoprene filler rods, sealants and other accessories shall be as shown on Contract Drawings and as required for weather-tight and light-tight installations.

N. Fasteners

Same basic metal and alloy as fastened metal, unless otherwise shown on the Contract Drawings. Do not use metals that are corrosive or incompatible with metals joined.

1. Types, gages and lengths to suit installation conditions.
2. Concealed fasteners for interconnecting sheet metal fabrications and attachment to other construction.

O. Anchors and Inserts

Stainless steel or hot-dipped galvanized anchors and inserts as required for corrosion resistance, hidden when possible. Include inserts as required, to be set into substrate.

P. Mounting Tapes and Adhesives

Adhesives, as recommended by sign manufacturer, to suit installation conditions; "VHB" (Very High Bond) tape for mounting sign plaques, as manufactured by 3M Company, or approved equal.

Q. Mastic Sealant

Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

R. Gaskets

Tubular or fingered design of neoprene or polyvinyl chloride, or block design of sponge neoprene.

S. Galvanizing Repair Paint

High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing minimum 94 percent zinc dust by weight, and complying with SSPC-Paint 20.

T. Bituminous Paint

Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

2.03 CONSTRUCTION FEATURES

Sign graphics and finish shall be as shown on the Contract Drawings.

- A. Ceiling Mounted Signs
Fabricated of metal sheet and steel framing with copy on either one or two faces, as shown on the Contract Drawings.
- B. Wall Mounted Signs and Plaques
Fabricated of metal sheet or plastic laminate and directly mounted to wall or fascia as shown on the Contract Drawings.
- C. Pylon Signs
Square, triangular, rectangular shaped in plan, or as shown, in the form of either a tower or slab. Fabricated of metal sheet or aluminum sandwich panels and steel framing, as shown on the Contract Drawings.
- D. Roadway Signs
Fabricated of metal sheet, aluminum sandwich panels and steel framing, as shown on the Contract Drawings.
- E. Post and Panel Signs
Post mounted units fabricated of metal sheet and either aluminum or steel framing as shown on the Contract Drawings.
- F. Suspended and Wall Mounted Signs
Fabricated of metal sheet or aluminum sandwich panels, and either directly mounted to a building fascia or façade or suspended by steel or aluminum framing, as shown on the Contract Drawings.

2.04 FABRICATION

- A. General
Work shall be fabricated to details shown on the Contract Drawings and on the approved Shop Drawings, and shall be first class workmanship in accordance with the best trade practices. Cutting, fabrication and assembly shall be performed in the factory. Joints, corners, mitres and splices shall be accurately machined, filled, fitted and filed, rigidly framed together at joints and contact points, and painted smooth to give a monolithic appearance with imperceptible joints; there shall be no visible connections. Mechanical fasteners shall match color and finish of the sign where they occur. Exposed metal surfaces shall be smooth with unblemished finish. The completed sign shall be shipped to the job site as one complete unit.
 - 1. Materials shall be selected for their surface flatness, smoothness and freedom from surface blemishes wherever exposed to view in the finished unit. Exposed-to-view surfaces that exhibit pitting, seam marks, roller marks, "oil canning", stains, discolorations or other imperfections on the finished unit are not acceptable.
 - 2. Surfaces shall be covered with a protective cover non-deleterious to finish for protection until final installation or erection.
 - 3. Field measurements shall be taken prior to preparation of Shop Drawings and fabrication.

4. Sandwich panels shall be made in lengths up to a maximum of 24 feet and shall be designed to be mounted horizontally. Locations of horizontal joints shall be determined by the layout of graphics on the signs in order to minimize graphics overlapping the joints. Minimum panel width shall be 2 feet and overall sign panel sizes shall be as shown on the Contract Drawings. Maximum span between supports on 1 inch panels shall not exceed 9 feet.
5. Porcelain steel panel units shall be formed in shape and size in accordance with approved Shop Drawings with allowable tolerances of plus or minus 1/16 inch.
6. Where aluminum is fastened to steel or other dissimilar metal, or where aluminum is in contact with concrete or masonry, contact surface shall be given a heavy coating of bituminous paint.
7. Form closures and trim members to profiles shown using the gage sheet metal shown. Furnish components required for support and installation of closures and trim. Fabricate closures and trim to tightly close with adjoining Work. Finish exposed edges of trim and closure strips. Joints in exposed Work shall not vary more than 1/32 inch in either width or alignment.
8. Locate fasteners to be concealed wherever possible, otherwise to be as inconspicuous as possible. Size fasteners to securely support the Work, and space to prevent buckling or waviness of the finished surface. Exposed fasteners shall be countersunk and filled to match finish.
9. Drill and tap holes required for securing closures to other surfaces. Fasteners shall be hidden from view or countersunk flush to surface.
10. Joints shall have contiguous concealed support to hold meeting faces in flush alignment. Miter or cope trim members at corners to form tight joints.

B. Welding, Brazing and Soldering

Comply with AWS D1.1 and D1.2 and NAAMM for recommended procedures in welding, brazing and soldering. Use filler metals that blend with and match the color of sheet metal being used and the required exposed finish appearance of the metals. Continuously weld, braze or solder corners and seams, and grind smooth and flush on exposed surfaces. Discoloration or stains between base metal and filler metal are not acceptable for exposed portions of natural metal finish.

1. Clean, preheat, heat, flux and sweat solder through full contact area of surfaces to be joined, in accordance with best standards of practice. Remove flux residue and foreign matter after soldering. Rinse soldered areas with water and wipe clean.

C. Graphics

1. The standard for sign messages shall be as shown on the Contract Drawings. Produce "camera-ready" artwork as required based on design furnished by the Engineer on a Macintosh compatible computer disk produced using Adobe Illustrator and QuarkXPress software.
2. Messages
 - a. Letterforms, numbers and symbols for silk-screens or die-cuts shall be prepared from photographic reproductions of repro-proofs of type set copy or computer-generated sign layouts. Film positives shall be submitted to the Engineer for approval, prior to preparation of silk-screens or vinyl lettering.

- b. Silk-screen printing or vinyl die-cutting shall be executed in a such a manner that edges and corners of finished letterforms are sharp, true and clean. Copy with rounded positive or negative corners, edges built-up, bleeding or spattering, shall not be acceptable. Prepare each silk-screen in one continuous piece to accommodate total message coverage, unbroken horizontally or vertically.
- c. Silk-screens and film positives shall be turned over to the Engineer. Refer to Appendix "A".
- d. Silk-screen messages and symbols shall be per Contract Drawings and "camera-ready" artwork. Paint or ink shall be of the finest quality of heat, moisture and fadeproof pigments and vehicles.
- e. Paint or ink shall be of type specially formulated and manufactured for application on the surface material upon which it is to be applied and recommended for such use by the manufacturer of the paint or ink. Priming, surface preparation and application of materials shall be in strict accordance with the manufacturer's written product data and description and as otherwise necessary to produce a finish free of blistering, bleeding, fading and other imperfections. Paint shall be ordered or mixed in quantity to assure consistent application for signs. Finishes shall be as approved by the Engineer during Shop Drawing review.
 - (1) Inks shall be products manufactured by Naz-Dar/KC, 3M Company, or approved equal that are specifically suited for applications shown on the Contract Drawings.

D. Internally Illuminated Signs

- 1. Internal housings and baffles shall be of aluminum sheets or bent plates in gages and thickness as shown on the Contract Drawings or, if not shown, as required by this Section.
- 2. Lamping and box design shall be such that even, consistant illumination is achieved across the sign face from edge to edge. Hot or cold spots, shadows or ghosting are not acceptable.
- 3. Graphics display shall use one of the following methods as shown on Contract Drawings:
 - a. Silk screen graphics or color sheet graphics as specified in this Section.
 - b. Cutout Copy:
 - Machine-cut letters, numbers, symbols and other graphic devices through the sign panel to produce precisely formed copy. Use high-speed cutters mechanically linked to master templates in a pantographic system, or equivalent process capable of producing characters of the style shown on the Contract Drawings with sharply formed edges.
 - (1) Backup
 - 0.125 inch thick acrylic sheet backup attached to backside of the panel.
 - (2) Pushed-Through Graphics
 - Precise-fitting copy cut from 0.250 inch thick transparent acrylic sheet projecting through engraved copy, chemically welded to 0.125 inch thick acrylic sheet backup, where pushed-through graphics are shown on the Contract Drawings. Apply vinyl films where shown on the Contract Drawings.

4. Wiring within the sign shall be installed in accordance with the National Electrical Code and shall be neatly arranged and supported.
 5. Ballasts shall be individually fused in an approved manner.
 6. Wire terminals, taps and other electrical connectors shall be of an approved swaged, clinched or positive clamping type. Plain soldered lugs with no means of mechanically holding the wire without solder are not permitted.
 7. Lamps, ballasts and fuses shall be arranged so that they are readily accessible for maintenance. Lamps and ballasts shall comply with the requirements of Division 16 Section on Lighting Systems. Determine actual types, lengths and wattages required for individual and fully legible signs. Furnish suitable lamps for interior and exterior use as required for even illumination of messages.
 8. Illuminated signs shall be connected into the existing building circuitry. Install conductors from the existing junction boxes or relays to the service entrances in the signs in order to provide power to the lamps. The exact location of existing junction boxes or relays shall be determined in the field before making provisions for concealed service entrances in the signs. Make electrical fixture and power connections.
 9. Illuminated signs shall be furnished with vent holes protected with insect screening, and adequately lightproofed.
 10. Illuminated signs shall be of weather-tight construction.
 11. Furnish prop bar for ease in relamping.
 12. Furnish a photocell-operated switch in an inconspicuous location, for the individual operation of each sign for maintenance purposes.
- E. Lighting Fixtures for Externally Illuminated Roadway Signs
1. Sign lighting fixtures shall be of the type specified hereinafter and shall be complete with self-contained ballasts, wired for operation and mounted and supported as shown on the Contract Drawings.
 2. Fixtures shall be dust-tight, weather-tight and suitable for outdoor use. Ballasts shall be of the high power factor type and shall bear the stamp of approval of the Electrical Testing Laboratory. Ballasts and lamps shall be suitable for operation at temperatures down to minus 20 degrees F. Ballasts shall be fused with the proper size fuse as recommended by the manufacturer. The fuse holders shall be type HLR and be equipped with type GMF glass tube fuses as manufactured by Bussman Manufacturing Company, or approved equal.
 3. Fixture housings shall be constructed of 18 gage (0.040 inch) aluminum, ASTM B 209, alloy 3003-H14, welded construction.
 4. Exterior surfaces of fixtures shall be field painted or shall receive a factory-applied finish as shown on the Contract Drawings.
 5. Fixture reflectors shall be minimum 0.020 inch thick aluminum, specular Alzak processed finish and of paracylindrical form.
 6. Housing door for internal access shall consist of an enclosure lens of clear, unribbed acrylic plastic, 1/8 inch thick, and an enclosure frame of extruded aluminum, with vinyl or neoprene gasketing. This framed plastic door shall be connected to the fixture body by a continuous extruded hinged frame member. Extruded hinge shall be constructed to form a stop so that when the door is in the upward position it is past 90 degrees. Furnish a positive latch assembly to keep the cover in the open position and to prevent accidental release.

7. Door shall be secured in place against a polyvinyl gasket around the opening and secured with toggle action stainless steel catches.
 8. Lamp sockets shall be protected by a polychloroprene moisture-proof boot.
 9. Fixture shall have a barrier type terminal block for terminating the lamp socket wires.
 10. Wiring shall be minimum number 10 AWG and as specified in Division 16 Section on Wires, Cables, Splices, Terminations.
 11. Conduit shall be watertight and as specified in Division 16 Section on Raceways.
 12. Signs shall be completely factory wired with at least five feet of slack to handholes at base of support for connection to branch circuits as shown on the Contract Drawings.
- F. Plastic Laminate Sign Panels
1. Face Material
High pressure plastic laminate engraving stock in finishes and color combinations shown on the Contract Drawings or, if not shown, as selected by the Engineer from the manufacturer's standard colors.
 2. Back-Up Material
Cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet in sizes and thickness shown on the Contract Drawings.
- G. Plastic Laminate Plaques and Room Identification Signs
1. Unframed panel signs fabricated as follows, unless otherwise shown on the Contract Drawings:
 - a. Edges: Square cut with edge color same as the background.
 - b. Corners: Square.
 2. Graphic Image
Sign copy shall comply with the requirements for size, style, spacing, content and symbols shown on the Contract Drawings.
 3. Machine-engage letters, numbers and symbols into sign face to expose the contrasting core ply.
- H. Sandwich Panel Signs
1. Perimeter Frames: Extruded aluminum alloy 6063-T6, heliarc welded.
 2. Panel Thickness: 1 inch, unless otherwise shown on the Contract Drawings.
 3. Finish: As specified in this Section or as shown on the Contract Drawings.
 4. Aluminum honeycomb laminate construction: Minimum tensile strength of 50 psi in accordance with ASTM C 297 and ASTM C 481.
 5. Adhesives: Thermosetting epoxy type. Bonding shall be done in a heated flat platten press of sufficient size to contain the entire panel at one time with 10 psi over the entire platten area.
 6. Adhesively bonded panels shall have exterior faces of such flatness when measured at normal room temperature of 70 degrees to 80 degrees F that the maximum slope of the surface at any point, measured from the nominal plane of the surface, shall not exceed 1.5 percent. Wave slope shall be computed by measuring the distance between high points and placing a straight edge across these points to determine the depth of slope. Flatness of signs shall be within a slope determination of 1 percent when checked in this manner.

7. For exterior signs, 1/8 inch diameter weep holes shall be drilled in the cap and the perimeter frame at the bottom of each panel 3 inches in from either end, and in the center of each panel.

I. Aluminum Sheet on Plywood Signs

Form sign panels of aluminum sheet, adhesively attached to fire-retardant plywood backing, as shown on the Contract Drawings.

2.05 SHOP FINISHING

A. General

1. Shop finish of signs shall be as follows and as shown on the Contract Drawings:

- a. Porcelain Enamel finish on Sandwich Panel signs, Aluminum Sheet on Plywood signs, or other type of sign face as shown on the Contract Drawings.
- b. Fluoropolymer 3-Coat System on aluminum.
- c. Clear or Color Anodic on aluminum.
- d. Acrylic Polyurethane on aluminum.
- e. Baked Enamel on steel or galvanized steel.
- f. Paint on steel or galvanized steel.
- g. Stainless Steel: Finish as shown on the Contract Drawings.

2. Comply with NAAMM's *Metal Finishes Manual for Architectural and Metal Products* for finish description and application recommendations, except as otherwise shown and specified.

3. Materials comprising a sign shall be finished with a coating system compatible with that material; priming shall be done in accordance with finisher's specification. Exposed surfaces, edges and connections shall receive this same finish system.

B. Surface Preparation

1. Aluminum: AA-C12-C42-R1x (Chemical Finish: Cleaned with inhibited chemical conversion coating, acid chromate-fluoride-phosphate pretreatment); coating system as specified below.
2. Steel for Porcelain Enamel Finish: Panels shall be thoroughly cleaned, degreased, acid etched, and neutralized.
3. Stainless Steel: The cleaned stainless steel surface shall be pretreated with a wash-coat conforming to Military Specification DOD-P-15328D or approved equal.
4. Before finishing, remove loose mill scale, dirt, weld flux, weld spatter and other foreign material.

C. Color

1. Exposed sign surfaces, including panel backgrounds, shall be in a color and gloss as shown on Contract Drawings or, if not shown, as selected by the Engineer from manufacturer's custom range.
2. Messages on sign panels to be satin or matte finish white, unless otherwise shown on Contract Drawings.
3. Exposed conduit, electrical boxes, clamps and connectors shall be painted to match sign finish.
4. Interior housing surfaces of internally illuminated signs shall be painted in a high-gloss white enamel finish.

5. Colors and degree of gloss for surface paint and finish applications shall be consistent throughout, regardless of substrate.
- D. Porcelain Enamel Finish
1. General
 - a. Weather Resistance: The porcelain enamel finish on surfaces exposed to weathering shall pass the acid spot test in accordance with ASTM C 283. In addition, red, yellow and orange porcelain enamels shall pass the cupric sulfate test in accordance with ASTM C 538.
 - b. Continuity of Coating: Visual inspection of each piece shall reveal no visible breaks or surface defects in the cover coating that expose the underlying coating or the steel on surfaces exposed to weathering, nor the underlying steel on either the back or flanges. This requirement shall not apply to sheared edges.
 - c. Surface Appearance: The porcelain enamel on surfaces exposed to weathering shall be free of blemishes in the coating that may impair its serviceability or detract from the general appearance of the panel when viewed from a 5 foot distance.
 2. Compliance Statement
Obtain from Manufacturer certification that the porcelain enameling is performed in accordance with PEI 1001.
- E. Porcelain Enamel on Aluminum
1. Application: By automatic spray equipment and in conformance with PEI specifications; ASTM C 346 gloss reading of 50 to 70 units at an angle of 45 degrees when measured on the Photovolt meter.
 2. Weight loss of porcelain enamel shall be less than 20 mg per square inch when tested in accordance with ASTM C 283.
 3. Sign Graphics
 - a. Applied graphics shall be 0.080 inch thick flat sheet aluminum with a lamination of heat sensitive reflective sheeting, unless otherwise shown on the Contract Drawings to have integral colors.
 - b. Affix graphics to the sign panel with tape.
 - c. This method shall be used on other sign types and finishes, where shown on the Contract Drawings.
- F. Porcelain Enamel on Steel
1. Application: Apply porcelain enamel by spray application. Panels are to be given a ground coat of porcelain enamel on all surfaces. Panel surfaces exposed to the weather shall be given a cover coat of porcelain enamel necessary to produce the required colors specified. Back and other concealed areas of the panel shall be given at least one coat of porcelain enamel (in addition to the ground coat) for protection and as an aid to maintain shape during firing. Ground and cover coats of porcelain enamel on the front or exposed surface of the panel shall be a minimum of 8.5 mils. Minimum thickness of ground coat shall be 2.5 mils.
 - a. Fire panels at approximately 1450 degrees F in a continuous furnace to properly fuse the porcelain enamel to the metal and ensure color uniformity.
 - b. Check colors and gloss of the porcelain enamel finish during each production run. Produce colors and gloss finishes within the limits established by porcelain samples approved by the Engineer.

- G. Fluoropolymer 3-Coat System
 Manufacturer's standard 3-coat thermocured system composed of specially formulated inhibitive primer, fluoropolymer color coat and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene resin by weight (Atofina "Kynar 500", or Solvay Solexis, Inc. "Hylar 5000"), complying with AAMA 2605; color and gloss as shown on the Contract Drawings or, if not shown, as selected by the Engineer from manufacturer's custom range.
- H. Anodic Finishes
 Finish designations prefixed by "AA" shall conform to the system established by the Aluminum Association for designating aluminum finishes, listed in NAAMM's *Metal Finishes Manual for Architectural and Metal Products*.
1. Class I Clear Anodic Finish
 AA-M12-C22-A41 (nonspecular as fabricated; medium matte etched surface; Architectural Class I clear coating 0.7 mil or thicker), complying with AAMA 611.
 2. Class I Color Anodic Finish
 AA-M12-C22-A42/A44 (nonspecular as fabricated, medium matte etched surface, Architectural Class I, integrally color or electrolytically deposited color coating 0.7 mil or thicker), complying with AAMA 611.
 3. Apply protective coating of clear acrylic lacquer of not less than 0.05 mil, dry film thickness.
- I. Acrylic Polyurethane on Aluminum
1. As manufactured by Matthews Paint Company, 8201 100th St., Pleasant Prairie, WI, or approved equal.
 - a. Colors must be proven to be equal in color and gloss retention to corresponding colors of Matthews Acrylic Polyurethane by United States Testing Company, Inc., Chemical Service Div., 1415 Park Avenue, Hoboken, NJ. The laboratory test shall consist of 1,000 hours in a QUV accelerated weathering tester maintained in accordance with ASTM G 154. The tester shall be programmed to alternate 40 degrees Celsius water condensation 4-hour periods with 60 degrees Celsius ultraviolet 4-hour periods. Gloss measurements are to be made with a Hunterlab color difference meter (ASTM D 523 and D 2244, respectively).
 - b. Proposed alternate coating systems shall include comparative results as indicated above from United States Testing Company, Inc., or other equivalent testing lab acceptable to the Engineer.
 2. Acrylic polyurethane system shall be ultraviolet inhibited, lead and heavy metal free.
 3. Surface to be coated shall be prepared, primed and finish coated in accordance with coating manufacturer's instructions.
 4. Paint shall be thoroughly and evenly applied and shall be well worked into corners and joints and shall have no edge or joint build-up.
 5. Coating shall be applied at not less than the manufacturer's recommended spreading rate, to establish a total dry film thickness of not less than 4.0 mils for the entire coating system of prime/conversion coating and finish coats for 2-coat work.

- J. Baked Enamel Finish on Steel or Galvanized Steel
Immediately after cleaning and pretreatment, apply manufacturer's standard 2-coat baked enamel finish, consisting of prime coat and minimum 1.0 mil dry film thickness thermosetting topcoat. Comply with paint manufacturer's instructions for application and baking to achieve total minimum dry film thickness of 2.0 mils; color and gloss shall be as shown on the Contract Drawings.
- K. Paint Finish on Steel Sheet
 - 1. Surface Preparation
Solvent-clean surfaces in compliance with SSPC-SP 1 to remove dirt, oil, grease and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel in compliance with SSPC-SP 5 or SSPC-SP 8.
 - 2. Factory-Priming for Factory Painted Finish
Apply shop primer, specified in Division 9 Section on Painting, immediately following surface preparation and pretreatment.
- L. Paint Finish on Galvanized Steel Sheet
 - 1. Surface Preparation
Clean surfaces of dirt, grease and other contaminants. Follow by a conversion coating of type suitable for organic coating application. Clean welds, mechanical connections and abraded areas. Follow by SSPC-Paint 20 galvanizing repair paint applied in accordance with ASTM A 780.
 - 2. Factory-Priming for Field Painted Finish
Where field painting after installation is specified or shown on the Contract Drawings, apply air-dried primer, specified in Division 9 Section on Painting immediately following cleaning and pretreatment.
- M. Stainless Steel Finish
Furnish one or more of the following finishes, where shown on the Contract Drawings:
 - 1. Bright, Directional Polish: AISI No. 4 finish.
 - 2. Satin, Directional Polish: AISI No. 6 finish.
 - 3. Satin, Reflective, Directional Polish: AISI No. 7 finish.
 - 4. Mirror-Like Reflective, Non-Directional Polish: AISI No. 8 finish.
 - 5. Non-Directional Finish: As specified in Division 5 Section on Stainless Steel Finish.

PART 3. EXECUTION

3.01 EXAMINATION

Examine substrates and conditions under which Work is to be installed before sign components are delivered to the site. Report in writing to the Engineer conditions that will prevent proper execution of the Work or endanger its permanency. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer. Commencement of the Work shall constitute acceptance of the conditions.

3.02 PREPARATION

- A. Determine location of utilities that will be within the excavation site. Immediately notify the Engineer of conflicting conditions.

- B. Schedule installation of signs at the convenience of the Engineer, so that the Work may be coordinated with other finishing in progress within the building. Signs shall be erected by skilled workmen especially trained in this type of work.

3.03 INSTALLATION

- A. Install signs, including sign structures, anchorages, electrical components and required connections into existing circuits.
- B. Comply with manufacturer's product data and published instructions for material installation requirements.
- C. Install the Work in location, in alignment and in elevation, free of rack, plumb, level and straight with no distortions, measured from established lines and levels. Shim as required using concealed shims. Install to a tolerance of 1/8 inch in 8 feet for plumb and level, with maximum 1/32 inch offset in flush adjoining sign panels, and maximum 1/16 inch offsets in flush and in revealed adjoining surfaces. Level with instruments; measuring equal distances from existing building surfaces is not acceptable as a basis of level and plumb.
- D. Execute drilling, cutting and fitting carefully and fit at job before finishing. Install anchors, expansion bolts and anchor bolts for complete anchorage. Install supporting members, fastenings, framing, bracing brackets, straps, bolts and angles as required to set and connect signage Work rigidly and properly to underlying construction.
- E. Obtain prior approval of Engineer before field cutting or drilling galvanized steel.
- F. Set anchor bolts and anchorages with templates to correct elevations, plumb and true, where shown on the Contract Drawings, complying with approved Shop Drawings. Complete connections in proper alignment and tighten bolts securely.
- G. Sign faces shall be flat, true and free from oil canning and waviness; exposed surfaces shall not deviate from flat by more than 1/16 inch in any 36 inch distance.
- H. Bases and Pedestals
Coordinate setting with Contract Drawings, diagrams, templates, instructions and directions for the installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the construction site.
- I. Sign Posts and Supports
 1. Locate field splices in the sign structures where shown on the Contract Drawings.
 2. Form weather-tight joints with connections.
 3. Connections shall not be visible, unless otherwise shown.
 4. Install concealed gaskets, flashing, sealants, fillers and insulation per manufacturer's recommendations as the Work progresses, to make the installations sealed.
 5. Repair finishes damaged by cutting, welding, soldering and grinding operations required for shop fitting and jointing. Restore finishes and paint so that there is no evidence of corrective work. Return items that cannot be refinished in the field to the shop, make the new required alterations, and refinish the entire unit or furnish and install new units at fabricator's option.

6. Fasteners

- a. Fasteners shall be concealed, except where otherwise noted on Contract Drawings. Exposed fasteners, if any, shall be flush and match color and finish of adjacent surfaces.
- b. When dissimilar metals are in contact, coat and finish the contacting surfaces compatibly to their adjacent surfaces.
- c. Visible welding shall be continuous, ground smooth and finished; seams shall be made invisible. Internal welding shall be structurally sound and eliminate racking.

J. Touch-Up

1. Immediately after erection, clean field welds, bolted connections and abraded areas of shop paint, and paint exposed areas with same paint used for shop painting. Field apply by brush or spray to yield a minimum dry thickness of 2.0 mils.
2. Touch-up abraded galvanized surfaces with galvanized repair paint applied in accordance with ASTM A 780.

3.04 FIELD TESTS

Test and adjust illuminated electrical signs for illumination level, hot spots and light leaks.

3.05 CLEANING

- A. Upon completion of Work, remove tools, equipment, surplus and discarded materials from the site, including debris, dirt and rubbish accumulated as a result of the sign installation. Leave the site in a neat and presentable condition.
- B. Clean site of litter and foreign substances. Sweep paved areas to a broom-clean condition; remove stains, petrochemical spills and other foreign deposits.
- C. Upon completion of final installation, clean surfaces of units of work to normal "clean" condition. Comply with manufacturer's instructions for cleaning operations. The following are examples, but not by way of limitation, of cleaning levels required:
 1. Remove temporary protective coverings and labels that are not required as permanent labels.
 2. Clean exposed hand-surface finishes to a dirt-free condition, free of dust, stains, films and similar noticeable distracting substances. Avoid disturbance of natural weathering of surfaces, except as otherwise indicated. Restore reflective surfaces to original reflective condition.
 3. Wipe surfaces of mechanical and electrical equipment clean; remove excess lubrication and other substances.
 4. Clean light fixture housings and lamps to permit functioning with full efficiency.

END OF SECTION

SECTION 10430
ARCHITECTURAL SIGNAGE 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

- 10430A01 Mark Shop Drawings and samples to show name and address of project, Engineer, Contractor, manufacturer and supplier.
- 10430A02 Identify the locations where materials or equipment are to be installed. Show the various parts of the sign construction, including: fastenings, anchorage, lighting, details of lighting fixture supports, electrical fixtures and connections, wiring, stiffening, bracing, types and thicknesses of metal, finishes and complete instructions regarding concealed joints, welds and adjacent and related Work.
- 10430A03 Submit erection drawings for the complete installation of the signs.

Samples

- 10430C01 Submit samples of each sign type to demonstrate quality of fabrication methods, material finishes and color. Matching shall be subject to approval by the Engineer.
- 10430C02 Submit samples of required finish materials and graphics processes for signage.
- 10430C03 Color match Engineer's samples for sign support coating and for sign panel paint or finish system. Submit color chips on samples of actual materials in each color required by project to be used for sign construction, including light fixture finishes. Minimum sample size is 12 by 12 inches.
- 10430C04 Vinyl lettering and graphics shall include at least one uppercase and one lowercase letter of each lettering style and one of each type of graphics shown on the Contract Drawings. Submit actual full size letterforms and graphics of each size to be used, mounted on samples of actual materials to be used for Work of this Section.
- 10430C05 Submit actual full-scale silk-screen letterforms of each size and style of letters shown on Contract Drawings to be used, mounted on samples of actual materials to be used for sign construction.

- 10430C06 Stencil-cut aluminum with pushed-through acrylic for fabrication of illuminated signs, including accessory materials. Submit samples for both pylon type sign and existing sign band locations. Supply one uppercase and one lowercase letter form for each lettering style shown on the Contract Drawings.
- 10430C07 Porcelain enamel sign panels, including lettering and graphics. Include at least one uppercase and one lowercase letter of each lettering style shown on the Contract Drawings.
- 10430C08 Exposed trim, connections and closures. Submit color and material samples of actual materials to be used.
- 10430C09 Each sample submittal shall have a typed label showing: Name of project.
 1. Address of project.
 2. Contractor's name.
 3. Name and description of item represented.
- 10430C10 Sign Panel Materials and Sign Graphics: Furnish one 6 inch by 6 inch sample of each different sign panel material and finish type and of each graphic material type with sample letter used in the Work of this Section. Mark each sample with typed label per C.9 above. Deliver samples to the Engineer. Samples shall become the property of the Authority.
- 10430C11 Silk-Screens and Film Positives: Deliver to the Engineer in good, usable condition to become the property of the Authority. Number in accordance with the Type Nomenclature.

Product Data

- 10430D01 Submit manufacturer's literature and descriptive data including catalog sheets for materials, instructions for cleaning, equipment and fixtures showing control, schedule and other pertinent information as required. Where printed materials describe more than one product or model, clearly identify which is submitted for approval.
- 10430D02 Submit data for fire-retardant treatment type for plywood, if any.

Calculations

- 10430H01 Submit design calculations for sign panels and structural supports.

Manuals, Warrantees/Guarantees

- 10430I01 Sample of guarantee for materials and workmanship.
- 10430I02 Sample of material and finish extended warranties.

Qualifications

10430K01 For entities specified in this Section (professional engineer, fabricator and installer), demonstrating their capabilities and experience. Include list of completed projects with project names, addresses, names of architects, owners and other information specified.

END OF APPENDIX "A"

10430 -22

SECTION 10430

ARCHITECTURAL SIGNAGE SYSTEMS

APPENDIX "B"

MANUFACTURERS

- A. Subject to compliance with the requirements of this Section, furnish and install products by the following, or approved equal:
- ABC Architectural Signing System, Div. of Nelson Harkins Ind., Chicago, IL
 - Andco Industries Corp., Greensboro, NC
 - Artisan Graphic Group, Huntington Station, NY
 - ASI Sign Systems, Inc., New York, NY
 - Going Sign Co., Inc., Plainview, NY
 - Lolite International, West Columbia, SC
 - Signal Sign Co., Livingston, NJ
 - Signs + Decal Corp., Brooklyn, NY
 - Spectrum Signs Inc., Farmingdale, NY
 - Wilcox Brothers Sign & Awning Co., Tonawanda, NY
- B. Subject to compliance with the requirements of this Section, furnish and install porcelain sign products by one of the following, or approved equal:
- American Porcelain Enamel Co., Dallas, TX
 - Cherokee Porcelain Enamel Co., Knoxville, TN
 - Enameltec, Div. of P.G. Bell, Georgetown, Ontario, CN

END OF APPENDIX "B"

DIVISION 14
SECTION 14330
BRIDGE CRANE

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Requirements for bridge cranes including all accessories, spare parts, training, and related materials.

1.02 RELATED WORK:

- A. Section 05120 Structural Steel
- B. Section 09910 Painting
- C. Division 16 Electrical

1.03 STANDARDS AND REGULATIONS:

- A. Regulatory requirements:
 - 1. The equipment shall be designed, manufactured and installed in accordance with the portions of the following industrial and safety standards that are applicable to the work specified herein:
 - a. ANSI - American National Standards Institute
ANSI B30.2 Safety Standard
ANSI B30.10 Safety Standards for Hooks
ANSI B30.16, Overhead Hoists
 - b. ASME - American Society of Mechanical Engineers
ASME B30.2d-1994 Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist).
 - c. AWS - American Welding Society
D1.1 Structural Welding Code--Steel
D14-1 Specification for Welding Industrial and Mill Cranes
 - d. CMAA - Crane Manufacturers Association of America
Specifications No. 70 and 74 for Electric Overhead Traveling Cranes
 - e. HMI - Hoist Manufacturing Institute

100 Standard Specifications for Electrical Wire Rope Hoists

- f. ISO - International Standards Organization
 - (1) ISO 9001, 1988 Edition
- g. NEMA - National Electric Manufacturers Association
- h. NFPA - National Fire Protection Association
Publication No. 70 (NFPA 70)
- i. OSHA - Occupational Safety and Health Administration

2. Work shall conform to the following codes:

- a. NEC - National Electric Code, including Article 610
Cranes and Hoists
- b. NESC - National Electrical Safety Code
- c. UL - Underwriters Laboratories, Inc.
- d. All applicable Federal, state and local codes and regulations.

3. Electrical apparatus safety: All electrical apparatus shall be UL listed.

4. Flame and Smoke Rating Requirements: Comply with New York State Regulations.

5. Products or composite materials containing asbestos shall not be utilized.

1.04 QUALITY CONTROL:

- A. Equipment shall be located within the spaces allocated for such equipment. Verify that all dimensions and utility supplies are adequate for the equipment.
- B. Design and manufacture the system for a minimum 30-year life span. Assume that scheduled maintenance will be performed in accordance with the manufacturer's instructions.
- C. Registration of Designer(s)
 - 1. Shop drawings and design calculations that pertain to the equipment to be furnished and installed under the work of this Section shall be reviewed and sealed by a Professional Engineer who is qualified, registered and licensed to practice in the State of New York.

2. Professional Engineer shall have a minimum of five years documented experience in providing engineering services of the kind indicated herein.

D. Manufacturer Qualifications:

1. Manufacturing firm having minimum 10 years documented experience in the design and manufacture of industrial crane equipment specified.
2. Assembled Components: Shall be manufactured by firm(s) having minimum 10 years documented experience in the manufacture of the component.
3. Verify that the equipment manufacturer employs a quality assurance program that meets the requirements of ANSI and that satisfies all safety-related quality assurance requirements imposed by applicable government regulatory agencies.
4. Obtain from the Manufacturer and submit to the Engineer the following information:
 - a. A list of operating systems supplied by the proposed manufacturer of similar type, function, application and capacity.
 - b. Name of contact person at each installation submitted above who is familiar with the operation and maintenance of all equipment provided by the Manufacturer.
 - c. Detailed information listing country of origin for components to be purchased by the Manufacturer and furnished as part of this Contract.
 - d. Detailed information on locations where fabrication and/or assembly operations for the equipment to be furnished as part of this Contract are to take place.

E. Manufacturer's Representative:

1. Engage the services of a manufacturer's field service representative to supervise installation of equipment, to conduct acceptance testing, and to train the Authority's personnel in the proper operation and maintenance of the equipment.
2. The field service representative shall be a qualified supervisor employed by the manufacturer, having a minimum of 5 years documented training and experience in the installation of

equipment being furnished; and who shall work with the equipment supplier's specialists and shall be present at the site for at least 80 percent of the installation work of the equipment being furnished.

F. **Installer Qualifications:**

1. Firm having minimum 5 years documented experience in the installation of specified products and components, and performing the work under the direction of a supervisor approved by equipment manufacturer.
2. Firm employing an adequate number of skilled workmen having documented training and experience in the methods and requirements necessary for the installation.

G. **Welding: Qualify procedures and personnel according to the following:**

1. AWS D1.1, Structural Welding Code--Steel.
2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

H. **Standard Components:** Furnish and install standard, commercially available components, including motors, pumps and electrical devices, manufactured by companies regularly engaged in the manufacture of the components.

I. **Single Source Responsibility:** Furnish and install products manufactured by a single manufacturer. The design shall provide for interchangeability of items of piping, equipment, subassemblies, motors, starters and relays.

J. A corrosion-resistant identification plate clearly marked and stamped with the manufacturer's name and address, model number, serial number, date of manufacture, and all pertinent utility or operating data (or ratings) shall be attached in a prominent location to each major piece of equipment.

1.05 SUBMITTALS:

A. **Product Data:** Technical documentation defining crane design, testing, and operational criteria, type and grade of each material to be utilized, machining tolerances, and types of finish.

1. Detailed information including location where fabrication assembly and testing operations are performed, submitted to the Engineer within 60 calendar days of receipt of equipment Purchase Order.
2. Submit Manufacturer's recommended installation procedures which, when reviewed and accepted by the Engineer, shall be the basis for accepting or rejecting installation procedures used on the work.
3. Installation details, including column requirements.
4. Performance and operating characteristics.
5. Typed Operating Narrative.
6. Electric power requirements.
7. Catalog cuts of all purchased components.
8. Mill certificates for crane runway rail.

B. Shop Drawings: Submit dimensioned shop drawings showing fabrication details, materials, tolerances, component clearance diagrams, wiring diagrams, system logic diagrams, layout and finish.

1. Crane clearance drawing drawn to a scale of not less than $\frac{1}{4}$ in.=1 ft.-0 in. and showing hook side and end approach limits, extreme high and low hook elevation, runway rail elevation, clearance from overhead and side obstructions, the rated load, wheel spacing, maximum wheel loadings and approach limits of pendant control.
2. Bridge general arrangement drawing showing bridge beam sizes, end trucks, bridge drive arrangement, bridge festoon electrification, festoon pendant system and name and location of each electrical enclosure.
3. Runway electrification system drawings showing how all conductor bar components and collector assemblies are assembled and mounted.
4. Schematic and interconnecting wiring diagrams of all electrical equipment. Interconnection diagrams shall show what electrical

equipment is located in each control enclosure. All electrical equipment and components shall be identified.

5. Pendant station and radio control drawing showing layout of all controllers and indicators, the proper labeling of each, overall dimensions and indicating manufacturer catalog number and NEMA type enclosure.
6. Structural Design calculations indicating compliance with cited standards, addressing structural deflections of bridge beams, rails and supporting structure, and certified by a New York registered Professional Engineer.

C. Record Documents:

1. Operation and Maintenance Manuals: Submit one complete set of the operating and maintenance instruction for equipment, including lubrication instructions, motor replacements, and spare parts, and related drawings and diagrams for review. Upon approval deliver 5 complete sets of the manual and one set of full size plastic film reproducible of drawings and diagrams.
 - a. Submit data required for proper operation and maintenance. For operating type procedures, ensure nomenclature for control positions, test points and indicating devices having panel nomenclature is written exactly as it appears on equipment panel, placard, or structure (e.g., "Set master switch to 'OFF'").
2. Parts Catalog:
 - a. Enumerate and describe each component and related parts, including identifying numbers and commercial equivalents where applicable.
 - b. Cut away and exploded view drawings for identification of parts
3. Spare Parts:
 - a. Submit recommendations for spare parts inventory including types and quantities considered normal for routine maintenance of the equipment for one year.
 - b. Submit recommendations for spare parts inventory including types and quantities considered critical and for

- which extended acquisition time would create excessive downtime
- c. Within 30 days the Authority will determine parts and quantities to be furnished.
 - d. After approval, deliver 5 approved parts lists as adjuncts of the Operation and Maintenance Manuals.
- 4. Bind manual, catalogues, and lists in heavy 3 ringed binders, and deliver to Engineer prior to request for Certificate of Final Completion. Indicate the name and telephone number of manufacturer(s), local representative(s), and nearest source(s) of service and parts, inside the front cover of each manual.
 - 5. Training Manual: Submit 2 hard copies of the training manual and an electronic version on a CD or DVD of the training manual. Submit in conjunction with proposed Training Program.
- D. Testing Data: Submit load test certificate for each electric wire rope hoist which indicates actual breaking strength of wire rope.
- E. Certifications:
- 1. Submit certification that proposed equipment meets or exceeds specification requirements and is appropriate for the intended application.
 - 2. Crane shall be in accordance with New York City Rules and Regulations and meet the requirements of the New York City Building Code.
- F. Testing and Training:
- 1. Factory testing procedures, submitted to Engineer for approval a minimum of 30 calendar days prior to testing.
 - 2. Acceptance (field) testing procedures, submitted to Engineer for approval a minimum of two weeks before the acceptance test can be scheduled.
 - 3. Proposed training program, submitted to Engineer for approval a minimum of 30 calendar days before the scheduled start of training.

1.06 DELIVERABLES:

- A. Approved Maintenance and Operation Manuals.
- B. Certified No-Load and Load Test results.
- C. Documentation of Training Program, including all training materials, completion certificates, and electronic recording (VHS and/or DVD format) of instruction.
- D. One set of the special tools and instruments for the crane, required for maintenance, packed in an appropriate steel tool box. Deliver to the Authority within 30 calendar days of commencement of training program, and obtain written receipt from the Authority for delivery.
- E. One gallon of matching touch-up paint.

1.07 DELIVERY, STORAGE, AND HANDLING:

- A. Equipment and components shall be suitably packed or crated to protect each component against damage during transportation, unloading, setting in place, and assembly.
- B. Avoid and prevent damage to electrical components such as motors, controls and conductors.
- C. Deliver to site in sealed containers protected against intrusion of moisture or foreign matter. Items shall be carefully stored at the site as required in a manner to prevent misalignment or distortion, and shall be adequately protected against damage by weather or other cause.
- D. All materials shall be delivered to the site with their original manufacturer's markings and identification intact. The Authority reserves the right to reject materials that are damaged, improperly identified or not in conformance with reviewed shop drawings and catalog cuts.
- E. Upon completion of work, leave the building and premises in good order. This includes removal of temporary installations, manufacturer-owned materials, and shipping and packaging materials used by the manufacturer in support of delivery of the equipment being provided under this Section.

1.08 VERIFICATION OF DIMENSIONS:

- A. Coordinate all work to the site and to the work of all trades.

- B. Verify all dimensions of the site and vehicles that relate to fabrication of the equipment. Notify the Engineer of any discrepancy before fabrication and delivery of the equipment to the site.
- C. Surfaces to receive metal fabrications shall be sound, square and true. Such surfaces shall be examined prior to installation of the fabrications and all defects which might impair the operability or shorten the life of any of the parts of the equipment shall be corrected at no cost to the Authority.

1.09 WARRANTY:

- A. Submit warranty signed by equipment supplier and executed by manufacturer for equipment, materials, and workmanship against defects and agreeing to repair or replace equipment and materials and correct workmanship.
 - 1. Warranty Period: Minimum 1 year from the Date of issuance of the Certificate of Final Completion or the manufacturer's standard warranty period, whichever is greater
- B. This warranty shall be in writing, on the equipment supplier's letterhead and shall be included in the operations and maintenance manual(s). The warranty shall run to the Authority's benefit and shall grant the Authority a direct right of action against the manufacturer.
- C. Major equipment components, specifically those manufactured by other than the primary equipment supplier, shall be covered by their own respective warranties, which shall be not less than the supplier's standard warranty in scope and time period. Copies of these warranties shall also be included in the operations and maintenance manual(s).
- D. Work which has been abused or neglected by the Authority is excluded from these warranties.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Equipment shall be manufactured by one of the following or by Engineer-approved equal:
 - 1. North American Industries
80 Holton Street
Woburn, MA 01801

781-897-4100

2. Konecranes
Spantec Systems Inc.
3 Ring Neck Ridge
Huntington, NY 11743
631-547-0466
3. Whiting Corporation
26000 Whiting Way
Monee, IL 60449
708-587-2000

2.02 CRITERIA:

- A. The crane shall be top running, enclosed double box girder, electric overhead traveling, including runway rail, runway electrification, control pendant, radio control, walkway, and lighting with a 25 ton safe lifting capacity.
- B. Service class for bridge, trolley, hoists and runway: CMAA Class A, Standby or Infrequent Service.
- C. Crane Description:
 1. Have the nominal span of the bridge crane and runway length determined by the equipment supplier, but subject to the Engineer's approval.
 2. Hook clear height shall be measured from the top of the finished first floor to the lowest part of the crane.
 3. Hook coverage, at a minimum, and operating clearance envelope as indicated on the Contract Drawings.

2.03 BRIDGE:

- A. Bridge shall be fabricated of two welded box members or standard rolled sections. Box sections consisting of a top and bottom flange and two sides welded for the entire span at required intervals in accordance with AWS standards.
- B. Furnish and install a full length main walkway, with railing, on the drive girder side constructed of safety plate and of sufficient width to provide a minimum 30 inches clear space in front of control panels.
- C. Bridge drive: CMAA specification No. 70 classification number A4.

D. Bridge end trucks:

1. Furnished with a total of four wheels and rotating or fixed axles with a double row of permanently lubricated sealed or regreasable roller of ball bearings mounted in a cartridge on each side of the wheels.
2. Wheel assemblies, including bearing cartridges, shall be easily removable as a unit.
3. Bridge wheels manufactured of drop-forged steel or material of equal wear characteristics, double flanged, with rail sweeps.

E. Bridge Crane Bumpers and End Stops:

1. Locate on bridge end trucks, of resilient material suitably sized to withstand impact at 20 percent of the maximum bridge speed.
2. Offset bumpers on the idler side to maximize hook end approach.
3. Have bumpers furnished by the crane manufacturer, mating with the end stops.
4. Have end Stops furnished and installed by equipment supplier, as indicated on Contract Drawings.

F. High (Maximum) Bridge Speed: 80 feet per minute \pm 10%.

G. Stepless (variable frequency drive) motor control for speeds from "creep" to 100% of high speed, independent of the hook load.

2.04 HOIST:

- A. Hoisting mechanism consisting of a winding drum, reduction gearing, motor and a solenoid operated self-adjusting hoist holding brake.
- B. True vertical lift; manufacturer's standard design.
- C. Wire rope guides to guide and maintain ropes in the grooves with and without a load.
- D. Sufficient wire rope length to allow the hook to contact the floor of the lowest pit in the area of the crane hook coverage. Wrap wire rope minimum 2 complete wraps on drum when hook is in the lowest position.

- E. High (Maximum) Hoist Speed shall be 25 feet per minute \pm 10%.
- F. Stepless (variable frequency drive) motor control for speeds from "creep" to 100% of high speed, independent of the hook load.
- G. Gear Boxes: Totally enclosed with helical and/or planetary gearing with shafts supported on each end. Design box so there are no overhung gears or pinions. Provide oil bath internal gear case lubrication and antifriction bearings rated for minimum 25,000 hours B10. Comply with gearing requirements of AGMA Class 10 as a minimum.
- H. Bearings rated for a minimum of 10,000 hours L 10.
- I. Hoist brake: Regenerative type to control the hoist speed in accordance with CMAA Specification No. 70. Design each brake capable of stopping and holding capacity loads.
- J. Furnish and install load limiting device to prevent upward motion of the hoist if the load is more than 125% of the rated capacity.
- K. Equipped with a geared type upper and lower limit switch to prevent over travel when lifting and lowering. Additional upper limit switch operating independent of the drum rotation in accordance with ASME B 30.2d - 1994.
- L. Condition monitoring device:
 - 1. Measure the hoist's safe working period.
 - 2. Measure the hoist's running hours.
 - 3. Count the number of hoist starts.
 - 4. Count the number of hoist overload incidents.
 - 5. This information shall be displayed on a monitor located per manufacturer's standard design.
- M. Hoist Bottom Block: Enclosed safety type.
 - 1. Guarded against rope jam in normal usage.

2. Equipped with guides to maintain the wire rope in grooves at all times, even when the wires are loose (e.g., when block is lying on floor).
3. Provide smooth sheave grooves, free from surface defects that could cause wire rope damage. Ensure sheave grooves provide rope clearance to avoid excess wear on outer strands of rope. Provide antifriction permanently lubricated bearings.

N. Hook:

1. Complete 360° hook rotation under full load.
2. Equip hook with permanently attached safety latch.

2.05 TROLLEY:

- A. Trolley with hoisting mechanism integral with the trolley frame.
- B. High (Maximum) Trolley Speed: 65 feet per minute \pm 10%.
- C. Stepless (variable frequency drive) motor control for speeds from "creep" to 100% of high speed, independent of the hook load.
- D. Flanged trolley wheels mounted on rotating or fixed axles supported by permanently lubricated sealed bearings.
- E. Steel lugs to limit trolley drop to 1 inch or less in the event of wheel or axle failure.
- F. Trolley travel limit switches and mechanical stops.

2.06 CRANE RUNWAY:

- A. Rail:
 1. Furnish and install carbon steel crane rails with a minimum weight of 85 lb/yd in accordance with CMAA.
 2. Crane rail shall conform to the ASTM – A759-00 specification, governing the manufacture of carbon steel crane rails.
 3. All rails shall be produced utilizing a strict quality control system approved by North American crane or North American railroad industry.

4. All finished crane rails shall be produced from a continuously cast bloom, and shall have a minimum 20:1 reduction. Rails shall be both vacuum degassed and control cooled, with hardened ends.
5. Furnish standard length rails (39'). Arrange for supplier to furnish mill certs with each shipment.
6. Source of rail: L.B. Foster Company or approved equal.

B. Joint Bars:

1. Join rail sections with "Tight-Fit" Joint Bars (under-drilled per ASCE) with A325 bolts, nuts and washers.
1. Joint Bars shall be as supplied by L. B. Foster Company or Engineer approved equal.

C. Rail Clips:

1. Furnish and install welded clips, spaced in opposing pairs at 30 inch centers, compatible with rail pad and rail section installed. Clips may be pre-installed by structural beam fabricator.
2. Clips shall have 15 kip lateral resistance and ½" lateral adjustment.
3. Rail clips shall be MX15 series clips as manufactured by Molyneux Industries, Inc. or Engineer approved equal.

D Rail Pad:

1. Furnish continuous steel reinforced synthetic rubber pad and install between base of rail and structural beam flange. Furnish in standard rail lengths and field-trim as necessary.
2. Rail pads shall be manufactured by Molyneux Industries, Inc. or Engineer approved equal.

2.07 PAINTING:

- A. Comply with requirements of Section 09910 for system designation S-15.
- B. Non-Sliding or Non-Rotating Steel Surfaces:

1. Paint all non-stainless metal component parts of the cranes, except electrical connections and machined surfaces.
 2. Factory apply primer coat of rust inhibiting paint to a dry film thickness of 1.5 mils and complying with requirements of FS-TT-P-86.
 3. Factory apply 2 finish coats of enamel paint factory over primer coat.
 4. Color match OSHA Safety Yellow, Gloss.
 5. Manufacturer's standard paint system may be utilized subject to approval of Engineer.
- C. Surface Preparation: Clean surfaces free of rust, scale, dirt and oil before painting.
- D. Compass Points: Paint on underside of bridge, large enough and in a location readily visible from the pendant station at all locations.
- E. Perform required touch-ups prior to acceptance of the equipment. Match touch up paint to factory coat.
- F. Furnish one gallon of matching touch-up paint.

2.08 CONTROLS:

- A. Pendant:
1. Indicator lights and pushbuttons to control all motions with a vertical arrangement of buttons reading from top to bottom:
 - a. "Power On" indicating light
 - b. "Radio" pendant transfer switch
 - c. "Hoist Up" pushbutton
 - d. "Hoist Down" pushbutton
 - e. "Trolley North" pushbutton
 - f. "Trolley South" pushbutton
 - g. "Bridge East" pushbutton
 - h. "Bridge West" pushbutton
 - i. "Emergency Stop" pushbutton-pull reset
 - j. "Horn" pushbutton
 2. "Emergency STOP" pushbutton shall be red mushroom type.

3. The pendant shall utilize a single vertical row of pushbuttons with a "power on" indicating light such as a Euclid PBP unit as manufactured by Hubble or approved equal.
4. Strain relief: Support push button to protect electrical conductors against strain.
5. Furnish and install push buttons that have a spring return to OFF.
6. Bottom of pendant suspended 40 inches above the floor.
7. Suspended, festooned system running the full length of the bridge to support the pendant independent of the trolley.
8. Festooned cable not extending below the bridge of the crane, and not extending below the hoist hook of the 1-ton crane. Segment of pendant control cable from pendant to crane shall not be attached to the trolley.
9. Enclosure: NEMA 12.
10. Maximum voltage in the pendant of 120 volts.
11. Grounding conductor between ground terminal in the pendant and the crane's common ground.
12. Provision for pendant storage on the bridge walkway when not in use, including storage for pendant cable.
13. The "radio" switch in the pendant pushbutton station shall stop all control signals through the control cable, and transfer control of the crane to the radio controller.

B. Radio:

1. Manufacturer: Cattron, or approved equal.
2. Duplicate all functions of the pendant control. Dedicated radio controls to operate only the crane specified. Selector switch to transfer control from pendant to radio.
3. Furnish one hand held radio control transmitter for each crane bridge, ready to operate.

4. Transmitters: Hand held with leather holsters, double detent large push buttons for convenient one handed operation, work glove accessible.
 - a. Internal antenna and standard size disposable alkaline batteries.
 - b. Provide for simultaneous motions and provide a low battery indicator LED, transmission indication LED and ramp up and down push button control.
 - c. FCC license: If required for radio remote controls, have such license obtained by the manufacturer and delivered with each control.

2.09 ELECTRICAL:

- A. Motors: Plugging type squirrel cage, cylindrical rotor, totally enclosed, non-ventilated construction, heavy duty NEMA D type, equipped with copper windings, sealed ball bearing and overload protection. Include overload protection for motors to permit operation within their rating under all design load conditions, without sparking or overheating. Motors shall be rated for use in cranes in class "A" service.
- B. Insulation: Class F; temperature rating of motors not to exceed that permitted by Class B insulation.
- C. Noise Level: Comply with NEMA MB 1 12.49 and OSHA Article 1910.95 when measured in accordance with IEEE 85.
- D. Equip each individual motor circuit with branch circuit over current protection in all three phases via circuit breakers.
- E. Protect motor circuits with overload elements of the bimetal thermal type on each phase.
- F. Equip each motor with an emergency safety stop station wired in control circuit and installed at motor location with maintained contact device and NEMA 12 enclosure. Connect stations to prevent operation of motor when station is in OFF position, with provision for padlocking in OFF position; when one motor switch in a set is in the OFF position, other motors shall be inoperative.
- G. Motor control panels and cabinets: NEMA 12 Standards. Include all overload breakers, starters, circuit breakers, disconnect switching and control transformers in the cabinet.

- H. Control Voltage: Control panels shall be served by 120 V or less.
- I. Crane shall be totally wired by the manufacturer at the factory, up to and including wall-mounted disconnect switch to the runway electrification, requiring only a power connection by the installer from the crane to runway.
- J. Ground cranes by a separate grounding conductor in each conduit, sized according to National Electric Code. The grounding conductor shall have green insulation.
- K. Include a solid state soft damping transient voltage protection system as manufactured by Psytronics Corp., Glenview, IL or approved equal.
- L. Supply voltage to the cranes shall be 480 V, 3 phase, 3 wire, 60 Hz.
- M. Control Wiring: Furnish and install 3 additional conductors.
- N. Runway Electrification:
 - 1. Furnish and install a four conductor insulated runway conductor bar system sized to accommodate maximum current draw, as manufactured by the Insul-8 Corp., Addison, Illinois, or approved equal.
 - 2. Center electrical connection on runway with a separate ground conductor.
- O. Trolley Electrification:
 - 1. Festooned flat cable trolley cross conductors with heavy duty ball bearing wheeled trolleys as manufactured by Wampfler Inc., Florence, Kentucky, or approved equal.

2.10 LIGHTING:

- A. Furnish and install four 400-watt metal halide "high bay" fixtures suspended from the underside of the walkway with access from the walkway.
 - 1. Furnish and install same fixture as used for ~~shop~~ high bay lighting. Coordinate with equipment supplier and manufacturer.
 - 2. Lights shall not extend below the bottom of the bridge or restrict the hook end approach.

3. Fixtures shall be equally spaced and dimensioned on the submitted shop drawings.
- B. Furnish and install 480/277V, 1 phase, step down transformer with primary circuit breaker to power the fixtures. Circuit so that lights are on whenever power is supplied to the bridge.
- C. Ballasts: Autoreg, as required for specified metal halide fixtures, suitable for 277V operation.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Verify and coordinate actual dimensions of building relating to fabrication of system and notify Engineer of discrepancies prior to ordering equipment and material, and starting fabrication or installation.
- B. Verify that dimensions and utility supplies are satisfactory for placement of crane and hoist.
- C. Verify surfaces receiving metal fabrications are sound, square, and true. Correct any surface defects that would impair operability or shorten the life of any component of equipment.
- D. Examine conditions for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of equipment.
- E. Proceed with installation after unsatisfactory conditions have been corrected.
- F. Coordinate and verify proper relation of all work to the site and to the work of all trades.

3.02 PREPARATION:

- A. Locate cranes in accordance with general arrangement indicated on Contract Drawings. Modification of crane is permitted only as required to suit specific equipment being supplied and with Engineer's written approval.
 1. Modify layout dimensions to improve operating efficiency.

2. Modifications required to building design to accommodate the equipment are Contractor's responsibility. Submit modification to Engineer for review.

3.03 INSTALLATION:

- A. Install cranes in strict accordance with the approved shop drawings and manufacturer's installation instructions.

3.04 FIELD QUALITY CONTROL:

- A. Provide the services of a qualified manufacturer's representative to perform the following:
 1. Supervise preparatory work performed by other trades.
 2. Supervise installation.
 3. Supervise testing, by the equipment supplier in the presence of the Authority, to ensure proper operation of the equipment.
 4. Instruct personnel in the proper operation and maintenance of the equipment.

3.05 TESTING:

- A. Field Testing: Prior to the acceptance test, submit for review by the Authority, a testing program. Indicate material, equipment, and manpower required for testing. As a minimum, the tests shall consist of:
 1. Completely assemble the crane and raise the empty block until it shuts off by the limit switch. Operate crane to ensure hook coverage in accordance with approved shop drawings.
 2. Verify that the stopped position matches the position shown on the approved shop drawings.
 3. Verify that every wrap of the wire rope on the drum is in a groove by itself.
 4. Operate all motors and limit switches with controls being supplied with both crane radio and pendant.
 5. Load Test: Adjust brakes using a 125% load. Comply with OSHA regulation 1910.179 (K) (2) and ANSI B30.20.

6. Furnish test loads for load testing.
7. Submit certified written report of test results to Engineer.

3.06 TRAINING:

- A. Prior to installation, submit for review a program to train Authority personnel to operate and maintain equipment. Provide materials required for the program.
- B. Following installation and at the Authority's convenience, conduct the training program for Authority personnel. Schedule the training period for three mutually agreed-upon consecutive days of 8 hours each day.
- C. Following completion of training, submit to the Authority:
 1. A letter attesting to the names of persons receiving instruction and the dates instruction took place.
 2. Certificate of completion for each person receiving instruction.
 3. Minimum of 2 copies of training materials (excluding O&M and Parts Manuals).
 4. Two VHS format videotapes, CD-ROMs, or DVD disks conveying the essential information contained in training sessions.

END OF SECTION

SECTION 14330

BRIDGE CRANE

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

- 14330A01 Submit dimensioned shop drawings showing fabrication details, materials, tolerances, component clearance diagrams, wiring diagrams, system logic diagrams, layout and finish.
1. Crane clearance drawing drawn to a scale of not less than $\frac{1}{4}$ in. = 1 ft. - 0 in. and showing hook side and end approach limits, extreme high and low hook elevation, runway rail elevation, clearance from overhead and side obstructions, the rated load, wheel spacing, maximum wheel loadings and approach limits of pendant control.
 2. Bridge general arrangement drawing showing bridge beam sizes, end trucks, bridge drive arrangement, bridge festoon electrification, festoon pendant system and name and location of each electrical enclosure.
 3. Runway electrification system drawings showing how all conductor bar components and collector assemblies are assembled and mounted.
 4. Schematic and interconnecting wiring diagrams of all electrical equipment. Interconnection diagrams shall show what electrical equipment is located in each control enclosure. All electrical equipment and components shall be identified.
 5. Pendant station and radio control drawing showing layout of all controllers and indicators, the proper labeling of each, overall dimensions and indicating manufacturer catalog number and NEMA type enclosure.
 6. Structural Design calculations indicating compliance with cited standards, addressing structural deflections of bridge beams, rails and supporting structure, and certified by a New York registered Professional Engineer.

Product Data

- 14330D01 Technical documentation defining crane design, testing, and operational criteria, type and grade of each material to be utilized, machining tolerances, and types of finish.
1. Detailed information including location where fabrication assembly and testing operations are performed, submitted to the Engineer within 60 calendar days of receipt of equipment Purchase Order.
 2. Submit Manufacturer's recommended installation procedures which, when reviewed and accepted by the Engineer, shall be the basis for accepting or rejecting installation procedures used on the work.
 3. Installation details, including column requirements.
 4. Performance and operating characteristics.
 5. Typed Operating Narrative.
 6. Electric power requirements.
 7. Catalog cuts of all purchased components.
 8. Mill certificates for crane runway rail.

Certificates

- 14330E01 Submit load test certificate for each electric wire rope hoist which indicates actual breaking strength of wire rope.
- 14330E02
1. Submit certification that proposed equipment meets or exceeds specification requirements and is appropriate for the intended application.
 2. Crane shall be in accordance with New York City Rules and Regulations and meet the requirements of the New York City Building Code.

Record Documents

- 14330M01 Submit one complete set of the operating and maintenance instruction for equipment, including lubrication instructions, motor replacements, and spare parts, and related drawings and diagrams for review. Upon approval deliver 5 complete sets of the manual and one set of full size plastic film reproducible of drawings and diagrams.
- a. Submit data required for proper operation and maintenance. For operating type procedures, ensure nomenclature for control positions, test points and indicating devices having panel nomenclature is written exactly as it appears on equipment panel, placard, or structure (e.g., "Set master switch to 'OFF'").
- 14330M02
- a. Enumerate and describe each component and related parts, including identifying numbers and commercial equivalents where applicable.
 - b. Cut away and exploded view drawings for identification of parts

- 14330M03 a. Submit recommendations for spare parts inventory including types and quantities considered normal for routine maintenance of the equipment for one year.
b. Submit recommendations for spare parts inventory including types and quantities considered critical and for which extended acquisition time would create excessive downtime
c. Within 30 days the Authority will determine parts and quantities to be furnished.
d. After approval, deliver 5 approved parts lists as adjuncts of the Operation and Maintenance Manuals.
- 14330M04 Submit 2 hard copies of the training manual and an electronic version on a CD or DVD of the training manual. Submit in conjunction with proposed Training Program.
- 14330M05 Bind manual, catalogues, and lists in heavy 3 ringed binders, and deliver to Engineer prior to request for Certificate of Final Completion. Indicate the name and telephone number of manufacturer(s), local representative(s), and nearest source(s) of service and parts, inside the front cover of each manual.

Training

- 14330Q01 1. Factory testing procedures, submitted to Engineer for approval a minimum of 30 calendar days prior to testing.
2. Acceptance (field) testing procedures, submitted to Engineer for approval a minimum of two weeks before the acceptance test can be scheduled.
3. Proposed training program, submitted to Engineer for approval a minimum of 30 calendar days before the scheduled start of training.

END OF APPENDIX "A"

DIVISION 14
SECTION 14331
MONORAIL CRANE

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Requirements for monorail cranes including all accessories, spare parts, training, and related materials.

1.02 RELATED WORK:

- A. Section 05120 Structural Steel
- B. Section 09910 Painting
- C. Division 16 Electrical

1.03 STANDARDS AND REGULATIONS:

- A. Regulatory requirements:
 - 1. The equipment shall be designed, manufactured and installed in accordance with the portions of the following industrial and safety standards that are applicable to the work specified herein:
 - a. ANSI - American National Standards Institute
ANSI B30.2 Safety Standard
ANSI B30.10 Safety Standards for Hooks
ANSI B30.16, Overhead Hoists
 - b. ASME - American Society of Mechanical Engineers
ASME B30.2d-1994 Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist).
 - c. AWS - American Welding Society
D1.1 Structural Welding Code--Steel
D14-1 Specification for Welding Industrial and Mill Cranes
 - d. CMAA - Crane Manufacturers Association of America
Specifications No. 70 and 74 for Electric Overhead Traveling Cranes
 - e. HMI - Hoist Manufacturing Institute
100 Standard Specifications for Electrical Wire Rope Hoists
 - f. ISO - International Standards Organization
(1) ISO 9001, 1988 Edition
 - g. NEMA - National Electric Manufacturers Association

- h. NFPA - National Fire Protection Association
Publication No. 70 (NFPA 70)
 - i. OSHA - Occupational Safety and Health Administration
2. Work shall conform to the following codes:
- a. NEC - National Electric Code, including Article 610 Cranes and Hoists
 - b. NESC - National Electrical Safety Code
 - c. UL - Underwriters Laboratories, Inc.
 - d. All applicable Federal, state and local codes and regulations
3. Electrical apparatus safety: All electrical apparatus shall be UL listed.
4. Flame and Smoke Rating Requirements: Comply with New York State Regulations.
5. Products or composite materials containing asbestos shall not be utilized.

1.04 QUALITY CONTROL:

- A. Equipment shall be located within the spaces allocated for such equipment. Verify that all dimensions and utility supplies are adequate for the equipment.
- B. Design and manufacture the system for a minimum 30-year life span given that scheduled maintenance will be performed in accordance with the manufacturer's instructions.
- C. Registration of Designer(s)
 - 1. Shop drawings and design calculations that pertain to the equipment to be provided under the work of this Section shall be reviewed and sealed by a Professional Engineer qualified, registered, and licensed to practice in the State of New York.
 - 2. Professional Engineer shall have a minimum of five years documented experience in providing engineering services of the kind indicated herein.
- D. Manufacturer Qualifications:
 - 1. Manufacturing firm having minimum 10 years documented experience in the design and manufacture of industrial crane equipment specified.

2. Assembled Components: Shall be manufactured by firm(s) having minimum 10 years documented experience in the manufacture of the component.
3. The equipment manufacturer shall employ a quality assurance program that meets the requirements of ANSI and that satisfies all safety-related quality assurance requirements imposed by applicable government regulatory agencies.
4. The Manufacturer shall submit the following information:
 - a. A list of operating systems supplied by the proposed manufacturer of similar type, function, application and capacity.
 - b. Name of contact person at each installation submitted above, who is familiar with the operation and maintenance of all equipment provided by the Manufacturer.
 - c. Detailed information listing country of origin for components to be purchased by the Manufacturer and furnished as part of this Contract are to take place.
 - d. Detailed information on locations where fabrication and/or assembly operations for the equipment to be furnished as part of this Contract are to take place.

E. Manufacturer's Representative:

1. Engage the services of a manufacturer's field service representative to supervise installation of equipment, to conduct acceptance testing, and to train the Authority's personnel in the proper operation and maintenance of the equipment.
2. The field service representative shall be a qualified supervisor employed by the manufacturer, having a minimum of 5 years documented training and experience in the installation of equipment being furnished; and who shall work with the equipment supplier's specialists and shall be present at the site for at least 80 percent of the installation work of the equipment being furnished.

F. Installer Qualifications:

1. Firm having minimum 5 years documented experience in the installation of specified products and components, and performing the work under the direction of a supervisor approved by equipment manufacturer.
2. Firm employing an adequate number of skilled workmen having documented training and experience in the methods and requirements necessary for the execution.

- G. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, Structural Welding Code--Steel.
 - 2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- H. Standard Components: Provide standard, commercially available components, including motors, pumps, electrical devices, standard, manufactured by companies regularly engaged in the manufacture of the components.
- I. Single Source Responsibility: Provide products manufactured by a single manufacturer. The design shall provide for interchangeability of items of piping, equipment, subassemblies, motors, starters and relays.
- J. A corrosion-resistant identification plate clearly marked and stamped with the manufacturer's name and address, model number, serial number, date of manufacture, and all pertinent utility or operating data (or ratings) shall be attached in a prominent location to each major piece of equipment.

1.05 SUBMITTALS:

- A. Product Data: Technical documentation defining crane design, testing, and operational criteria, type and grade of each material to be utilized, machining tolerances, and types of finish.
 - 1. Detailed information including location where fabrication assembly and testing operations are performed, submitted to the Engineer within 30 calendar days of receipt of equipment Purchase Order.
 - 2. Submit Manufacturer's recommended installation procedures which, when reviewed by the Engineer, shall be the basis for accepting or rejecting installation procedures used on the work.
 - 3. Installation details, including column requirements.
 - 4. Performance and operating characteristics.
 - 5. Typed Operating Narrative.
 - 6. Electric power requirements.
 - 7. Catalog cuts of all purchased components.
 - 8. Mill certificates for crane runway rail.

B. Shop Drawings: Submit dimensioned shop drawings showing fabrication details, materials, tolerances, component clearance diagrams, wiring diagrams, system logic diagrams, layout and finish.

1. Crane clearance drawing drawn to a scale of not less than $\frac{1}{4}$ in.=1 ft.-0 in. and showing hook side and end approach limits, extreme high and low hook elevation, runway rail elevation, clearance from overhead and side obstructions, the rated load, wheel spacing, maximum wheel loadings and approach limits of pendant control.
2. Bridge general arrangement drawing showing bridge beam sizes, end trucks, bridge drive arrangement, bridge festoon electrification, festoon pendant system and name and location of each electrical enclosure.
3. Runway electrification system drawings showing how all conductor bar components and collector assemblies are assembled and mounted.
4. Schematic and interconnecting wiring diagrams of all electrical equipment. Interconnection diagrams shall show what electrical equipment is located in each control enclosure. All electrical equipment and components shall be identified.
5. Pendant station and radio control drawing showing layout of all controllers and indicators, the proper labeling of each, overall dimensions and indicating manufacturer catalog number and NEMA type enclosure.
6. Structural Design calculations indicating compliance with cited standards, addressing structural deflections of bridge beams, rails and supporting structure, and certified by a New York registered Professional Engineer.

C. Record Documents:

1. Operation and Maintenance Manuals: Submit one complete set of the operating and maintenance instruction for equipment, including lubrication instructions, motor replacements, and spare parts, and related drawings and diagrams for review. Upon approval deliver 5 complete sets of the manual and one set of full size plastic film reproducible of drawings and diagrams.
 - a. Submit data required for proper operation and maintenance. For operating type procedures, ensure nomenclature for control positions, test points and indicating devices having panel nomenclature is written exactly as it appears on equipment panel, placard, or structure (e.g., "Set master switch to 'OFF'").

2. **Parts Catalog:**
 - a. Enumerate and describe each component and related parts, including identifying numbers and commercial equivalents where applicable.
 - b. Cut away and exploded view drawings for identification of parts
 3. **Spare Parts:**
 - a. Submit recommendations for spare parts inventory including types and quantities considered normal for routine maintenance of the equipment for one year.
 - b. Submit recommendations for spare parts inventory including types and quantities considered critical and for which extended acquisition time would create excessive downtime
 - c. Within 30 days the Authority will determine parts and quantities to be furnished.
 - d. After approval, deliver 5 approved parts lists as adjuncts of the Operation and Maintenance Manuals.
 4. Bind manual, catalogues, and lists in heavy 3 ringed binders, and deliver to Engineer prior to request for final acceptance. Indicate the name and telephone number of manufacturer(s), local representative(s), and nearest source(s) of service and parts, inside the front cover of each manual.
 5. **Training Manual:** Submit 2 hard copies of the training manual and an electronic version on a CD or DVD of the training manual. Submit in conjunction with proposed Training Program.
- D. **Testing Data:** Submit load test certificate for each electric wire rope hoist which indicates actual breaking strength of wire rope on manufacturer's minimum wire rope breaking strength.
- E. **Certifications:**
1. Submit certification that proposed equipment meets or exceeds specification requirements and is appropriate for the intended application.
 2. Crane shall be in accordance with New York City Rules and Regulations and meet the requirements of the New York City Building Code.
- F. **Testing and Training:**
1. Factory testing procedures, submitted to Engineer for approval a minimum of 30 calendar days prior to testing.

2. Acceptance (field) testing procedures, submitted to Engineer for approval a minimum of two weeks before the acceptance test can be scheduled.
3. Proposed training program, submitted to Engineer for approval a minimum of 30 calendar days before the scheduled start of training.

1.06 DELIVERABLES:

- A. Approved Maintenance and Operation Manuals.
- B. Certified No-Load and Load Test results.
- C. Documentation of Training Program, including all training materials, completion certificates, and electronic recording (VHS and/or DVD format) of instruction.
- D. Authority-Approved Spare Parts. Equipment supplier shall obtain written receipt from the Authority for delivery.
- E. One set of the special tools and instruments for the crane, required for maintenance, packed in an appropriate steel tool box, if required. Equipment supplier to deliver to the Authority within 30 calendar days of commencement of training program, and obtain written receipt from the Authority for delivery.
- F. One gallon of matching touch-up paint.

1.07 DELIVERY, STORAGE, AND HANDLING:

- A. Equipment and components shall be suitably packed or crated to protect each component against damage during transportation, unloading, setting in place, and assembly.
- B. Special precautions shall be taken to prevent damage to electrical components such as motors, controls and conductors.
- C. Deliver to site in sealed containers protected against intrusion of moisture or foreign matter. Items shall be carefully stored at the site as required in a manner to prevent misalignment or distortion, and shall be adequately protected against damage by weather or other cause.
- D. All materials shall be delivered to the site with their original manufacturer's markings and identification intact. The Authority (or its designated site representative) reserves the right to reject materials that are damaged, improperly identified or not in conformance with reviewed shop drawings and catalog cuts.

- E. Upon completion of work, the leave the building and premises in good order. This includes removal of temporary installations, manufacturer-owned materials, and shipping and packaging materials used by the manufacturer in support of delivery of the equipment being provided under this Section.

1.08 VERIFICATION OF DIMENSIONS:

- A. Equipment supplier shall be responsible for coordination and proper relation of all work to the site and to the work of all trades.
- B. Equipment supplier shall verify all dimensions of the site and vehicles that relate to fabrication of the equipment and notify the Engineer of any discrepancy before fabrication and delivery of the equipment to the site.
- C. Surfaces to receive metal fabrications shall be sound, square and true. Such surfaces shall be examined prior to installation of the fabrications and all defects, which might impair the operability or shorten the life of any of the parts of the equipment, shall be corrected.

1.09 WARRANTY:

- A. Submit warranty signed by equipment supplier and executed by manufacturer for equipment, materials, and workmanship against defects agreeing to repair or replace equipment and materials and correct workmanship.
 - 1. Warranty Period: Minimum 1 year from the Date of Substantial Completion or the manufacturer's standard warranty period whichever is greater
- B. This warranty shall be in writing, on the equipment supplier's letterhead and shall be included in the operations and maintenance manual(s).
- C. Major equipment components, specifically those manufactured by other than the primary equipment supplier, shall be covered by their own respective warranties, which shall not be less than the supplier's standard warranty. These warranties shall also be included in the operations and maintenance manual(s).
- D. Work which has been abused or neglected by the Authority is excluded from these warranties.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Equipment shall be manufactured by one of the following or Engineer-approved equal:

1. North American Industries
80 Holton Street
Woburn, MA 01801
781-897-4100
2. Konecranes
Spantec Systems Inc.
3 Ring Neck Ridge
Huntington, NY 11743
631-547-0466
3. Whiting Corporation
26000 Whiting Way
Monee, IL 60449
708-587-2000

2.02 HOIST:

- A. Monorail crane shall have a 1 ton safe lifting capacity.
- B. Hoisting mechanism consisting of a chain lift wheel, reduction gearing, motor and a solenoid operated self-adjusting hoist holding brake.
- C. True vertical lift; manufacturer's standard design.
- D. Chain guides to guide and maintain smooth lifting.
- E. Sufficient chain length to allow the hook to contact the floor of the lowest pit in the area of the crane hook coverage.
- F. High (Maximum) Hoist Speed shall be 16 feet per minute \pm 10%.
- G. Two speed operation independent of the hook load.
- H. Gear Boxes: Totally enclosed with helical and/or planetary gearing with shafts supported on each end. Design box so there are no overhung gears or pinions. Provide oil bath internal gear case lubrication and antifriction bearings rated for minimum 25,000 hours B10. Comply with gearing requirements of AGMA Class 10 as a minimum.
- I. Bearings rated for a minimum of 10,000 hours L 10.
- J. Hoist brake: Design each brake capable of stopping and holding capacity loads.
- K. Provide load limiting device to prevent upward motion of the hoist if the load is more than 125% of the rated capacity.

L. Equipped with a geared type upper and lower limit switch to prevent over travel when lifting and lowering.

M. Hook:

1. Complete 360° hook rotation under full load.
2. Provide hook with permanently attached safety latch.

2.03 TROLLEY:

- A. High (Maximum) Trolley Speed: 65 feet per minute \pm 10%.
- B. Stepless (variable frequency drive) motor control for speeds from "creep" to 100% of high speed, independent of the hook load.
- C. Flanged trolley wheels mounted on fixed axles supported by permanently lubricated sealed bearings.
- D. Steel lugs to limit trolley drop to 1 inch or less in the event of wheel or axle failure.
- E. Trolley travel limit switches and mechanical stops.

2.04 PAINTING:

- A. Comply with requirements of Section 09910.
- B. Non-Sliding or Non-Rotating Steel Surfaces:
 1. Paint all non-stainless metal component parts of the cranes, except electrical connections and machined surfaces.
 2. Primer coat of factory applied rust inhibiting paint to a dry film thickness of 1.5 mils and complying with requirements of FS-TT-P-86.
 3. Factory apply 2 finish coats of enamel paint factory over primer coat.
 4. Color match OSHA Safety Yellow, Gloss.
 5. Manufacturer's standard paint system may be utilized subject to approval of Engineer.
- C. Surface Preparation: Clean surfaces free of rust, scale, dirt and oil before painting.

- D. Compass Points: Paint on underside of bridge, large enough and in a location readily visible from the pendant station at all locations.
- E. Perform required touch-ups prior to acceptance of the equipment. Match touch up paint to factory coat.
- F. Provide one gallon of matching touch-up paint.

2.05 CONTROLS:

- A. Pendant:
 - 1. Indicator lights and pushbuttons to control all motions with a vertical arrangement of buttons reading from top to bottom:
 - a. "Power On" indicating light
 - b. "Radio" pendant transfer switch
 - c. "Hoist Up" pushbutton
 - d. "Hoist Down" pushbutton
 - e. "Trolley East" pushbutton
 - f. "Trolley West" pushbutton
 - g. "Emergency Stop" pushbutton-pull reset
 - h. "Horn" pushbutton
 - 2. "Emergency STOP" pushbutton shall be red mushroom type.
 - 3. The pendant shall utilize a single vertical row of pushbuttons with a "power on" indicating light such as a Euclid PBP unit as manufactured by Hubble or approved equal.
 - 4. Strain relief: Support push button to protect electrical conductors against strain.
 - 5. Provide spring return push buttons to OFF.
 - 6. Bottom of pendant suspended 40 inches above the floor.
 - 7. Suspended, festooned system running the full length of the Monorail to support the pendant independent of the trolley.
 - 8. Festooned cable not extending below the bridge of the crane, and not extending below the hoist hook of the 1-ton crane. Segment of pendant control cable from pendant to crane shall not be attached to the trolley.
 - 9. Enclosure: NEMA 12., rubber box.
 - 10. Maximum voltage in the pendant of 120 volts.

11. Grounding conductor between ground terminal in the pendant and the crane's common ground.

2.06 ELECTRICAL:

- A. Motors: Plugging type squirrel cage, cylindrical rotor, totally enclosed, non-ventilated construction, heavy duty NEMA D type, equipped with copper windings, sealed ball bearing and overload protection. Provide overload protection for motors to permit operation within their rating under all design load conditions, without sparking or overheating. Motors shall be rated for use in cranes in class "A" service.
- B. Insulation: Class F; temperature rating of motors not to exceed that permitted by Class B insulation.
- C. Noise Level: Comply with NEMA MB 1 12.49 and OSHA Article 1910.95 when measured in accordance with IEEE 85.
- D. Protect motor circuits with overload elements of the bimetal thermal type on each phase.
- E. Control Voltage: Control panels shall be served by 120 V or less.
- F. Crane shall be totally wired by the manufacturer at the factory, up to and including wall-mounted disconnect switch to the runway electrification, requiring only a power connection by the installer from the crane to runway.
- G. Ground cranes by a separate grounding conductor in each conduit, sized according to National Electric Code. The grounding conductor shall have green insulation.
- H. Provide a solid state soft damping transient voltage protection system as manufactured by Psytronics Corp., Glenview, IL or approved equal.
- I. Supply voltage to the cranes will be 480 V, 3 phase, 3 wire, 60 Hz.
- J. Control Wiring: Provide 3 additional conductors.
- K. Runway Electrification:
 1. Furnish and install a four conductor insulated runway conductor bar system sized to accommodate maximum current draw, as manufactured by the Insul-8 Corp., Addison, Illinois, or approved equal.
 2. Center electrical connection on runway with a separate ground conductor.

3. Provide an expansion section or other means (manufacturer's standard design) to accommodate thermal expansion/contraction due to ambient temperature changes. Conductor shall be designed and installed to remain tangent through the full range of expected climate conditions at shop location.
4. On runways with multiple crane bridges size conductor bar to operate both simultaneously.

PART 3 - EXECUTION

3.01 EXAMINATION:

- A. Verify and coordinate actual dimensions of building relating to fabrication of system and notify Engineer of discrepancies prior to ordering equipment and material, and starting fabrication or installation.
- B. Verify that dimensions and utility supplies are satisfactory for placement of crane and hoist.
- C. Verify surfaces receiving metal fabrications are sound, square, and true. Correct any surface defects that would impair operability or shorten the life of any component of equipment.
- D. Examine conditions for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of equipment.
- E. Proceed with installation after unsatisfactory conditions have been corrected.
- F. Coordinate and verify proper relation of all work to the site and to the work of all trades.

3.02 PREPARATION:

- A. Locate cranes in accordance with general arrangement indicated on Drawings. Modification of crane is permitted only as required to suit specific equipment being supplied and with Engineer's written approval.
 1. Modify layout dimensions to improve operating efficiency.
 2. Modifications required to building design to accommodate the equipment are equipment supplier's responsibility. Submit modification to Engineer for review.

3.03 INSTALLATION:

- A. Install cranes in strict accordance with the approved shop drawings and manufacturer's installation instructions.

3.04 FIELD QUALITY CONTROL:

- A. Provide the services of a qualified manufacturer's representative to perform the following:
 - 1. Supervise preparatory work performed by other trades.
 - 2. Supervise installation.
 - 3. Supervise testing, by the equipment supplier in the presence of the Authority, to ensure proper operation of the equipment.
 - 4. Instruct personnel in the proper operation and maintenance of the equipment.

3.05 TESTING:

- A. Field Testing: Prior to the acceptance test, submit for review by the Authority, a testing program. Provide material, equipment, and manpower required for testing. As a minimum, the tests shall consist of:
 - 1. Completely assemble the crane and raise the empty block until it shuts off by the limit switch. Operate crane to ensure hook coverage in accordance with approved shop drawings.
 - 2. Verify that the stopped position matches the position shown on the approved shop drawings.
 - 3. Verify that every wrap of the wire rope on the drum is in a groove by itself.
 - 4. Operate all motors and limit switches with controls being supplied with both crane radio and pendant.
 - 5. Load Test: Adjust brakes using a 125% load. Comply with OSHA regulation 1910.179 (K) (2) and ANSI B30.20.
 - 6. Provide test loads for load testing.
 - 7. Provide certified written report of test results to Engineer.

3.06 TRAINING:

- A. Prior to installation, submit for review a program to train Authority personnel to operate and maintain equipment. Provide materials required for the program.

- B. Following installation and at the Authority's convenience, conduct the training program for Authority personnel. Schedule the training period for mutually agreed-upon consecutive days of 8 hours each day.
- C. Following completion of training, provide the Authority with:
 - 1. A letter attesting to the names of persons receiving instruction and the dates instruction took place.
 - 2. Certificate of completion for each person receiving instruction.
 - 3. Minimum of 2 copies of training materials (excluding O&M and Parts Manuals).
 - 4. Two VHS format videotapes, CD-ROMs, or DVD disks conveying the essential information contained in training sessions.

END OF SECTION

SECTION 14331
MONORAIL CRANE

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

- 14331A01 Submit dimensioned shop drawings showing fabrication details, materials, tolerances, component clearance diagrams, wiring diagrams, system logic diagrams, layout and finish.
-

-

1. Crane clearance drawing drawn to a scale of not less than ¼ in.=1 ft.-0 in. and showing hook side and end approach limits, extreme high and low hook elevation, runway rail elevation, clearance from overhead and side obstructions, the rated load, wheel spacing, maximum wheel loadings and approach limits of pendant control.
-

-

2. Bridge general arrangement drawing showing bridge beam sizes, end trucks, bridge drive arrangement, bridge festoon electrification, festoon pendant system and name and location of each electrical enclosure.
-

-

3. Runway electrification system drawings showing how all conductor bar components and collector assemblies are assembled and mounted.
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4. Schematic and interconnecting wiring diagrams of all electrical equipment. Interconnection diagrams shall show what electrical equipment is located in each control enclosure. All electrical equipment and components shall be identified.
-

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5. Pendant station and radio control drawing showing layout of all controllers and indicators, the proper labeling of each, overall dimensions and indicating manufacturer catalog number and NEMA type enclosure.
-

-

6. Structural Design calculations indicating compliance with cited standards, addressing structural deflections of bridge beams, rails and supporting structure, and

Product Data

- 14331D01 Technical documentation defining crane design, testing, and operational criteria, type and grade of each material to be utilized, machining tolerances, and types of finish.
1. Detailed information including location where fabrication assembly and testing operations are performed, submitted to the Engineer within 30 calendar days of receipt of equipment Purchase Order.
 2. Submit Manufacturer's recommended installation procedures which, when reviewed by the Engineer, shall be the basis for accepting or rejecting installation procedures used in the work.
 3. Installation details, including column requirements.
 4. Performance and operating characteristics.
 5. Typed Operating Narrative.
 6. Electric power requirements.
 7. Catalog cuts of all purchased components.
 8. Mill certificates for crane runway rail.

Certificates

- 14331E01 Submit load test certificate for each electric wire rope hoist which indicates actual breaking strength of wire rope.
- 14331E02 1. Submit certification that proposed equipment meets or exceeds specification requirements and is appropriate for the intended application.
2. Crane shall be in accordance with New York City Rules and Regulations and meet the requirements of the New York City Building Code.

Record Documents

14331M01

1. Operation and Maintenance Manuals: Submit one complete set of the operating and maintenance instruction for equipment, including lubrication instructions, motor replacements, and spare parts, and related drawings and diagrams for review. Upon approval deliver 5 complete sets of the manual and one set of full size plastic film reproducible of drawings and diagrams.

a. Submit data required for proper operation and maintenance. For operating type procedures, ensure nomenclature for control positions, test points and indicating devices having panel nomenclature is written exactly as it appears on equipment panel, placard, or structure (e.g., "Set master switch to 'OFF'").

2. Parts Catalog:

a. Enumerate and describe each component and related parts, including identifying numbers and commercial equivalents where applicable.

b. Cut away and exploded view drawings for identification of parts

3. Spare Parts:

a. Submit recommendations for spare parts inventory including types and quantities considered normal for routine maintenance of the equipment for one year.

b. Submit recommendations for spare parts inventory including types and quantities considered critical and for which extended acquisition time would create excessive downtime

c. Within 30 days the Authority will determine parts and quantities to be furnished.

d. After approval, deliver 5 approved parts lists as adjuncts of the Operation and Maintenance Manuals.

4. Bind manual, catalogues, and lists in heavy 3 ringed binders, and deliver to Engineer prior to request for Certificate of Final Completion. Indicate the name and telephone number of manufacturer(s), local representative(s), and nearest source(s) of service and parts, inside the front cover of each manual.

5. Training Manual: Submit 2 hard copies of the training manual and an electronic version on a CD or DVD of the training manual. Submit in conjunction with proposed Training Program.

Training

14331Q01

1. Factory testing procedures, submitted to Engineer for approval a minimum of 30 calendar days prior to testing.

2. Acceptance (field) testing procedures, submitted to Engineer for approval a minimum of two weeks before the acceptance test can be scheduled.

3. Proposed training program, submitted to Engineer for approval a minimum of 30 calendar days before the scheduled start of training.

END OF APPENDIX "A"

14331 - 18

DIVISION 15**SECTION 15313****FM-200 SUPPRESSION SYSTEM AND APPURTENANCES****PART 1. GENERAL****1.01 SUMMARY**

- A. This Section specifies requirements for a "total flood" FM-200 fire suppression system with automatic detection and control. The work described in this specification includes all engineering, labor, materials, equipment and services necessary, and required, to complete and test the suppression system.
- B. Related Work Specified Elsewhere:
Electrical: Section 16000.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Design and performance of components and methods specified herein shall comply with all Federal, State, and Local Laws, ordinances, regulations and codes, and with the latest industry standards including, but not limited to those of the entities listed below.
 - 1. National Fire Protection Association (NFPA) Codes and Standards:
 - a. NFPA No. 2001 – Clean Agent Fire Extinguishing Systems
 - b. NFPA No. 70 – National Electrical Code
 - c. NFPA No. 72 – National Fire Alarm Code
 - 2. Factory Mutual Approval Guide
 - 3. Underwriters Laboratories Inc. (UL) Listings
 - 4. The New York City Building Code (NYCBC), NY City Fire Code, its bulletins and the sub-codes with their Supplements and Reference Standards.
- B. Contractor is responsible for the work listed below.
 - 1. 120 VAC or 208/220 VAC power supply to the control panel.
 - 2. Interlock wiring and conduit for shutdown of HVAC, dampers and/or electric power supplies, relays, or shunt trip breakers.
 - 3. Connection to local/remote fire alarm systems, listed central alarm station(s).

1.03 QUALITY ASSURANCE

A. Manufacturer

1. Verify that the manufacturer of the suppression system hardware and detection components has a minimum of 10 years of experience in the design and manufacture of suppression systems similar to that specified herein and can refer to similar installations providing satisfactory service.
2. The name of the manufacturer, part numbers and serial numbers shall appear on all major components.
3. All devices, components and equipment shall be the products of the same manufacturer.
4. All devices, components and equipment shall be standard products of the manufacturer's latest design and suitable to perform the functions intended.
5. All devices and equipment shall be UL Listed and/or FM Approved.
6. Locks for all cabinets shall be keyed alike.

B. Installing Contractor

1. Arrange to receive training from manufacturer to design, install, test and maintain suppression systems.
2. Employ a NICET certified special hazard designer, level 2 or above.
3. Verify that the Contractor is an experienced firm regularly engaged in the installation of automatic FM-200, or similar clean agent, fire suppression systems in strict accordance with all standards that will apply if the Authority were a private corporation.
4. Verify that the Contractor has a minimum of five years experience in the design, installation and testing of FM-200, or similar clean agent, fire suppression systems. Submit a list of systems of a similar nature and scope on request.
5. Maintain, or have access to, a FM-200 recharging station. Submit proof of your ability to recharge the largest FM-200 system within 24 hours after a discharge. Include the amount of bulk agent storage available.
6. Verify that the Contractor is an authorized stocking distributor of the FM-200 system equipment so that immediate replacement parts are available from inventory.
7. Submit proof of emergency service available on a twenty-four, seven-days-a-week basis.

1.04 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 SYSTEM DESCRIPTION AND OPERATION

- A. The system shall be a total flood FM-200 suppression system supplied by one of the following manufacturers:
 - 1. Fike Corporation
 - 2. Chemetron Fire Systems
 - 3. Kidde-Fenwal, Inc., or approved equal.
- B. The system shall provide a FM-200 minimum design concentration of 7%, by volume, in all areas and/or protected spaces, at the minimum anticipated temperature within the protected area. System design shall not exceed the NOAEL value of 9.0%, adjusted for maximum space temperature anticipated, unless provisions for room evacuation, before FM-200 release, are provided.
- C. The system shall be complete in all ways. It shall include all mechanical and electrical installation, all detection and control equipment, FM-200 storage containers, FM-200 agent, discharge nozzles, pipe and pipe fittings, manual release and abort stations, audible and visual alarm devices, auxiliary devices and controls, shutdowns, alarm interface, caution/advisory signs, functional checkout and testing, training and all other operations necessary for a functional, UL Listed and/or FM Approved FM-200 agent suppression system.
- D. Perform two inspections during the first year of service following issuance of the certificate of the final completion. Inspections shall be made at six month intervals commencing when the system is first placed into normal service.
- E. Seal and secure all protected spaces against FM-200 loss and/or leakage during the 10 minute "hold" period.
- F. The system(s) shall be actuated by a combination of ionization and photoelectric detectors installed at a maximum spacing of 250 sq. ft. (23.2 sq. m) per detector in the protected spaces. If the airflow is one air change per minute, photoelectric detectors only shall be installed at a spacing not to exceed 125 sq. ft. (11.6 sq. m) per detector.
- G. Detectors shall be wired in standard cross-zoned detection using a Class "A" wiring arrangement. No other detection/wiring arrangements will be acceptable.
- H. Automatic operation of each protected area shall be as follows:
 - 1. Actuation of one detector, within the system, shall:
 - a. Illuminate the "ALARM" lamp on the control panel face.

- b. Energize an alarm bell and a visual indicator.
 - c. Transfer sets of 5 Amp rated auxiliary contacts, which can perform auxiliary system functions such as:
 - 1) Operate door holder/closures on access doors.
 - 2) Transmit a signal to a fire alarm system.
 - 3) Shut down HVAC equipment and/or close dampers.
2. Actuation of a second detector, within the system, shall:
- a. Illuminate a "PRE-DISCHARGE" condition on the control panel face.
 - b. Energize a pre-discharge horn/strobe device.
 - c. Shut down the HVAC system and/or close dampers.
 - d. Start time-delay sequence (not to exceed 30 seconds).
 - e. System abort sequence is enabled at this time.
3. After completion of the time-delay sequence, the FM-200 system shall discharge and the following shall occur:
- a. Illuminate a "RELEASE" lamp on the control panel face.
 - b. Shutdown of all power to high-voltage equipment.
 - c. Energize a visual indicator(s) outside the hazard in which the discharge occurred.
 - d. Energize a "SYSTEM FIRED" audible device.
4. The system shall be capable of being actuated by manual discharge devices located at each hazard exit. Operation of a manual device shall duplicate the sequence as describe above except that the time delay and abort functions SHALL be bypassed. The manual discharge station shall be of the electrical actuation type and shall be supervised at the main control panel.

2.02 MATERIALS AND EQUIPMENT

A. General Requirements

The FM-200 system materials and equipment shall be standard products of the manufacturer's latest design and suitable to perform the functions intended. When one or more pieces of equipment must perform the same function(s), they shall be duplicates produced by one manufacturer.

1. All devices and equipment shall be UL Listed and/or FM Approved.

B. Fm-200 Storage And Distribution

Each system shall have its own supply of clean agent.

1. The system design may be modular, central storage, or a combination of both design criteria.
2. Systems shall be designed in accordance with the manufacturer's guidelines.
3. Each supply shall be located within or as near as possible to the hazard area to reduce the amount of pipe and fittings required to install the system.
4. The FM-200 agent shall be stored in FIKE P/N 70-154 series agent storage containers or approved equal. Containers shall be super-pressurized, with dry nitrogen, to an operating pressure of 360 psi @ 70o F. (2482 kpa at 21o C). Containers shall be of high-strength alloy steel construction and shall conform to NFPA No. 2001.
5. Containers shall be actuated by parallel wired initiators to a Fike P/N 10-1832 Agent Release Module (ARM) or approved equal, located at each agent container.
6. Each container shall have a pressure gauge and low pressure switch to provide visual and electrical supervision of the container pressure. The low pressure switch shall be wired to the control panel to provide an audible and visual "Trouble" alarm in the event the container pressure drops below 288 psi (1986 kpa). The pressure gauge shall be color coded to provide an easy, visual indication of container pressure.
7. Each container shall have a pressure relief provision that automatically operates when the internal temperature exceeds 150o F. (66o C).
8. Engineered discharge nozzles shall be provided, within the manufacturing guidelines, to distribute the FM-200 agent throughout the protected spaces. The nozzles shall be Fike Co. or approved equal designed to deliver proper agent quantity and distribution.
 - a. Nozzles shall be available in pipe sizes 3/8" thru 2.0" (BPS 10 mm thru 50 mm). Each size shall be available in 180o and 360o distribution patterns.
9. Distribution piping, and fittings, shall be installed in accordance with the manufacturer's requirements, NFPA No. 2001 and approved piping standards and guidelines. Have all distribution piping installed by qualified individuals using good, accepted practices and quality procedures. All piping shall be adequately supported and anchored at all directional changes and nozzle locations.
 - a. All piping shall be reamed, blown clear and swabbed with suitable solvents to remove burrs, mill varnish before assembly.
 - b. All pipe threads shall be sealed with Teflon tape pipe sealant applied to the male threads ONLY.

C. Control Panel

1. The control panel shall be a CHEETAH Xi 50 control panel, P/N 10-071, manufactured by Fike Protection Systems, or approved equal.
2. The control system shall provide the following capabilities and functions:
 - a. Two (2) Class B (Style Y) indicating appliance circuits rated for 2.0 amps @ 24 VDC.
 - b. Up to two Style B initiating device circuits capable of sequential alarm, cross-zone, or single detector release operation with an overall system capacity of maximum 50 detectors.
 - c. Optional Class A module converts all five output circuits to Style Z (3 NAC, 2 Releasing) for initiating circuits.
 - d. Ten Status LEDs plus alpha-numeric display for troubleshooting: AC normal, alarm, pre-discharge, release, supervisory, trouble, panel silenced, abort, release disabled, and ground fault.
 - e. Programmable pre-discharge and discharge timers.
 - f. Resettable and continuous auxiliary output power..
 - g. Five optional abort types.
 - h. Intelligent transistor protection to prevent noise spikes and microprocessor failure from inadvertently activating release outputs.
 - i. A dedicated disarm switch for release outputs. Disarm switch shall be Fike P/N 10-2699, or approved equal.
 - j. Dedicated alarm and trouble contacts programmable for alarm, trouble, pre-discharge, discharge, abort, supervisory or water flow functions, depending on panel configuration.
 - k. Panel board shall have three Form C relays rated at 2 amp and CRM4 relay modules (Fike P/N 10-2204) with four additional 2 amp relays.
 - l. Multiple input power source – 120 VAC or 240 VAC.
 - m. A 4.0 amp @ 24 VDC power supply to operate high current draw horns and strobes.
 - n. Panel shall be in red finish.

D. Detectors

The detectors shall be spaced and installed in accordance with the manufacturer's specifications and the guidelines of NPFA No. 72.

1. The photoelectric detector shall be a Fike P/N 63-1052 or approved equal.

2. The ionization detector shall be Fike P/N 67-033 or approved equal.

E. Detector Bases

Select, furnish and install detector bases according to their operational characteristics and size of base.

1. The bases shall be Fike P/N 63-1054 (6"/15 mm base) or approved equal.

F. Manual Release (Electric)

The electric manual release switch shall be a dual action device which provides a means of manually discharging the suppression system when used in conjunction with the control system.

1. The manual pull station, P/N 20-1343 or approved equal.
2. The manual release switch or manual pull station shall be a dual action device requiring two distinct operations to initiate a system actuation.
3. Manual actuation shall bypass the time delay and abort functions, shall cause the system to discharge and shall cause all release and shutdown devices to operate in the same manner as if the system had operated automatically.
4. A manual release switch shall be located at each exit from the protected hazard and shall have an advisory sign, Fike P/N 02-4964 or approved equal, provided at each location.

G. Abort Station

The abort station shall be the "dead man" type and shall be located next to each manual switch.

1. The abort station shall be supervised and shall indicate a trouble condition at the control panel, if depressed, and no alarm condition exists.
2. "Locking" or "keyed" abort stations will not be permitted.
3. The abort station shall be located adjacent to each manual station and shall be furnished in combination with a manual release switch or in combination with a manual release switch and digital countdown timer (Fike P/N 20-046 or approved equal).

H. Audible And Visual Alarms

Alarm audible and visual signal devices shall operate from the control panel.

1. The alarm bell, alarm horn and horn/strobe devices shall be Fike P/N's 20-110 and P/N's 20-1598 or approved equal.
2. The visual alarm unit shall be a Fike P/N 02-3969 vertical strobe or approved equal.

3. Furnish and install strobe device outside, and above, each exit door from the protected space. Furnish and install an advisory sign, Fike P/N 02-10138 or approved equal, at each light location.

I. Caution And Advisory Signs

Furnish and install signs, as required, to comply with NFPA No. 2001.

1. Entrance sign: One required at each entrance to a protected space (Fike P/N 02-10139 or approved equal).
2. Manual discharge sign: One required at each manual discharge station (Fike P/N 02-4964) or approved equal.
3. Flashing light sign: One required at each flashing light over each exit from a protected space (Fike P/N 02-10105 or approved equal).

J. Pipe And Fittings

1. Furnish and install pipe, fittings, and flanges in accordance with the "PIPE, FITTINGS, AND FLANGES SCHEDULE" specified below, including gaskets, bolts, nuts, washers and other pressure containing parts necessary for the complete installation of piping systems.
2. Nipples shall be extra-heavy shoulder type of same material as pipe; close nipples are not acceptable.
3. Unless otherwise shown on the Contract Drawings, piping connections to equipment shall be made up with unions for piping 2 inches and smaller and shall be flanged for piping 2-1/2 inches and larger.
4. Furnish and install insulating flanges, couplings or unions where brass or copper pipe connects to ferrous pipe material. Flanged connections shall be made with gaskets, sleeves and washers of dielectric material for complete insulation between flanges, bolts, nuts and washers.
5. Furnish and install couplings complete with gaskets, bolts and nuts recommended by the manufacturer for the service. Use vandal proof nuts and bolts on vertical piping in stairs. Couplings shall be Victaulic "Style 75" lightweight for system pressure not exceeding 0 psi (including shut-off pressure of fire pump and static street pressure of water main) and Victaulic "Style 77" couplings for system pressure exceeding 400 psi, or approved equal. Couplings shall be manufactured by Victaulic Co. of America; Tyler pipe Subsidiary, Tyler Corp./Gustin-Bacon Division; Gruvlock couplings by Grinnell; or approved equal.

Systems	Pipes	Fittings and Flanges
Fm200 System	Galvanized Steel, ASTM A 795 or A 53, Schedule 40	Galvanized Cast Iron, ANSI B16.4 or Galvanized Malleable Iron, ANSI B16.3, 175 psi exposed to the w.w.p., Threaded

K. Valves

Control Valves

1. Valves shall be OS&Y, solid wedge gate valves with rising stem and wheel handles, rated for 175 psi w.w.p. Valves shall have gland followers in stuffing box and shall be repackable while open and under pressure.
2. Each valve shall be stamped with manufacturer's name and working pressure of the valve.
3. Valves, 2 inches and smaller, shall be threaded, bronze body.
4. Valves, 2 1/2 inches and larger, shall be flanged and iron body.
5. Valves shall be manufactured by Crane Co., Walworth Co., Stockham Valves & Fittings, or approved equal.

PART 3. EXECUTION

3.01 INSTALLATION

A. System And Control Wiring

Furnish and install all system wiring.

1. Furnish and install all wiring in Engineer approved electrical metallic tubing (EMT) or conduit, and keep separate from all other building wiring.
2. All system components shall be securely supported independent of the wiring. Runs of conduit and wiring shall be straight, neatly arranged, properly supported, installed parallel and perpendicular to walls and partitions.
3. The sizes of the conductors shall be those specified by the manufacturer. Color coded wire shall be used. All wires shall be tagged at all junction points and shall be free from shorts, earth connections (unless so noted on the system drawings), and crosses between conductors. Final terminations between the control panel and the system field wiring shall be made under the direct supervision of a factory trained representative.
4. All wiring shall be installed by qualified individuals, in a neat and workmanlike manner, to conform to the National Electrical Code, Articles 725 and 760, except as otherwise permitted for limited energy circuits, as described in NFPA No. 72. Wiring installation shall meet all local codes.
5. The complete system electrical installation, and all auxiliary components, shall be connected to earth ground in accordance with the National Electrical Code.

3.02 SYSTEM INSPECTION AND CHECKOUT

After the system installation has been completed, have the entire system checked out, inspected and functionally tested by qualified, trained personnel, in accordance with the manufacturer's recommended procedures, NFPA standards, and local codes.

- A. Test all containers and distribution piping shall be tested for proper mounting and installation.
- B. Test all electrical wiring for proper connection, continuity and resistance to earth.
- C. Functionally test the complete system in the presence of the Engineer, and all functions, including system and equipment interlocks, must be operational at least five days prior to the final acceptance tests.
 - 1. Each detector shall be tested in accordance with the manufacturer's recommended procedures, and test values recorded.
 - 2. All system and equipment interlocks, such as door release devices, audible and visual devices, equipment shutdowns, local and remote alarms, etc. shall function as required and designed.
 - 3. Each control panel circuit shall be tested for trouble by inducing a trouble condition into the system.

3.03 TRAINING REQUIREMENTS

Prior to final acceptance, provide operational training to each shift of the Authority. Each training session shall include system control panel operation, manual and abort functions, trouble procedures, supervisory procedures, auxiliary functions and emergency procedures.

3.04 ACCEPTANCE TESTS

- A. At the time "as-built" drawings and maintenance/operations manuals are submitted, submit a "test plan" describing procedures to be used to test the control system(s). The test plan shall include a step-by-step description of all tests to be performed and shall indicate the type and location of test apparatus to be employed. The tests shall demonstrate that the operational and installation requirements of this specification have been met. Conduct all tests in the presence of the Engineer after the test plan has been approved.
- B. The tests shall demonstrate that the entire control system functions as designed and intended. All circuits shall be tested: automatic actuation, solenoid and manual actuation, HVAC and power shutdowns, audible and visual alarm devices and manual override of abort functions. Supervision of all panel circuits, including AC power and battery power supplies, shall be tested and qualified.
- C. Conduct a room pressurization test in each protected space, to determine the presence of openings, which would reflect the FM-200 system concentration levels. The test(s) shall be conducted using the Retro-Tec Corp. Door Fan system, or approved equal, with integrated computer program. All testing shall be in accordance with NFPA No. 2001.
- D. If room pressurization testing indicates that openings exist which would result in leakage and/or loss of the extinguishing agent, coordinate the proper sealing of the protecting space(s). Adequately seal all protected space(s) against FM-200 loss or leakage. Inspect

all work to ascertain that the protected space(s) have been adequately and properly sealed. The contractor shall be responsible for the success of the room pressurization tests. If the first room pressurization test is not successful, in accordance with these specifications, determine, and correct, the cause of the test failure. Conduct additional room pressurization tests, at no additional cost to the Authority, until a successful test is obtained. Copies of successful test results shall be submitted to the Engineer.

- E. Upon acceptance by the Engineer, the completed system(s) shall be placed into service.

3.05 SYSTEM INSPECTIONS

- A. Conduct two inspections of each system, installed under this contract, during the one-year warranty period. The first inspection shall be at the six-month interval, and the second inspection at the 12-month interval, after system acceptance. Conduct inspections in accordance with the manufacturer's guidelines and the recommendations of NFPA No. 2001.
- B. Documents certifying satisfactory system(s) operation shall be submitted to the Engineer upon completion of each inspection.

3.06 WARRANTY

All system components furnished, and installed under this contract, shall be warranted by the installing contractor against defects in design, materials and workmanship for the full warranty period which is standard with the manufacturer, but in no case less than one year from the date of system acceptance. Warranty shall run to the Authority's benefit and shall grant the Authority a direct right of action against the manufacture.

END OF SECTION

SECTION 15313
FM200 FIRE SUPPRESSION

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

- 15313A01 The factory-authorized FM200 Protection Systems distributor shall provide all required installation drawings and material catalog specification sheet per NFPA 2001.
- 15313A02 All system control electric wiring diagrams which include required power supply information and fire alarm signal.

Calculations

- 15313H01 The Contractor shall provide a flow calculation report containing detailed information about the customer, project, enclosure to be protected, agent design concentrations, cylinders and piping network.
- Provide NY State Professional Engineer signature and seal on provided drawing and report.

Schedules

- 15313J01 Provide working plan per NFPA 2001 requirement for review.

Record Documents

- 15313M01 The Contractor shall provide a commissioning equipment list for each installed FM200 fire protection system. The equipment list shall identify all installed equipment and configurations.
- FM-200 Protected Space Checklist - To be completed and submitted by General Contractor prior to acceptance testing with Architect and Owner's Representative.

END OF APPENDIX "A"

DIVISION 15

SECTION 15410

PLUMBING PIPING AND APPURTENANCES

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for domestic water service piping, storm and sanitary sewer piping, and appurtenances.
- B. Domestic water service and storm and sanitary sewers installed under this Section end at the building line unless otherwise shown on the Contract Drawings. The continuation of the domestic water service and storm and sanitary sewers is specified under Division 2 of the Specifications. Types of material and installation of the piping under this Section shall be compatible with types of material and installation specified under Division 2.
- C. Trenching and backfilling required in conjunction with underground piping furnished under this Section shall be as specified in applicable Sections of Division 2 and shall be included as Work under this Section.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

Design and performance of components and methods specified herein shall comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and the latest industry standards including, but not limited to the entities listed below.

New York City Building Code
New Jersey Uniform Construction Code
Municipal Water Company
American National Standards Institute (ANSI)
American Society for Testing and Materials (ASTM)
American Society of Mechanical Engineers (ASME)
Cast Iron Soil Pipe Institute (CISPI)
American Water Works Association (AWWA)

In addition, specific provisions cited herein shall govern for the associated specific application.

1.03 QUALITY ASSURANCE

- A. Plumbing piping and appurtenances, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.
- B. Entities performing the Work of this section shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Clean all pipe sections of foreign matter and cover ends with temporary sheet metal closures or plastic end caps of sufficient tightness to prevent entry of foreign matter prior to shipping to the construction site.
- B. Store pipe, fittings, valves and other components at the construction site on pallets or raised platforms with suitable coverings satisfactory to the Engineer to protect them against damage and weather.
- C. Inspect all pipe, fittings, valves and other components for damage before moving them from storage to the point of installation at the construction site.

1.05 SUBMITTALS

Refer to Appendix A.

PART 2. PRODUCTS

2.01 PIPE, FITTINGS, AND FLANGES

- A. Unless otherwise shown on the Contract Drawings, provide pipe (and tube), fittings, and flanges in accordance with the "Pipe, Fittings, and Flanges Schedule" specified below, including gaskets, bolts, nuts, washers and other pressure containing parts necessary for the complete installation of piping systems.
- B. Nipples shall be extra-heavy shoulder type. No close nipples shall be used. All nipples shall have designation mark of the manufacturer and shall conform to ASTM pipe specifications for system served.
- C. Gaskets for flanges shall be 1/16-inch thick (after compression) rubber or neoprene, full-faced, and punched bolt holes.

D. Unions shall be malleable iron, threaded, conforming to ANSI B16.39.

Pipe, Fittings and Flanges Schedule

<u>Systems</u>	<u>Pipe</u>	<u>Fitting and Flanges</u>
Storm & Sanitary Drainage & Vent (underground)	Cast Iron, ASTM A 74, Service Weight Hub & Spigot Type	Cast Iron, ASTM A 74, Service Weight Hub & Spigot Type; caulked or compression type joints
Storm & Sanitary Drainage & Vent (above ground and underground)	Cast Iron, CISPI-301, ASTM A888, Service Weight Hubless Type	Cast Iron, CISPI-301, ASTM A888, Service Weight, Hubless Type
Storm & Sanitary Pump Discharge	Galvanized Steel, ASTM A 53, Schedule 40	Galvanized Malleable Iron, ANSI B16.3, 150 lb. Class, Threaded
Sanitary Indirect Drainage	Galvanized Steel, ASTM A 53, Schedule 40	Galvanized Cast Iron (Drainage), ANSI B16.12, 125 lb. Class, Threaded
Domestic Water	Copper Tubing, ASTM B 88, Type L, Drawn, Nominal Wall	Cast Bronze, ANSI B16.18, Same Wall as Tube, Solder Joints
Domestic Water at Meter Assembly (3 inches and larger)	Galvanized Steel, ASTM A 53, Schedule 40	Galvanized Cast Iron, ANSI B16.1, 125 lb. Class, Flanged (Companion)

2.02 VALVES

A. General

1. Provide types of valves as and where shown on the Contract Drawings.
2. All gate and globe valves shall be the products of one manufacturer.
3. Valves shall be of one of the following manufacturers, or approved equal:

Stockham Valves and Fittings
Crane Co.
Walworth Co.
NIBCO Inc.

B. Gate Valves

1. For piping 2 inches and smaller: Class 125, bronze body, screw-in bonnet, rising stem, solid wedge, approved equal of Stockham fig. B-122 (threaded ends), or Fig B-109 (soldered ends).
2. For piping 2 1/2 inches and 3 inches
 - a. Class 125, iron body, bolted bonnet, rising stem, solid wedge, bronze mounted, flanged ends, similar to Stockham Fig. G-623, or approved equal.
 - b. Class 150, bronze body, screw-in bonnet, rising stem, solid wedge, threaded ends, similar to Stockham Fig. B-122, or approved equal.
3. For piping 4 inches and larger: Class 125, iron body, bolted bonnet, solid wedge, bronze mounted, OS&Y, flanged ends, similar to Stockham Fig. G-623, or approved equal.

C. Globe Valves

Class 150, bronze body, screw-in bonnet, rising stem, integral seat, renewable disc, approved equal of Stockham Fig. B-22 (threaded ends), or Fig. B-24 (soldered ends).

D. Drain Valves

Class 125, gate valve, bronze body, screw-in bonnet, non-rising stem, solid wedge, threaded ends on inlet side of valve and hose end thread with cap and chain on the outlet side, similar to NIBCO Fig. T-113-HC, or approved equal.

E. Check Valves

1. For pipe 2 inches and smaller: Class 125, bronze body, horizontal swing, renewable disc, approved equal of Stockham Fig. B-321 (threaded ends), or Fig. B-319 (soldered ends).
2. For piping 2 1/2 inches and larger: Class 125, iron body, bronze mounted, bolted bonnet, horizontal swing, renewable seat, flanged ends, similar to Stockham Fig. G-931, or approved equal.

F. Ball Valves

For piping 1 inch and smaller: Class 150, bronze body, full port, bronze trim, approved equal of Stockham Fig. S-216 BRRT (threaded ends) or Fig. S-216 BRRS (soldered ends).

2.03 ACCESSORIES

A. Pipe and Valve Identification

1. Adhesive Bands
 - a. Provide approved adhesive bands in sets of two, one identifying the piping system type and the second, the direction of flow. Sets shall be provided in quantities sufficient to accommodate the requirements of 3.04 A of this Section.
 - b. For 3-inch or larger pipe, the adhesive band identifying the piping system shall display the name of the service in letters at least two inches high and the band indicating direction of flow shall display an arrow of similar size. For 2 1/2-inch or smaller pipe, the letters and the arrow shall be not less than one inch high. Bands shall be in colors and shall conform to ANSI A13.1.
 - c. Adhesive bands shall be W.H. Brady Co. "Quik-Label", or approved equal.
2. Valve Tags, Charts and Schedules
 - a. Provide each valve with a 2-inch diameter 18 gauge brass tag with brass chain. Service designation shall be 1/4-inch high and valve number shall be 1/2-inch high, on two lines with service designation on the upper line, and valve number on the lower line. The characters shall be indented and filled with durable black compound.
 - b. Provide diagrammatic valve charts and schedules, using a valve numbering system that differentiates between classes of service and indicates floor level of valve location.

- c. Tags shall conform to the numbers, locations, and uses listed in the valve charts and schedules.
- d. Valve charts and schedules shall be mounted under glass in wood frames or aluminum self-closing frames.
- e. Tags and the frames for valve charts and schedules shall be manufactured by Seton Name Plate Corp., or approved equal.

B. Access Doors

Provide a complete list of all access doors required in finished walls, ceilings, partitions and any other areas for access to all valves concealed behind such finished construction. Access doors will be furnished and installed under other Sections.

2.04 PIPE HANGERS AND SUPPORTS

- A. Design, fabricate and provide all pipe hangers and supports adequate to support and guide the piping, allow for forces imposed by expansion joints, satisfy structural requirements and maintain proper clearances with respect to adjacent piping, equipment and structures.
- B. Hangers and supports shall include guides, anchors, stops, restraints, welded attachments, insulation shields, saddle strands, stays, braces, bolts, nuts, washers, expansion bolts, pipe clamps, beam clamps, and supplementary structural steel for pipe hangers and supports.
- C. Keep the different types of hangers to a minimum. Provide clevis type hangers for sizes 3 inches and above.
- D. Suspend hangers from beam clamps, brackets, fish plates, inserts or other approved means. Furnish and install any additional miscellaneous steel supports between building framing members as may be required. The installation of "C" clamps on beams must include retaining straps to prevent separation of beam and clamp.
- E. Copper plate all hangers that will be in direct contact with brass or copper tubing.
- F. Support vertical piping with steel riser clamps. Additional intermediate support brackets, secured to the structure, shall be installed on piping utilizing gasket or coupling joints in accordance with the manufacturer's recommendations.
- G. Trapeze type hangers of steel construction, with hold-down U-bolts, may be used for two or more pipes which have a uniform slope throughout.
- H. Base hanger loads on weight of pipe supported, weight of insulation covering and weight of fluid being transported.
- I. When loads between supports can be expected to cause a sag in the pipe in excess of 1/4 inch, reduce spacing as necessary to stay within such a limit.
- J. Provide and install on all supporting rods, a forged steel turnbuckle with top and bottom lockouts having a vertical adjustment of 6 inches, minimum.
- K. All pipe hangers, rods, supports, insulation shields, clamps, and other associated components shall be galvanized.

- L. Do not hang piping from other piping and ductwork, except for small water branches in pipe enclosures behind toilet rooms or as approved by the Engineer.
- M. Vertical pipes shall be supported on every floor and at intervals between floors so that no more than 10'-0" of pipe is unsupported.
- N. Provide protection shields for all insulated piping at all points of support. Shields shall be 12 inches long, galvanized steel plate with a radius suitable for the required applications, including insulation.
- O. Tabs in metal deck construction shall not be used to support pipe or equipment.
- P. Provide pipe anchors where necessary to restrain forces due to thermal expansion and contraction of pipe.
- Q. Anchors shall be adequately designed to rigidly oppose forces acting on them and shall be embedded in structural concrete or connected to the building structural steel framework.
- R. Provide pipe guides where necessary to confine movement along the centerline of the pipe due to thermal expansion and contraction between anchors. Guides shall be adequately designed and placed, generally between 20 to 30 feet on centers and an equal distance from the expansion loop.
- S. Expansion anchors, self-drilling expansion shields, power driven studs and similar devices shall not be used, unless specifically approved by the Engineer.
- T. Unless otherwise specifically approved, hanger rod size and spacing shall be within the following limits:

1. Steel Pipe

<u>Pipe Size</u>	<u>Maximum Hanger Spacing</u>	<u>Minimum Rod Size</u>
1/2" to 1"	8 ft. o.c.	3/8"
1 1/4" to 2"	10 ft. o.c.	3/8"
2 1/2" to 3 1/2"	12 ft. o.c.	1/2"
4" and 5"	12 ft. o.c.	5/8"
6"	12 ft. o.c.	3/4"
8"	12 ft. o.c.	7/8"
10" and 12"	12 ft. o.c.	7/8"

2. Copper Tube

<u>Pipe Size</u>	<u>Maximum Hanger Spacing</u>	<u>Minimum Rod Size</u>
1/2" to 1 1/4"	6 ft. o.c.	3/8"
1 1/2" and 2"	8 ft. o.c.	3/8"
2 1/2" to 3 1/2"	10 ft. o.c.	5/8"

3. Cast Iron Soil Pipe (No-Hub)

Supports for horizontal or vertical no-hub pipe shall be on each side of every stainless steel coupling except for spaces behind toilet rooms or where many fittings are installed at one location. At these points, support every 5'-0" o.c. and on as many fittings as necessary so that no more than one fitting shall be without a hanger in any 5'-0" space. Rod size shall be the same as for steel pipe above for corresponding pipe size.

4. Cast Iron Soil Pipe (Hub and Spigot)

- a. Support vertical piping at base and at each story height but in no case at intervals greater than 20 feet.
- b. Support horizontal piping at 5-foot intervals and behind every hub except for spaces behind toilet rooms or where many fittings are installed at one location. At these points, support every 5'-0" o.c. and on as many fittings as necessary so that no more than one fitting shall be without a hanger in any 5'-0" space. Rod size shall be the same as for steel pipe above for corresponding pipe size.

5. Base of Cast Iron Stacks

Bases of cast iron stacks shall be supported on concrete, on brick laid in cement mortar, by metal bracket attached to the building construction, or by equivalent methods. All stacks shall be anchored so as to relieve the load from the base of the stack.

- U. Hangers and supports shall be manufactured by Grinnell Corp., Carpenter & Patterson Inc., Michigan Hanger Co. Inc., or approved equal.

2.05 SLEEVES, SEALS, AND ESCUTCHEONS

A. Pipe Penetration through Walls, Partitions and Floors

1. Piping passing through masonry or concrete walls and framed partitions shall have a trim opening cut no greater than necessary for the installation of a sleeve secured therein. Sleeve shall be 1/2 inch in diameter larger than the diameter of the insulated pipe. Sleeve shall be flush with the finished wall or partition surface.
2. Sleeves through concrete floors for piping shall have the opening 1/2 inch in diameter larger than the diameter of the insulated pipe passing through. Floor sleeves shall project one inch above floor slab.
3. Pipe insulation shall be omitted at penetrations through fire-rated barriers. In all cases pack the annular space between the pipe (whether insulated or uninsulated) and sleeve with mineral wool. Additionally, at penetrations through fire-rated barriers seal the annular space to retain the fire integrity of the fire-rated barrier with nonhardening through-penetration firestops having F-ratings, compatible with the fire ratings of the barriers in which they are installed, per ASTM E814. Firestop systems shall be UL-approved, and shall be as manufactured by 3M, Bio Fireshield, Inc., General Electric Company, Dow Corning Corporation, or approved equal.
4. Sleeves in walls and floors shall be galvanized steel pipe, Schedule 40 for sizes up to 10 inches and 3/8-inch wall thickness for 12 inches and larger. Sleeves in partitions shall be 20-gauge galvanized sheet metal.

5. Piping in exposed areas, passing through walls, floors or ceilings shall be fitted with chromium-plated cast brass escutcheons with fastening set screws.
6. Piping passing through floor waterproofing membrane shall be provided with a 4-pound lead flashing or a 16-ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches above the floor. The annular space between the flashing and the pipe shall be sealed watertight.
7. Piping passing through roof construction shall be provided with counterflashing, consisting of steel rainhood secured all around the pipe and overlapping the flashing.

B. Pipe Penetration through Exterior Foundation and Pit Walls

1. General

- a. All penetrations for piping through perimeter foundation walls and subgrade pit walls shall be provided with the pipe sleeves and seals as shown on the Contract Drawings.
- b. Sleeves shall be Schedule 40 for sizes up to 10 inches and 3/8-inch wall thickness for sizes 12 inches and larger. All pipe sleeves shall be galvanized steel, set into foundation walls with anchors and water stop plates.

2. Lead-Oakum Seals

Where "Lead-Oakum" seal is shown on the Contract Drawing, the annular space between the pipe and the sleeve shall be made watertight by caulking with oakum and poured lead, edged and trimmed.

3. Interlocking Modular Seals (Link-Seal)

- a. Where "Link Seal" is shown on the Contract Drawings, seal shall be modular mechanical type, consisting of interlocking sealing element links shaped to continuously fill the annular space between the pipe and the sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the sealing elements to expand and provide a watertight seal between the pipe and the sleeved opening. The seal shall provide electrical insulation between the pipe and wall.
- b. The inside diameter of each wall sleeve shall be sized as recommended by the manufacturer to fit the pipe, seal, and any coating or insulation to ensure a watertight joint.
- c. Install sleeves and seals in accordance with the seal manufacturer's instructions to provide a watertight installation.
- d. Seals for perimeter foundation wall penetrations shall be two individual sealing units in tandem unless otherwise shown on the Contract Drawings. Single sealing unit shall be used for pit wall penetration unless otherwise shown on the Contract Drawings.
- e. Seals shall be Thunderline Corp. "Link-Seal", or approved equal.

PART 3. EXECUTION

3.01 INSTALLATION

A. General

1. Install piping and appurtenances in accordance with manufacturers' installation procedures, applicable codes and standards, and as specified.
2. Coordinate piping installation with other Work to avoid interference. Coordinate as necessary to ensure that all hangers, supports, sleeves and other built-in devices are incorporated in forms or in masonry to avoid necessity of cutting finished structure.
3. All measurements, both horizontal and vertical, shall be based on established benchmarks. All Work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the Work.
4. Perform necessary cutting and patching in accordance with requirements specified in the Section of Division 2 entitled "CUTTING, PATCHING AND REMOVAL". All openings in existing slabs required for pipe penetrations shall be core drilled.
5. Installation requirements for pipe hangers and supports and pipe penetration sleeves, seals, and escutcheons are specified in 2.04 and 2.05, respectively.

B. Piping

1. Install piping as shown on the Contract Drawings and straight and direct as possible, forming right angles or parallel lines with building walls, neatly spaced, with risers plumb and true.
2. Piping shall pitch back toward system drain valve and any installed low points or pockets shall have a hose end drain valve.
3. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing pipe, thoroughly clean the inside, free of cuttings and foreign matter. Cut all piping square and smooth and make up all joints to required limits.
4. Erect all piping to obtain sufficient flexibility to prevent excessive stresses in materials and excessive bending moments at joints or connections.
5. Make changes in pipe size by the use of reducing fittings. Do not use reducing bushings except by approval of the Engineer. Do not use close or shoulder nipples.
6. Arrange water piping so that system can be completely drained. Where lines are purposely pitched for drainage, a uniform grade shall be maintained. Lines shall be so supported as to prevent pocketing of water. No lines shall have pockets due to changes in elevation unless proper provisions for draining are made.
7. Installed piping shall not interfere with the operation or accessibility of doors and windows; shall not encroach on aisles, passageways and equipment; and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.

C. Pipe Joints

1. Threaded Joints

Make up threaded joints tight using pipe joint Teflon compound or tape, applied on the male thread only.

2. Flanged Joints

Make up flanged joints square and tight with gaskets. Dip bolts and nuts in mixture of graphite and oil immediately prior to installation.

3. Soldered Joints

- a. Cut ends of tubing square and remove all burrs. Clean inside and outside of tubing with steel wool.
- b. Make joints with non-corrosive paste flux and 95 per cent tin and 5 per cent antimony solder. Cored or lead-containing solder is not permitted.
- c. Remove excess solder while still in plastic state.
- d. Leave a fillet at the wall of the fitting.
- e. Prior to silver soldering, remove the internal parts of all valves or other devices to be installed directly in line.

4. Caulked Joints

For cast iron pipe with hub, pack hub firmly with hemp or picked oakum and fill with molten lead, using a minimum of twelve ounces of lead for each inch of pipe size per joint and to a one-inch minimum depth. After the lead has cooled, the joints shall be thoroughly caulked, using approved caulking irons, faced smooth and made tight without the use of putty, paint or cement.

5. Compression Joints

Make compression joint with ASTM C564 neoprene rubber gaskets and lubricant. Gaskets shall match class of pipe and fittings. Make joints in accordance with recommendations of CISPI.

6. Cast Iron No-Hub Joints

No-hub cast iron pipe joint shall be of a coupling type. Each joint shall consist of 2 spigot ends of pipe or fitting, and a sealing sleeve assembly, consisting of a stainless steel shield over a neoprene gasket, held together by stainless steel clamps. The gasket shall be slid over the ends of the two pipes to be joined, then the shield and clamps shall be placed over the gasket. The entire coupling shall be held firmly together by the clamps, by alternately turning the screws to 100-115 in.-lb. torque. Couplings shall be "Clamp-All" type manufactured by Clamp-All Corp., or Husky SD Series 4000 type manufactured by Anaheim foundry Company, or approved equal.

3.02 FIELD TESTS

A. General

1. Perform tests as herein specified on the various piping systems or portions thereof prior to backfilling, painting, concealing or insulating.
2. Notify the Engineer and those authorities having jurisdiction, at least 48 hours in advance of making the required tests, so that arrangements may be made for their presence to witness the tests.
3. Provide and install all equipment and devices required in connection with tests. Provide all necessary materials, supplies, labor and power for the tests.
4. Should the tests reveal any leaks or deficiencies in piping installed under this Section, make the necessary repairs immediately, or, if required by the Engineer, replace defective work with new work without additional cost to the Authority. Repeat tests as directed until the entire installation is proven satisfactory. No temporary method of repairing leaks will be permitted.
5. Where piping installed under this Section is connected to any existing system, such installed piping shall be isolated from the existing system during the performance of the required field tests, unless otherwise directed by the Engineer.
6. The Engineer reserves the right to direct the Contractor not to isolate the newly-installed piping from the existing system during the performance of the required field tests. In such event, the Contractor shall correct any revealed leaks or other deficiencies within the first 20 feet of the existing system, measured in any direction from the point of connection with the newly installed piping, all as directed by the Engineer and at no additional cost to the Authority.
7. Dispose of water removed from pipelines in a manner that will not cause damage to any property.
8. Provide and install the required air vents in the piping system tested.
9. All equipment, including water coolers, and all controls and instruments shall be isolated from the piping system during test, as well as during cleaning, disinfecting and flushing procedures.

B. Hydrostatic Tests

1. Storm and Sanitary Drainage and Vent
 - a. Tightly close all openings in the entire system and fill it with water to the point of overflow above the roof. The water level shall be maintained for one hour.
 - b. When piping is tested in sections, test piping with a pressure equivalent to a 10-foot water head. The water level shall be maintained for one hour.
 - c. For piping added, relocated or replaced on existing systems, install a test tee at the lowest elevation of each added, relocated or replaced piece of pipe and fill it with water to overflow level of next highest fixture outlet or drain. The water level shall be maintained for one hour.

2. Domestic Water

- a. Cap or plug all outlets, apply a hydrostatic pressure of 125 psi and sustain such pressure for one hour.
- b. For piping added, relocated or replaced on existing systems, apply a hydrostatic pressure of 50 psi above the existing system pressure for one hour.

C. Cleaning and Disinfecting

The potable water system shall be disinfected prior to use by a method of disinfection in accordance with the applicable code.

3.03 PAINTING

Upon completion of the installation, remove all protecting materials, thoroughly remove all scale and grease and leave in a clean condition for painting. Piping to be painted shall be as shown on the Contract Drawings. Painting shall be in accordance with the requirements of Division 9, Section entitled "PAINTING".

3.04 PIPE AND VALVE IDENTIFICATION

A. Pipe Identification

Affix sets of pipe adhesive bands specified in 2.03 A.1 where they can be easily read, with their long dimension parallel to the axis of the pipe and no more than 40 feet apart on a piping system. At least one set of identifying bands shall be affixed in all occupied and unoccupied rooms as well as in all other spaces, such as hung ceilings or shafts, where piping may be viewed and the identity of the piping system cannot be readily ascertained. A set of such bands shall be affixed at each branch and riser takeoff; adjacent to each valve; at each pipe passage through floor and ceiling construction; at each capped line; and at each pipe passage to an underground area.

B. Valve Tags

Securely fasten valve tags specified in 2.03 A.2 with approved brass chain.

END OF SECTION

SECTION 15410
PLUMBING PIPING AND APPURTENANCES

APPENDIX "A"
SUBMITTALS

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

Shop Drawings

- 15410A01 Detailed piping layout drawings, including hanger and support locations and details.
- 15410A02 List of access doors.

Catalog Cuts

- 15410B01 Catalog cuts, including product data for the following: Fittings and flanges
- 15410B02 Catalog cuts, including product data for the following: Valves
- 15410B03 Catalog cuts, including product data for the following: Hangers and supports
- 15410B04 Catalog cuts, including product data for the following: Sleeves and escutcheons
- 15410B05 Catalog cuts, including product data for the following: Valve tags and pipe identification bands

Product Data

- 15410D01 Piping material and schedule for each piping system.
- 15410D02 Valve charts and schedules
- 15410D03 Hanger and support schedule showing manufacturer's figure No., size, location and features of each required hanger and support.

Manuals, Warrantees/Guarantees

- 15410I01 Submit operation and maintenance manuals, including replacement and spare parts lists for each type of valve.

Inspection Reports

15410-13

15410001 Submit field hydrostatic test results.

END OF APPENDIX "A"

15410-14

DIVISION 15
SECTION 15430
PLUMBING SPECIALTIES

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for plumbing specialties.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

Design and performance of components and methods specified herein shall comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and the latest industry standards including, but not limited to the entities listed below.

American National Standards Institute (ANSI)
American Society of Mechanical Engineers (ASME)
American Society of Sanitary Engineering (ASSE)
American Society for Testing and Materials (ASTM)
Plumbing and Drainage Institute (PDI)

In addition, specific provisions cited herein shall govern for the associated specific application.

1.03 QUALITY ASSURANCE

- A. Plumbing specialties of the types and sizes required shall have performed satisfactorily for purposes similar to those intended herein, for not less than three years.
- B. Entities performing the work of this Section shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. All specialties shall be factory-cleaned, wrapped and packaged in boxes prior to shipping to construction site.
- B. Store specialties in clean, dry spaces and protect them from weather.
- C. Prior to installation, inspect specialties for damage.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 DRAINS

A. General

1. Drains shall be of types and sizes shown on the Contract Drawings.
2. Special type drains other than those specified in 2.01 B and C below shall be provided as shown on the Contract Drawings.
3. Floor drains shall be provided with vandal proof grates in all areas except mechanical equipment rooms.
4. Drains shall be manufactured by Jay R. Smith Manufacturing Co., Josam Manufacturing Co., Zurn Industries Inc., Tyler Pipe Industries Inc./Wade Division, or approved equal.

B. Floor Drains

1. Toilet Rooms and Finished Areas

Floor drains shall have cast iron body, with flashing collar, round top with nickel bronze adjustable strainer head; Jay R. Smith No. 2005-A or 2010-A or approved equal.

2. Mechanical Equipment Rooms

Floor drains shall have cast iron body, with flashing collar, round cast iron grate and slotted sediment bucket; Jay R. Smith No. 2230 or approved equal.

3. Drains receiving indirect waste shall be fitted with a cast iron funnel; Jay R. Smith No. 3581 or approved equal.

C. Roof Drains

1. Roof drains shall have cast iron body with adjustable extension sleeve, flashing collar, and cast iron dome. Provide sump receiver and underdeck clamp for all roofs except poured-in place installations. Drain shall be Jay R. Smith No. 1015 or approved equal.
2. Install roof drains with 6-lb. lead flashing extending 12 inches beyond the outside diameter of the roof drain. Coordinate the installation with other affected Work.

2.02 VENT FLASHING COUPLINGS

- A. Where shown on the Contract Drawings, provide cast iron, threaded (upper end) counterflashing sleeves; Jay R. Smith No. 1750 or approved equal.
- B. Vents extending through roof shall be flashed watertight. Flashing shall be 6-lb. lead extending not less than 12 inches around the perimeter of the pipe, outside the barrel and terminate 12 inches above the roof with the vent flashing couplings specified above.

2.03 CLEANOUTS

- A. Use "Y" (and "TY") fittings for cleanouts; full size "Y" for piping up to 4 inches and not less than 4-inch "Y" outlets for piping 5 inches and larger.
- B. Provide cleanouts for storm and sanitary piping at bases of stacks, at changes in direction of horizontal piping, and at 50-foot intervals, minimum, on horizontal runs.
- C. Floor cleanout deckplates shall be the following or approved equals:
 - 1. Unfinished areas: Jay R. Smith No. 4226
 - 2. Finished areas: Jay R. Smith No. 4026
 - 3. Tiled areas: Jay R. Smith No. 4146
 - 4. Carpeted areas: Jay R. Smith No. 4026-Y (with carpet marker)
- D. Toilet room wall cleanouts shall be cast iron caulk ferrule and cast iron head seal plug with stainless steel cover and center screw; Jay R. Smith No. 4402 or approved equal.
- E. Cleanouts at changes of direction of above-floor piping shall be cast iron caulk ferrule with straight threaded, tapered bronze plug; Jay R. Smith No. 4420 or approved equal.
- F. All cleanout plugs shall be lubricated with graphite before installation.
- G. Cleanouts shall be manufactured by Jay R. Smith Manufacturing Co., Josam Manufacturing Co., Zurn Industries Inc., Tyler Pipe Industries Inc./Wade Division, or approved equal.

2.04 FRESH AIR INLETS

- A. Where shown on the Contract Drawings, provide fresh air inlets of perforated wall plate with pipe expander type securing device and spanner type tamperproof locking device; Jay R. Smith No. 9005 or approved equal.
- B. Finish of plate shall be polished bronze unless otherwise shown on the Contract Drawings.

2.05 DOMESTIC WATER METERS

Provide water meter(s) of the type and size(s) shown on the Contract Drawings. The meter shall be set horizontally, dial facing upward not more than three feet above floor, properly supported, and installed in accordance with the regulations of the local municipal water company.

2.06 STRAINERS

Where shown on the Contract Drawings, provide strainers of "Y" type with tapped blowdown connections, 150 psi w.w.p., bronze body, and bronze screens. Strainers shall be manufactured by Spirax Sarco Inc., Mueller Steam Specialty Co./MUESSCO, or approved equal.

2.07 GAUGES

- A. Provide pressure gauges on water main, at pressure reducing valve assemblies and at other locations shown on the Contract Drawings.
- B. Gauges shall be of bronze bourdon tube material, with 4 1/2-inch dial face and aluminum case and shall have a range of 160 psi with an accuracy of 0.5 percent of the scale range. Each gauge shall be provided with a snubber and cock. Pressure gauges shall be Weiss Instruments Inc. "Series UG-1" or approved equal.

2.08 THERMOMETERS

- A. Provide thermometers on inlets and outlets of water heaters and circulating pumps, and where shown on the Contract Drawings.
- B. Thermometers shall be of "red reading" Mercury, industrial glass type with V-shaped cast aluminum case, adjustable angle face, and stainless steel extension necks to suit insulation thickness, having a 9-inch long scale and a temperature range of 20 degrees F to 180 degrees F with an accuracy of one per cent of the scale range. Thermometers shall be provided with immersion bulb and separable socket. Thermometers shall be Weiss "Vari-Angle Industrial Thermometers" or approved equal.

2.09 AIR CHAMBERS

- A. Provide full pipe size, 12-inch high air chambers at each plumbing fixture domestic water supply connection.
- B. Provide full pipe size, 24-inch high air chambers at the top of each domestic water riser.

2.10 WATER HAMMER ARRESTORS

- A. Provide water hammer arrestors adjacent to all equipment where quick-closing valves are provided and at other locations shown on the Contract Drawings.
- B. Sizes and installation procedures of water hammer arrestors shall be in accordance with PDI Standards.
- C. Water hammer arrestors shall be Jay R. Smith "Series 5000" or approved equal.

2.11 AIR RELIEF VALVES

- A. Provide automatic air relief valves at high points in hot water piping and where shown on the Contract Drawings, with 3/4-inch threaded inlet; class 150 cast iron body and cap; valve, float, leverage and valve seat; and compressed non-asbestos gasket. Pipe drain from relief valves shall spill over to adjacent floor drain, mop sink, or as shown on the Contract Drawings.
- B. Relief valves shall be Taco air vent, Model 409, or approved equal.

2.12 NON-FREEZE WALL HYDRANTS

Where shown on the Contract Drawings, provide non-freeze wall hydrants, key operated with 3/4-inch, threaded inlets. Hydrant shall be all-bronze nickel-plated with hose connection, integral vacuum breaker, and stainless steel box with full 180° door opening, nickel-bronze face. Hydrants shall be Jay R. Smith No. 5509 QT, or approved equal.

2.13 HOSE BIBBS

Where shown on the Contract Drawings, provide Woodford Manufacturing Co. Model 24 C hose bibbs or approved equal. Finish shall be rough brass in mechanical or non-finished spaces, and polished chrome-plated in all finished areas. Provide matching finish vacuum breakers at each hose bibb.

2.14 VACUUM BREAKERS

Vacuum breakers shall be bronze body, chrome-plated Watts Regulator Co. Model No. 288A-C or approved equal. Check valve shall be provided at the outlet side of vacuum breaker.

2.15 BACKFLOW PREVENTERS

- A. Where shown on the Contract Drawings provide backflow preventers to prevent the backflow of contaminated water into the potable water supply. Each backflow preventer shall be a complete assembly, including tight-closing shutoff valves before and after the device, and shall be protected by a strainer. The design shall include test cocks and a pressure-differential relief valve located between two positive seating check valves. The device shall meet the requirements of ASSE Standards.
- B. Backflow preventers shall be of a size shown on the Contract Drawings and shall be CMB Industries/FEBCO Division Model No. 825, Watts Regulator Co. Model No. 909, or approved equal.

2.16 DIELECTRIC FITTINGS

Connections between ferrous and non-ferrous pipe or equipment connections shall be made using isolating union or flange joints as manufactured by Watts Regulator Company, Series 3000, or approved equal.

PART 3. EXECUTION

3.01 INSTALLATION

Install plumbing specialties in accordance with the manufacturers' installation instructions.

3.02 PROTECTION

Upon completion of the installation, remove all protective materials and thoroughly clean all specialties to the satisfaction of the Engineer.

END OF SECTION

SECTION 15430
PLUMBING SPECIALTIES

APPENDIX "A"
SUBMITTALS

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

Catalog Cuts

15430B01 Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS: Catalog cuts

Product Data

15430D01 Product outlines and dimensions, including required clearance.

15430D02 Components , materials, weights and assembly details.

15430D03 Capacity and and performance data, if applicable;

Construction and Installation Procedures

15430G01 Installation procedures.

Manuals, Warrantees/Guarantees

15430I01 Submit operation and maintenance manuals for all specialties including replacement and spare parts lists.

END OF APPENDIX "A"

DIVISION 15
SECTION 15440
PLUMBING FIXTURES

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for plumbing fixtures.
- B. Types of plumbing fixtures specified in this Section are:

- Water Closets (WC)
- Water Closets for Disabled (HC WC)
- Urinals (UR)
- Urinals for Disabled (HC UR)
- Lavatories (LAV)
- Lavatories for Disabled (HC LAV)
- Counter Top Lavatories
- Service Sinks (SS)
- Mop Receptors (MR)
- Sinks (SK)
- Electric Water Coolers (EWC)
- Electric Water Coolers for Disabled (HC EWC)
- Showers (SHR)
- Jail Cell Fixtures
- Stainless Steel Plumbing Fixtures

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

Design and performance of components and methods specified herein shall comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and the latest industry standards including, but not limited to the entities listed below.

- Federal Specifications
- New York City Building Code
- New Jersey Uniform Construction code
- American National Standards Institute (ANSI)
- Air Conditioning and Refrigeration Institute (ARI)
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
- American Society of Sanitary Engineers (ASSE)
- American Society for Testing and Materials (ASTM)
- American Society of Mechanical Engineers (ASME)
- Underwriters Laboratories Inc. (UL)
- National Electrical Code (NEC)

In addition, specific provisions cited herein shall govern for the associated specific application.

1.03 QUALITY ASSURANCE

- A. Plumbing fixtures, of types, styles and configurations required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.
- B. Entities performing the work of this Section shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver plumbing fixtures individually wrapped in factory-fabricated containers.
- B. Handle plumbing fixtures carefully to prevent breakage and chipping and scoring of fixture finish.
- C. Store plumbing fixtures in a dry location, and preferably on elevated platforms.

1.05 SUBMITTALS

Refer to Appendix A.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements of this Section, provide plumbing fixtures of one of the following manufacturers or an approved equal:

- A. Plumbing Fixtures and trim (WC, HC WC, UR, HC UR, LAV, HC LAV, SS, Counter Top Lavatories)

American Standard Inc./US Plumbing Products
Crane Plumbing
Eljer
Kohler Co.
- B. Plumbing Trim (Brassware)

American Standard Inc.
Chicago Faucet Co.
Delta Faucet Co., Div. of Masco Corp.
Moen Group; Stanadyne Corp.
- C. Flush Valves

Coyne & Delany Co.
Sloan Valve Co.

- D. Fixture Seats
Sperzel Industries Inc.
Sanderson Plumbing Product Inc./Beneke Div.
Olsonite Corp.
- E. Electric Water Coolers
Elkay Manufacturing Co.
Halsey Taylor
Haws Drinking Faucet Co.
Sunroc Corp.
- F. Service Sinks
Kohler Co.
Elkay Manufacturing Co.
American Standard Inc.
Crane Plumbing
Stern-Williams Co., Inc.
- G. Sinks
Acorn Engineering Co.
American Standard Inc.
Elkay Manufacturing Co.
Just Manufacturing Co.
- H. Mop and Shower Receptors
Stern-Williams Co. Inc.
Crane Plumbing
- I. Showers and Trim
American Standard Inc.
Bradley Corp.
Kohler Co.
Leonard Valve Co.
Moen Group; Stanadyne Corp.
Powers Process Controls
- J. Fixture Supports
J.R. Smith Manufacturing Co.
Josam Co.
Tyler Pipe/Wade Div.
Zurn Industries Inc./Hydromechanics Div.
- K. Jail Cell Fixtures
Acorn Engineering Co.
Bradley Corp.

2.02 MATERIALS

- A. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished fixtures shall not be used.
- B. Where fitting, trim and accessories are exposed or semi-exposed, provide bright chrome-plated fixtures. Provide copper or brass where not exposed. All exposed piping, fittings, valves, stops, traps, escutcheons, washers, nuts, etc. shall be chromium-plated with polish finish. All exposed aerators, nuts, bolts, trim, handles, etc., installed on any fixture for use by the general public, shall be made vandalproof.
- C. Stainless steel sheets shall conform to ASTM A 167, for type specified in 2.03 and shall be of hardest workable temper.
- D. Vitreous china shall be high quality, free from fire cracks, spots, blisters, pinholes and specks. Glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C 554.
- E. Fiberglass shall conform to ANSI Z 124.2, smooth surfaced, with color selected by the Engineer.

2.03 CONSTRUCTION FEATURES

A. General

- 1. Provide factory-fabricated fixtures of types and styles shown on the Contract Drawings. For each type fixture, provide fixture manufacturer's trim, carrier, seats, valves, etc., as required for complete unit. All fixtures of the same type shall be furnished by the same manufacturer.
- 2. Unless otherwise specified herein, comply with applicable Federal Specification WW-P-541 Series sections pertaining to plumbing fixtures, fittings, trim metals and finishes. Comply with requirements of WW-P-541 Series relative to quality of ware, glazing, enamel, composition and finish of metals, air gaps, and vacuum breakers, even though some plumbing fixtures specified in this Section are not specified in WW-P-541 Series.
- 3. Plumbing Fixtures shown on Contract Drawings and specified herein are based on specific descriptions, manufacturers, and model numbers. Other manufacturers of these products will be considered acceptable if approved as equal by the Engineer.

B. Water Closets (WC)

Kohler K-4330 "Kingston Lite" white vitreous china, 1.5 gallon flush, elongated bowl, wall hung, siphon jet flushing, 1 1/2-inch top spud; K-4670, white collar, "LUSTRA" solid plastic seat, with open front with concealed stainless steel check hinge. Connect with exposed Sloan Royal No. 111 low consumption (LC), quiet action, chrome, water conserving flush valve complete with non-hold-open, nickel-silver handle, screw driver angle stop with protecting cap, vacuum breaker, 1 1/2-inch outlet spud coupling with flange and cast brass wall escutcheon with set screw. Adjustable closet fitting and support shall be floor-bolted, block base type.

C. Water Closets for Disabled (HC WC)

Same as specified in 2.03 B above except that the rim height shall be set at 19 inches above finished floor.

D. Urinals (UR)

Kohler K-4960-T "Bardon Lite", white vitreous china washout urinal, less than 1 gpf, with extended shields, integral flush spreader, 3/4-inch top spud, outlet connection threaded 2 inches inside with bolts, washers, hangers and removable beehive strainer. Connect with exposed Sloan Royal No. 186-1, low consumption (LC), quiet action, chrome, water conserving flush valve, complete with screw drive angle stop with protecting cap, vacuum breaker, non-hold-open, nickel-silver handle, 3/4-inch outlet spud coupling with flange and cast brass wall escutcheon with set screw. Supports shall be floor-bolted, block base type.

E. Urinals for Disabled (HC UR) (or Juvenile)

Kohler K-5024-T "Darfield-Lite", white vitreous china washout urinal, less than 1 gpf, elongated lip, 3/4-inch top spud, 1 1/2-inch outlet, wall hanger, removable strainer, tailpiece, K-9200 "P" trap; and fitted with flush valve as specified in 2.03 D above.

F. Lavatories (LAV)

Kohler K-2054 "Jamestown", 20-inch x 18-inch, white vitreous china, front overflow lavatory, drilled for concealed carrier arms; pair K-7622 1/4-inch threaded offset tailpieces; pair K-7601 3/8-inch threaded supplies with loose key angle stops, reducers and cast brass escutcheons with set screws; K-9010,

1 1/4-inch x 1 1/2-inch cast brass "P" trap with cleanout, slip inlet, threaded outlet; K-9015 1 1/2-inch x 6-inch trap nipple, and cast brass escutcheon with set screw; K-7715 drain assembly with perforated strainer. Faucet shall be Delta Model 501 lever handle chrome faucet, less lift rod and waste and fitted with a vandalproof flow regulator spout aerator, limiting the flow to a maximum of 1/2 gpm. Support shall be floor-bolted, block base type.

G. Lavatories for Disabled (HC LAV)

Kohler K-2054 "Jamestown" (20-inch x 18-inch) or Kohler K-12636 "Morningside" (20-inch x 27-inch), white vitreous china, as shown on the Contract Drawings; front overflow lavatory, drilled for concealed carrier arms; K-13885 drain plug assembly with integral perforated grid; pair K-7622 1/4-inch threaded offset tailpieces; pair K-13711 3/8-inch threaded extended supplies with loose key angle stops, reducers and cast brass escutcheons with set screws; K-9010, 1 1/4-inch x 1 1/2-inch cast brass "P" trap with cleanout, slip inlet, threaded outlet; K-9015 1 1/2-inch x 6-inch trap nipple, and cast brass escutcheon with set screw. Faucet shall be gooseneck, chromed, K-13358 with 4-inch handles, 3/4 gpm flow regulated spout aerator and 1/2-inch threaded inlets and coupling nuts on 4-inch centers. Support shall be floor-bolted, block base type.

H. Counter Top Lavatories

Kohler K-2195 "Pennington", 20-inch x 17-inch, white vitreous china, front overflow, self-rimming; pair K-7622 1/4-inch threaded offset tailpieces; pair K-7601 3/8-inch threaded supplies with loose key angle stops, reducers and cast brass escutcheons with set screws; K-9010 1 1/4-inch x 1 1/2-inch cast brass "P" trap with cleanout, slip inlet, threaded outlet; K-9015 1 1/2-inch x 6-inch trap nipple, and cast brass escutcheon with set screw; K-7715 drain assembly with perforated strainer. Faucet shall be Delta Model 501, lever handle chrome faucet, less lift rod and waste and fitted with a vandalproof flow regulator spout aerator, limiting the flow to a maximum of 1/2 gpm.

I. Service Sinks (SS)

Kohler K-6718 "Bannon", 22-inch x 18-inch, enameled cast iron, plain back, wall hanger; K-8936 stainless steel rim guard; K-6673 "P" trap, standard with strainer; K-8904 wall-mounted chrome faucet with loose key stops in shank and vacuum breaker.

J. Mop Receptors (MR)

Precast terrazzo receptor shall be Elfin by Stern-Williams, or approved equal, with 3-inch, integrally cast, chrome-plated brass drain connection, 6-inch high x 36-inch x 24-inch (unless otherwise shown on the Contract Drawings) made of marble chips cast in gray portland cement to produce a minimum compressive strength of 3,000 psi at 28 days. Exposed edges and tops of curbs shall be fitted with 18-gauge, integrally cast, Type 302, stainless steel guard. The supply fitting shall be Kohler K-8904 wall-mounted chrome faucet with loose key stops in shank and vacuum breaker.

K. Sinks (SK)

Elkay "Lustertone", size and model as shown on the Contract Drawings, 18-gauge, Type 302, self-rimming, stainless steel, counter top sink. Sink shall be fitted with Elkay LK-4100 faucet, LK-35 crumb cup strainer, "P" trap and loose key angle stops.

L. Electric Water Coolers (EWC)

Elkay Model EWA-8, surface-mounted, having a cooling capacity of 8.9 gallons per hour from 80 degrees F inlet water to 50 degrees F drinking water at room temperature of 90 degrees F. Water coolers shall comply with requirements of UL 399, ARI Standard 1010, and ASHRAE Standard 18.

M. Electric Water Coolers for Disabled (HC EWC)

Elkay Model EHFS-8, surface-mounted, wheel chair level model, having a cooling capacity of 8 gallons per hour from 80 degrees F inlet water to 50 degrees F drinking water at room temperature of 90 degrees F.

N. Showers (SHR)

Shower floor receptor shall be precast terrazzo 36-inch x 36-inch with 2-inch brass, integrally cast drain connection and stainless steel strainer plate. Receptor shall be Stern-Williams "Trieste" Model 54. Terrazzo shall be made of black and white marble chips cast in white portland cement to produce a compressive strength of not less than 3000 psi at 28 days. The shower shall be fitted with a Powers P902H-J-1 shower unit, with pressure-balancing mixing valve, integral service stops and 2 gpm flow restrictor in shower head.

O. Jail Cell Fixtures

Acorn Model 1420 Lav/Toilet combination fixture, angled or offset as shown on the Contract Drawings, fabricated from 14 gauge Type 304 stainless steel, integrally reinforced. Construction shall be seamless welded, and exposed surfaces shall have a satin finish. It shall include, but not be limited to a lavatory bowl in a rectangle countertop, cabinet, toilet bowl, integral seat, trap, and trap enclosure. Countertop shall be a minimum 12-inch x 20-inch with integral rectangular lavatory and an air-circulating self-draining dish. Toilet shall be blowout jet type, with an elongated bowl, a self-draining crevice-free flushing rim, and an integral contoured seat with a sanitary high polish finish. Toilet trap shall be capable of passing a 2 5/8-inch diameter ball, and shall be fully enclosed. Cabinet interior shall be sound-deadened with a vermin-proof and fire-resistant material. Fixture shall be capable of withstanding a load of 5,000 pounds without permanent damage. Provide the following with the fixture:

1. Acorn Penal-Trol single temperature lavatory valve (Acorn Option 01);
2. Acorn standard fast lavatory drain, with integral P-trap (Acorn PT) and a thru-wall extension with cleanout (Acorn LW2);
3. Fully-recessed toilet tissue holder (Acorn PH);
4. Acorn flush valve (Acorn FV) with push-button mounted backsplash. Valve shall be complete with vacuum breaker and push button. All exposed parts shall be chrome-plated. Provide a brass thru-wall flushing connection (Acorn FVT);
5. Acorn standard gasketed waste (Acorn GW) plus a yoke assembly to connect to a 3-inch or 4-inch no-hub waste line (Acorn YA3 or YA4, respectively) as indicated on Contract Drawings.

P. Stainless Steel Plumbing Fixtures

1. Water Closets

Acorn Model No. 2105, wall hung, top supply toilet, siphon jet type, made with Type 304 stainless steel, elongated bowl, Acorn HS hinged white plastic seat, Acorn FV flush valve with vacuum breaker. Toilet shall be seamless welded, and exposed surfaces shall have a satin finish. Toilet trap shall pass 2 5/8-inch diameter ball and be fully enclosed. Toilet waste outlet shall be gasketed waste. Adjustable closet fitting and support shall be floor-bolted, block base type.

2. Urinals

Acorn Model No. 2167, wall hung, Type 304 stainless steel urinal. Top supply washout type, Acorn FV flush valve with a vacuum breaker and push button, Acorn FVC stainless steel vandalproof cover and "P" trap. Support shall be floor-bolted, block base type.

3. Lavatories

Acorn Model No. 1951, wall hung, 18-inch x 18-inch rectangular lavatory, with 14-inch x 12-inch x 6-inch deep bowl. Fixture shall be fabricated from type 304 stainless steel. Construction shall be seamless welded, with satin-finish exterior. Lavatory deck shall have an integral air-circulating, self draining soap dish. Provide deck-mounted valve assembly (Acorn CSS), grid strainer (Acorn GT), chrome-plated brass supply with stop, "P" trap (Acorn TT). Manufacturer shall furnish a wall mounting bracket. Support shall be floor-bolted, block base type.

4. Drinking Fountains

Acorn Model No. 1670-1 front access drinking fountain, fabricated from type 304 stainless steel. Construction shall be seamless welded, with satin-finish exterior. Cabinet bottom shall be removable and secured with tamper-resistant screws. Cabinet interior shall be sound-deadened with fire-resistant material. Fixture shall be furnished complete with bubbler, self-closing valve, a removable P-trap, a fast drain, and mounting hardware.

PART 3. EXECUTION

3.01 EXAMINATION

Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures; examine floors and substrates, and conditions under which fixture installation is to be accomplished. For electrical water coolers, coordinate field electrical wiring requirements specified in Division 16 Sections of the Specifications. Do not proceed with installation of fixtures until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install plumbing fixtures in locations shown on the Contract Drawings, in accordance with manufacturers' installation procedures.
- B. Unless otherwise shown on the Contract Drawings, fixtures shall be installed at the following heights:
 - 1. Water Closets (WC) - Rim height shall be 15 inches "above finished floor" (AFF).
 - 2. Water Closet for Disabled (HC WC) - Rim height shall be 19 inches AFF.
 - 3. Lavatories (LAV) - Top of basin shall be 31 inches AFF.
 - 4. Lavatories for Disabled (HC LAV) - Bottom of apron shall be 29 inches AFF with 17 inches clear depth underneath. Install trap parallel with back wall. Insulate water supplies and trap.

5. Urinals (UR) - Rim height shall be 24 inches AFF.
 6. Urinals for the Disabled (HC UR) - Rim height shall be 17 inches AFF with supply handle a maximum of 44 inches AFF.
 7. Electric Water Coolers
 - a. Electric Water Coolers (EWC) - Rim height shall be 40 inches AFF.
 - b. Electric Water Coolers for Disabled (HC EWC) - Bottom of apron shall be 27 inches AFF with 17 inches clear depth underneath.
 8. Shower - Bottom of shower head to floor shall be:
 - a. 65 inches for male shower;
 - b. 60 inches for female shower.
 9. All other fixtures shall be installed in accordance with manufacturers' recommendations.
- C. Grout or caulk area where fixture surfaces rest against wall or floor surfaces with Keene White Plaster or silicone caulking.
- D. Fasten plumbing fixtures securely to supports or building structures. Ensure that fixtures are level and plumb. Secure supply lines behind or within wall construction so as to be rigid and not subject to pull or push movements.
- E. Clean plumbing fixtures, trim and strainers of dirt and debris upon completion of installation.
- F. Protect installed fixtures from damage during remainder of construction period.

3.03 FIELD TESTS

Upon completion of installation of fixtures and after the piping test specified in another Section of these Specifications is completed, operate the fixtures to demonstrate proper performance to the satisfaction of the Engineer.

3.04 ADJUSTMENTS

Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to assure proper performance in accordance with the manufacturers' recommendations and to the satisfaction of the Engineer.

END OF SECTION

**SECTION 15440
PLUMBING FIXTURES**

**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

15440A01 Shop drawings indicating dimensions, roughing-in requirements, and method of assembly of components and anchorage.

Catalog Cuts

15440B01 Catalog cuts of plumbing fixtures and associated accessories and appurtenances.

Product Data

15440D01 Product data of each selected model, including rated capacity, fixture and trim, fittings, accessories, appliances, appurtenances, equipment, supports, construction details and finishes.

Construction and Installation Procedures

15440G01 Installation procedures.

Manuals, Warrantees/Guarantees

15440I01 Maintenance manual for each type of plumbing fixture and accessory, including replacement and spare parts lists.

END OF APPENDIX "A"

DIVISION 15

SECTION 15491

PLUMBING INSULATION

PART 1. GENERAL

1.01 SUMMARY

This Section specifies insulation requirements for plumbing piping and equipment.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Design and performance of components and methods specified herein shall comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and the latest industry standards including, but not limited to the entities listed below.

- New York City Building Code
 - New York State Energy Conservation Construction Code
 - New Jersey Uniform Construction Code
 - American Society for Testing and Materials (ASTM)
 - National Fire Protection Association (NFPA)
 - Underwriters Laboratories Inc. (UL)

- In addition, specific provisions cited herein shall govern for the associated specific application.

- B. All insulation, including jackets or facings, adhesives, mastics, cements, tapes and glass cloth for fittings shall have composite fire and smoke hazard ratings as tested by ASTM E 84, NFPA 255, and UL 723 procedures, not exceeding a "Flame Spread" of 25 and "Smoke Developed" of 50.
- C. Any treatment of jackets or facings to impart flame and smoke safety shall be permanent. The use of water-soluble treatments is prohibited.

1.03 QUALITY ASSURANCE

- A. Insulation materials and accessories, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.
- B. Entities performing the Work of this Section shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to the construction site in manufacturer's sealed containers with manufacturer's stamp or label affixed, showing fire hazard indexes of products.
- B. All insulation components shall be stored at the construction site on pallets or raised platforms with suitable shed enclosures to protect against foreign matter and rain.
- C. Before moving insulation materials from storage platforms to construction site, all insulation sections and component materials shall be inspected for damage. Remove damaged materials from construction site.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements of this Section, provide insulation materials of one of the following manufacturers, or approved equal:

Schuller International, Inc.
Certain-Teed Corp./Insulation Group
Owens-Corning Fiberglas Corp.
Knauf Fiber Glass

2.02 MATERIALS

- A. Piping Insulation
 - 1. Insulation Thickness

<u>Piping System</u>	<u>Pipe Size</u>	<u>Insulation Minimum Thickness*</u>
Domestic Cold Water	up to 6 in. 8 in. & larger	0.5 0.5
Chilled Drinking Water	All	1"
Horizontal Storm Water	All	0.5
Domestic Hot Water and Hot Water Circulation	1 1/2 in. & smaller 2 in. & larger	1" 1.5
Floor Drain receiving condensate/ waste from HVAC cooling equipment, plus 15 feet of associated downstream drain piping.	All	0.5
Lavatory Waste Piping, exposed under fixtures for the disabled	All	0.5

Electric Drinking Water Cooler Waste, up to connection with sanitary system All 0.5

* Weatherproof or frostproof insulation, where shown on the Contract Drawings, shall have 3-inch thickness.

2. Indoor Piping and Frostproof Insulation
 - a. Insulation shall be molded fiberglass with factory-applied, pressure-sensitive, lap-sealing system jacket as a vapor barrier.
 - b. Molded fiberglass insulation shall conform with ASTM C 547, Class 1.
 - c. The insulation shall be Schuller "MICRO-LOK" with AP-T Plus jacket, having a bare insulation K-factor of 0.25 at 75° mean temperature, or approved equal.
 - d. Fitting, valve, and flange insulation requirements are specified in 3.02 B.2.
3. Outdoor Piping (or Weatherproof) Insulation
 - a. Insulation shall be molded fiberglass with aluminum jacket (ASTM B209, 3003 Alloy, H-14 temper).
 - b. Molded fiberglass insulation shall conform with ASTM C 547, Class 1 and shall be Schuller "MICRO-LOK", having a bare insulation K-factor of 0.25 at 75°F mean temperature, or approved equal.
 - c. Insulation jacket shall be 0.06-inch thick aluminum for pipe 2 1/2 inches and larger and 0.010-inch thick aluminum for pipe 2 inches and smaller, with a built-in isolation felt. All seams and joints shall be weatherproof.
 - d. Fitting, valve, and flange insulation requirements are specified in 3.02 C.3.

B. Equipment Insulation

1. Insulation Thickness

<u>Equipment</u>	<u>Insulation Thickness</u>
Meter Assembly	1"
Condensate Coolers/ Preheaters	2"
Hot Water Heaters (Field applied insulation)	2"
Storage Tanks	2"

2. Hot Surfaces

- a. Insulation shall be rigid fiberglass board.
- b. Rigid fiberglass board insulation shall conform with ASTM C 612, Type 1 except that the density shall not be less than 3 lbs. per cubic foot. The insulation shall be Schuller "814 SPIN-GLAS", having a bare insulation K-factor of 0.23 at 75°F mean temperature, or approved equal.
- c. Finishing requirements are specified in 3.02 D. 1.

3. Cold Surfaces
 - a. Insulation shall be flexible blanket fiberglass.
 - b. Flexible blanket fiberglass insulation shall conform with ASTM C 553, Type I, and shall be Schuller "MICROLITE", having a compressed thickness K-factor of 0.27 at 75°F mean temperature, or approved equal.
 - c. Finishing requirements are specified in 3.02 D.2.

PART 3. EXECUTION

3.01 PREPARATION

- A. Insulation shall be applied only after the piping systems have been hydrostatically tested and approved by the Engineer.
- B. Install insulation subsequent to installation of heat tracing and any coating or painting.
- C. Surfaces shall be clean of rust, scale, dirt, dust, grease and other foreign matter, and shall be dry before application of insulation.

3.02 INSTALLATION

A. General

1. Install insulation products in accordance with this Section and manufacturer's installation procedures.
2. Insulation shall be continuous through hangers, slabs, walls, ceiling openings and sleeves. Where pipes pass through non-fire rated walls, floors or partitions, the space around the insulated pipe shall be sealed with mineral wool.
3. Omit insulation through fire rated walls and slabs. Terminate insulation at penetration and seal insulation ends with vapor barrier coating. The annular space between the sleeve and bare pipe shall be filled with approved material and sealed to prevent flame spread.
4. Insulate specialties to match those of the systems to which they are connected.
5. Insulate horizontal leader piping to and including the first fitting of the vertical leader.
6. Fill surface imperfections of insulation such as chipped edges, small joints, cracks, voids or holes, with insulation material and smooth all such areas with a skim coat of insulating cement. Makeshift patching or filling with hose driven or blown insulation, because of lack of space, will not be permitted.
7. Do not insulate equipment nameplates, identification tags, stampings and final connections to plumbing fixtures beyond walls.
8. Omit insulation on hot and cold water toilet room group fixture roughing within concealed pipe chases.
9. Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, strainers, buried piping, and pre-insulated equipment.

10. Insulation on all piping at hangers and supports shall be provided with galvanized protection shields or saddles to prevent crushing of insulation and damage to vapor barrier.
11. Install insulation with smooth and even surfaces. Insulation shall be continuous, and be carefully fitted, with side and end joints butted tightly and staggered. Install each continuous insulation course with full-length units of insulation, with single cut piece to complete run. Do not use multiple cut pieces or scraps abutting each other.
12. For cold surface insulation, all openings, joints, laps, and end strips shall be sealed against moisture penetration with fire-retardant vapor barrier.
13. Maintain integrity of vapor-barrier jackets on insulation, and protect to prevent puncture or other damage. Staples and similar fastening material are prohibited for securing vapor barrier in insulation.
14. Do not apply seal or cement until all previous application of cement and adhesives have thoroughly dried.
15. Hangers and supports which are directly connected to cold surfaces must be adequately insulated and vapor-sealed to prevent condensation.

B. Indoor Piping and Frostproof Insulation

1. Longitudinal lap joints and end butt joints shall be sealed with approved adhesive. Butt joints shall be wrapped with a minimum three-inch wide strip of same material as pipe jacket.
2. Fittings, valves, flanges and accessories shall be insulated with compressed fiberglass of two lbs. per cubic foot density and of the same thickness as pipe insulation, wired in place with 18-gauge galvanized steel wire. Apply a uniform coat of fire retardant vapor barrier coating to the entire surface then cover with a factory-fabricated pre-formed insulated fitting cover, with sealed joints. The fire retardant vapor barrier shall be compatible with said insulation cover material.

C. Outdoor Piping Insulation

1. Longitudinal lap joints and end butt joints shall be sealed with approved adhesive.
2. Apply outer metal jackets over insulation. All seams and joints shall be weatherproof.
3. Fittings, valves and flanges shall be covered with either a fabricated metal jacket or matching aluminum fitted cover with sealed weatherproof joints.

D. Equipment Insulation

1. Hot Surfaces
Cut and miter fiberglass board and secure in place with bands or wire on 12-inch centers. Point up all joints with insulating cement. Cover insulation with one-inch hexagonal wire mesh. Apply two coats of mineral wool cement and trowel to a smooth finish. Finish with two coats of Foster (H.B. Fuller Co./Foster Products Div.) 30-36 adhesive, or approved equal.

2. Cold Surfaces

Fit and contour to shape blanket fiberglass and secure in place with bands or wire. Apply two coats of mineral wool cement and trowel to a smooth finish. Finish with two coats of Foster 30-35 vapor barrier finish, or approved equal.

END OF SECTION

SECTION 15491
PLUMBING INSULATION

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

15491B01 Catalog cuts of insulation.

Product Data

15491D01 Product data and installation procedures for each type, of insulation

Construction and Installation Procedures

15491G01 Schedule showing product number, k-factor, thickness, and furnished accessories for each plumbing system requiring insulation.

END OF APPENDIX "A"

DIVISION 15

SECTION 15502

REFRIGERANT PIPING AND APPURTENANCES

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for refrigerant piping and appurtenances.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Design and performance of components and methods specified herein shall comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and the latest industry standards including, but not limited to the entities listed below.

- American National Standards Institute (ANSI)
 - Air-Conditioning and Refrigeration Institute (ARI)
 - American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
 - American Society of Mechanical Engineers (ASME)
 - American Society for Testing and Materials (ASTM)
 - Environmental Protection Agency (EPA)
 - National Electrical Manufacturers Association (NEMA)
 - American Welding Society (AWS)
 - Underwriters Laboratories Inc. (UL)

In addition, specific provisions cited herein shall govern for the associated specific application.

- B. Refrigerant piping systems shall be designed in accordance with ANSI B 31.5.

1.03 QUALITY ASSURANCE

- A. Refrigerant piping and appurtenances, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein for not less than 3 years.
- B. Entities performing work shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Clean and dehydrate copper tube, and seal tube ends with temporary plastic end caps of sufficient tightness to prevent entry of foreign matter prior to shipping to the construction site.

- B. Store tube, fittings, valves, specialties and other components at the construction site on pallets or raised platforms with suitable coverings satisfactory to the Engineer to protect them against damage and weather.
- C. Inspect all tube, fittings, valves, specialties and other components for damage before moving them from storage to the point of installation at the construction site.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 COPPER TUBE AND FITTINGS

- A. Copper tube shall be ASTM B 88, Type K, hard drawn temper, nominal (standard) sizes.
- B. Fittings shall be wrought copper, solder-joint, pressure fittings in accordance with ANSI B 16.22 and shall be same rating as pipe.
- C. Tubing joints shall be solder joints, using appropriate ASTM B 32 solder metal.

2.02 REFRIGERANT VALVES AND SPECIALTIES

A. General

- 1. Provide required types, sizes and capacities of refrigerant valves and specialties where shown on the Contract Drawings.
- 2. Unless otherwise shown on the Contract Drawings, all valves and specialties shall be UL listed and have a rating of 240 degrees F, minimum, and 350 psi working pressure and shall have solder ends.

B. Refrigerant Valves

1. Globe Valves

- a. Forged brass body, packed type with back seating and cap seals
- b. Forged brass body, packless, diaphragm type with back seating and hermetic seals

2. Check Valves

Forged brass body, accessible internal parts, Teflon synthetic seat, with fully guided piston and stainless steel spring.

Valves shall be operable whether installed horizontally or vertically.

3. Solenoid Valves

Two-way, forged brass or corrosion-resistant steel body, conforming to ARI 760, normally closed, Teflon valve seat, NEMA 1 solenoid enclosure, 24-volt/60 Hz (unless otherwise shown on the Contract Drawings), with 1/2-inch conduit adapter. Valve with 1/4-inch and smaller ports shall be direct-operated, without manual stem. Valves having a port greater than 1/4-inch shall be pilot-operated and provided with a manual stem. Solenoid valves shall be Parker-Hannifin RB Series, or approved equal.

C. Refrigerant Specialties

1. Strainers

a. Strainers for systems with a capacity of 4 tons or less shall be of the sealed type, having brass or corrosion-resistant steel shell, and stainless steel or monel element capable of removing particles 15 microns and larger. Strainer shall be Henry Valve Company 891S Series, or approved equal.

b. Strainers for systems with a capacity greater than 4 tons shall be of the replaceable - core type, having a brass or corrosion-resistant steel shell, a steel flange ring and spring, cover plate with cap screws, and corrosion-resistant element, capable of removing particles 15 microns and larger. Strainers shall be Henry Valve Company 866 Series, or approved equal.

2. Moisture-liquid indicators shall have forged brass body, single port, removable cap, polished optical glass. Moisture-liquid indicators shall be Henry Valve Company MI-30 Series, or approved equal.

3. Filter-dryers shall be sealed or replaceable core type as indicated on the Contract Drawings.

a. Sealed filter-dryers shall have corrosion-resistant steel shell, with wrought copper fittings and ceramic-fired, desiccant core. Sealed Filter-dryers shall be Henry Valve Company H Series, or approved equal.

b. Replaceable core filter-dryers shall have corrosion-resistant steel shell with wrought copper fittings, steel flange ring and spring, cover plate with cap screws, replaceable filter-dryer core. Replaceable core filter-dryers shall be Henry Valve Company V8 Series, or approved equal.

4. Thermal expansion valve shall be thermostatic adjustable, modulating type; size as required for specific evaporator requirements and factory set for proper evaporator superheat requirements. Valve shall be complete with sensing bulb, a distributor having a side connection for hot gas bypass line if required, and an external equalizer line.

5. Hot gas bypass valve shall be adjustable type, sized to provide capacity reduction beyond the last step of compressor unloading.

D. Refrigerant valves and specialties shall be manufactured by Sporlan Valve Co., Parker-Hannifin Corp., Henry Valve Co. Inc., or approved equal.

2.03 PIPE AND VALVE IDENTIFICATION

A. Adhesive Bands

1. Provide approved adhesive bands in sets of two, one identifying the system and the second, the direction of flow.
2. For pipe 3 inches and larger, the adhesive band identifying the piping system shall display the name of the service in letters at least two inches high and the band indicating direction of flow shall display an arrow of similar size. For pipe 2 1/2 inches and smaller, the letters and the arrow shall be not less than one inch high.
3. Adhesive bands shall be W.H. Brady Co. "Quik-Label", or approved equal.

B. Valve Tags, Charts and Schedules

1. Provide each valve with a 2-inch diameter 18 gauge brass tag with brass chain. Service designation shall be 1/4-inch high and on the upper line. The valve number shall be 1/2-inch high and on the lower line. The characters shall be indented and filled with durable black compound.
2. Provide diagrammatic valve charts and schedules, using a valve numbering system which differentiates between classes of service and indicates floor level of valve location.
3. Tags shall conform to the numbers, locations, and uses listed in the valve charts and schedules.
4. Valve charts and schedules shall be mounted under glass in wood frames or aluminum self-closing frames.
5. Valve tags and the frames for valve charts and schedules shall be manufactured by Seton Name Plate Corp., or approved equal.

2.04 PIPE HANGERS AND SUPPORTS

- A. Design, fabricate and provide all pipe hangers and supports adequate to support and guide the piping, allow for forces imposed by expansion joints, satisfy structural and seismic requirements and maintain proper clearances with respect to adjacent piping, equipment and structures.
- B. Hangers and supports shall include, but not limited to guides, anchors, stops, restraints, welded attachments, insulation saddles, saddle strands, stays, braces, bolts, nuts, washers, expansion bolts, pipe clamps, beam clamps, and supplementary structural steel for pipe hanger and supports.
- C. All hangers and supports shall conform to requirements of ANSI B 31.5.
- D. Do not hang piping from other piping. In no case shall hangers be supported by means of vertical expansion bolts.
- E. Keep the types of hangers used to a minimum and provide hangers that are neat, without complicated bolting and with the number of parts of each hanger and its anchor kept to a minimum.
- F. Support riser piping independently from the connected horizontal piping.

- G. Pipe support attachments to the riser piping shall be riser clamp lugs at each floor level.
- H. Use only adjustable ring type, copper-plated, carbon steel hangers for uninsulated copper tubing.
- I. Provide pipe anchors where shown on the Contract Drawings and where necessary to restrain forces due to thermal expansion and contraction of pipe.
- J. Anchors shall be adequately designed to rigidly oppose forces acting on them and shall be embedded in structural concrete or connected to the building structural steel framework.
- K. Unless otherwise specifically approved, hanger size and spacing for copper tubing shall be as follows:

<u>Pipe Size</u>	<u>Maximum Hanger Spacing</u>	<u>Minimum Rod Size</u>
1/2" to 1"	5 ft. o.c.	3/8"
1-1/4" to 2"	7 ft. o.c.	3/8"
2-1/2" to 3"	9 ft. o.c.	1/2"
3-1/2" to 4"	11 ft. o.c.	5/8"

- L. All hangers and supports shall comply with the requirements specified under the Section entitled "VIBRATION ISOLATION AND CONTROL."
- M. Hangers and supports shall be manufactured by Grinnell Corp., Carpenter & Patterson Inc., Michigan Hanger Co. Inc., or approved equal.

2.05 SLEEVES, SEALS, AND ESCUTCHEONS

- A. Piping passing through masonry or concrete walls and framed partitions shall have a trim opening cut no greater than necessary for the installation of a sleeve secured therein. Sleeve shall be 1/2 inch in diameter larger than the diameter of the insulated pipe. Sleeve shall be flush with the finished wall or partition surface.
- B. Sleeves through concrete floors for piping shall have the opening 1/2-inch in diameter larger than the diameter of the insulated pipe passing through. Floor sleeves shall project one inch above floor slab.
- C. Annular spaces between insulated piping and sleeves shall be packed with mineral wool and sealed to retain the fire integrity of the walls, partitions and floors with non-hardening through-penetration firestops having F-ratings compatible with the fire ratings of the barriers in which they are installed, as determined by ASTM E 814. Firestop systems shall be UL-approved, and shall be as manufactured by 3M, Bio fireshield, Inc., General Electric Company, Dow Corning Corporation, or approved equal.
- D. Sleeves in walls and floors shall be galvanized steel pipe, Schedule 40. Sleeves in partitions shall be 20-gauge galvanized sheet metal.
- E. Piping in exposed areas, passing through walls, floors or ceilings shall be fitted with chromium-plated, cast brass escutcheons with fastening set screws.

- F. Piping passing through roof construction shall be provided with counterflashing, consisting of copper rainhood secured all around the pipe and overlapping the flashing, unless otherwise shown on the Contract Drawings.
- G. Piping passing through floor waterproofing membrane shall be provided with a 4-pound lead flashing or a 16-ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the floor membrane in a solid coating of waterproof cement compatible with the water proofing membrane. The flashing shall extend up the pipe a minimum of 10 inches above the floor. The annular space between the flashing and the pipe shall be packed to ensure a watertight seal.

PART 3. EXECUTION

3.01 PREPARATION

- A. Verify cleanliness of all tube, fittings, valves and specialties immediately prior to installation in the refrigeration system.
- B. Verify status of all precharged gas-or refrigerant-containing equipment for pressure retention and dehydration status. Replenish gas or refrigerant charges only after verification of internal conditions under the direction of the equipment manufacturer's representative at the construction site.
- C. Where necessary, clean refrigerant piping by swabbing with dry, lintless (linen) cloth, followed by refrigerant oil soaked swab. Remove excess oil by swabbing with cloth soaked in high flash point petroleum solvent, squeezed dry.

3.02 INSTALLATION

- A. Install piping system in accordance with manufacturer's installation procedures, requirements of ANSI B 31.5 and as specified.
- B. Coordinate piping installation with other work to avoid interference.
- C. The piping layout shown on the Contract Drawings shall be considered as diagrammatic. Install piping suitable in every respect for the work-intended clearances required.
- D. Run all piping perpendicular and parallel to walls and floors.
- E. Bend copper tubing with approved tubing benders to prevent deformation of the tubing in the bends. Use approved sweat-to-pipe threaded adapters for connection with valves and other equipment having threaded connections.
- F. All piping shall be concealed above furred ceilings, in furred walls and partitions, unless otherwise shown on the Contract Drawings.
- G. Bleed nitrogen through refrigerant piping during soldering operations and during idle periods of construction work to ensure maintenance of dehydrated status. Maintain 10 psi nitrogen charge with pipe end closures.
- H. Install solenoid valves with stem pointing upwards. Wiring of solenoid valves is specified in applicable Sections of Division 16.

- I. All equipment connections shall be provided with isolation valved disconnections and pump-down recharge connections.
- J. Installation requirements for hangers and supports and for pipe penetration sleeves, seals and escutcheons are specified in 2.04 and 2.05, respectively.
- K. Soldered Joints
 - 1. Cut ends of tubing square and remove all burrs. Clean inside and outside of tubing with steel wool.
 - 2. Remove excess solder while still in plastic state.
 - 3. Leave a fillet at the wall of the fitting.
 - 4. Prior to soldering, remove the internal parts of all valves or other devices to be installed directly in the line.
- L. Piping shall be so arranged and valved that any part or portion of the system may be cut out of service without pumping down the system, or otherwise interfering with the operation of other portions or equipment in the system.
- M. Provision shall be made for attaching pressure gauges, or for the installation of test thermometers. Suitable fittings with wells shall be installed where required for the insertion of temperature control sensing bulbs.
- N. In multi-circuit evaporators (split direct-expansion cooling coils), each circuit shall be provided with its individual thermostatic expansion valve, and its own refrigerant solenoid valve. Each solenoid valve shall be provided with a valved bypass and inlet and outlet isolation valves.

3.03 FIELD TESTS

- A. Refrigerant Piping Leak Tests
 - 1. Test refrigerant piping in accordance with ANSI B 31.5 and refrigeration equipment manufacturer's recommendations, using inert gas such as nitrogen or carbon dioxide, with leak tracer introduced to the piping system through a pressure regulator and gauge manifold.
 - 2. Maintain 150 psi inert gas test pressure in the piping system. Perform bubble test on all joints and then check complete system with halide torch or electronic leak detector.
 - 3. Maintain 150 psi pressure for 24 hours after tests.
- B. Dehydration and Charging System
 - 1. Procedure for dehydration and charging shall meet all requirements of EPA Section 608 of the Clean Air Act of 1990.
 - 2. Install core in the filter-dryer after leak test but before evacuation.
 - 3. Evacuate refrigerant system with vacuum pump until refrigerant pressure reaches the level established by EPA for the type of refrigerant and its ultimate recovery. During evacuation, apply heat to pockets, elbows, and low spots in piping.

4. Maintain vacuum on system for a minimum of 5 hours after closing valve between vacuum pump and system.
5. Break vacuum with refrigerant gas, allow pressure to build up to EPA acceptable level.
6. Complete charging of system, using new filter-dryer core in charging line. Provide full operating charge of refrigerant.
7. Maintain the charged system until startup.

3.04 PAINTING

Upon completion of the installation, remove all protecting materials, thoroughly remove all scale and grease and leave in a clean condition for painting. Piping to be painted shall be as shown on the Contract Drawings. Painting shall be in accordance with the requirements of Section 09910 "PAINTING" of Division 9 "FNISHES".

3.05 PIPE AND VALVE IDENTIFICATION

A. Pipe Identification

Affix pipe adhesive bands specified in 2.03 A where they can be easily read and with their long dimension parallel to the axis of the pipe.

At least one set of identifying bands shall be affixed in all occupied and unoccupied rooms as well as in all other spaces, such as hung ceilings or shafts, where piping may be viewed, and the identity of the piping system cannot be readily ascertained. As a minimum, a set of such bands shall be affixed at each branch and riser takeoff; adjacent to each valve; at each pipe passage through floor and ceiling construction; at each capped line; and at each pipe passage to an underground area.

B. Valve Tags

Securely fasten valve tags specified 2.03 B with approved brass chain.

END OF SECTION

SECTION 15502
REFRIGERANT PIPING AND APPURTENANCES

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

15502A01 Refrigerant piping layout drawings, including hanger and support locations and details.

Catalog Cuts

15502B01 Product data, including catalog cuts: Fittings

15502B02 Product data, including catalog cuts: Valves

15502B03 Product data, including catalog cuts: Specialties

15502B04 Product data, including catalog cuts: Hangers and supports

15502B05 Product data, including catalog cuts: Sleeves and escutcheons

15502B06 Product data, including catalog cuts: Valve tags

15502B07 Product data, including catalog cuts: Pipe identification bands

Product Data

15502D01 Valve charts and schedules

Manuals, Warrantees/Guarantees

15502I01 Submit operation and maintenance manuals for each type of valve

Spare Parts List

15502N01 Submit replacement and spare parts lists for each type of specialty.

Inspection Reports

15502O01 Submit leak test results.

END OF APPENDIX "A"

15502 -10

DIVISION 15

SECTION 15750

CONTROL ROOM AIR CONDITIONERS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for Control Room Air Conditioners.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Design and performance of components and methods specified herein shall comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and the with latest industry standards including, but not limited to those of the entities listed below.

New York State Energy Conservation Construction Code

New York State Building Code

American Society of Mechanical Engineers (ASME)

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

Air-Conditioning and Refrigeration Institute (ARI)

Underwriters Laboratories, Inc. (UL)

National Electrical Code (NEC)

In addition, specific provisions cited herein shall govern for the associated specific application.

- B. Design and performance requirements of the condensers shall be as specified in the Control Room Air Conditioners Schedule shown on the Contract Drawings.

1.03 QUALITY ASSURANCE

- A. Control Room Air Conditioners, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein, for not less than three (3) years.
- B. Entities performing the work of this Section shall have experience on at least two (2) projects involving complexities similar to those required under this Contract.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver Control Room Air Conditioners with factory-installed wooden skids and lifting lugs; pack components in factory-fabricated protective containers.
- B. Handle Control Room Air Conditioners carefully to avoid damage to components, enclosures, and finish.
- C. Store Control Room Air Conditioners in clean, dry spaces and protect them from weather.
- D. Comply with the manufacturer's rigging instructions for unloading Control Room Air Conditioners and moving them to final location for installation.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

1.06 WARRANTY

- A. Equipment manufacturer shall provide in writing to PATH a two (2) year warranty on all parts and appurtenances, and a five (5) year warranty for compressors.
- B. Warranty shall include all labor and parts.
- C. This warranty period shall start after PATH acceptance of the system.
- D. If within the warranty period as described above, upon written notice from PATH, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted to satisfy the Engineer at no additional cost to the Authority.
- E. Warranty shall run to PATH and shall grant PATH a direct right of action against the manufacturer and the Contractor.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements of this Section, furnish and install factory-fabricated Control Room Air Conditioners of one of the following manufacturers or approved equal:

Liebert Corporation
Compu-Aire, Inc.
Ecos-Aire by Dectron, Inc.

2.02 GENERAL

- A. Control Room Air Conditioners shall be of sizes, arrangements and capacities specified on the Contract Drawings.
- B. Control Room Air Conditioners shall be factory assembled and tested.
- C. Refrigerant R-407C or 410A.

2.03 CONTROL ROOM AIR CONDITIONERS

- A. Evaporator Cabinet Construction:
 - 1. The cabinet and chassis shall be constructed of heavy gauge galvanized steel, and shall be serviceable from one side only. Mounting brackets shall be factory attached to the cabinet.
- B. Air Distribution System:
 - 1. The air distribution system shall be constructed with a quiet, 51 dBA direct-drive fan assembly equipped with double-inlet blower, self-aligning ball bearings, and lifetime lubrication. Fan motor shall be permanent-spill capacitor, high efficiency type, equipped with two speeds for air flow modulation. Dehumidification shall utilize the lower fan speed.
 - 2. System shall be suitable for plenum or ducted air distribution.

Exemption (4)

D. Alarms

1. The control system shall monitor unit operation and activate an audible and visual alarm in the event of the following factory preset alarm conditions:
 - a. High Temperature
 - b. Low Temperature
 - c. High Humidity
 - d. Low Humidity
 - e. High Water Alarm - Lockout Unit Operation
 - f. High Head Pressure
 - g. Loss of Power
 - h. Compressor Short Cycle
2. Custom Alarms
 - a. Humidifier Problem
 - b. Filter Clog
 - c. Water Detected
 - d. Smoke Detected

3. Each alarm unit and custom shall be separately enabled or disabled, selected to activate the common alarm.
 4. The audible alarm shall annunciate any alarm that is enabled by the operator.
 5. A programmable common alarm shall be provided to interface user selected alarms with a remote alarm device.
- E. The evaporator section shall include evaporator coil, thermostatic expansion valve, and filter drier. It shall be constructed of copper tubes and aluminum fins. The coil shall be provided with a stainless steel drain pan. Refrigerant flow shall be controlled by an externally equalized thermostatic expansion valve.
- F. Air-Cooled Prop Fan Condensing Unit:
1. The condenser coil shall be constructed of copper tubes and aluminum fins with a direct-drive propeller-type fan, and shall include scroll compressors, high pressure switch, and lee-temp receiver. All components shall be factory assembled, charged with refrigerant, sealed, and be capable of being connected to the evaporator section using pre-charged refrigerant line sets. No internal piping, brazing, dehydration, or charging shall be required. Condensing unit shall be designed for 95°F ambient and be capable of operation to -30°F.
 2. The condensing unit shall be designed to operate at a sound level less than 58 dba.
- G. Factory Installed Options:
1. SCR (Silicon Controlled Rectifier) Electric Reheat:
 - a. The electric reheat shall be low-watt density, 304/304 stainless steel, finned-tubular and shall be capable of maintaining room dry bulb conditions when the control room air conditioning system is calling for dehumidification. The reheat section shall include a U.L. approved safety switch to protect the system from overheating.
 - b. The SCR controller shall proportionally control the reheat elements to maintain the selected room temperature. The rapid cycling made possible by the SCR controller shall provide precise temperature control, and the more constant element temperature shall extend heater life. The unit microprocessor control shall operate the SCR controller, while cooling is locked on.
 2. Disconnect Switch, Non-Locking: The non-automatic, non-locking, molded case circuit breaker shall be factory mounted in the high voltage section of the electrical panel. The switch shall be accessible from the front of the unit.

3. Firestat: The firestat shall immediately shut down the system when high temperatures are detected. The firestat shall be mounted with the sensing element in the return air.
4. Smoke Detector: The ionization smoke detector shall immediately shut down the environmental control system and activate the alarm system when activated. The sensing element shall be located in the return air compartment.
5. Steam Generating Humidifier
 - a. The environmental control system shall be equipped with a steam generating humidifier that is controlled by the microprocessor control system. It shall be complete with disposable canister, all supply and drain valves, 1" air gap on fill line, inlet strainer, steam distributor and electronic controls. The need to change canister shall be annunciated on the microprocessor wall box control panel. The humidifier shall have a capacity of 4.3 lb/hr. an LED light on the humidifier assembly shall indicate cylinder full, overcurrent detection, fill system fault and end of cylinder life conditions.

H. Ship-Loose Accessories:

1. Remote Sensors: Each control room air conditioner shall be supplied with remote temperature and humidity sensors. The sensors shall be connected to the air conditioners by shielded cables. Provide a minimum of forty (40) feet cable to connect sensors to unit
2. Air Distribution Plenum: The evaporator section shall be supplied with an air distribution plenum with integral filter. The plenum shall be equipped with 4-way air distribution, for installation into a standard ceiling grid. Filter type shall be deep pleated type with minimum efficiency of 20%, based on ASHRAE 52-2.
3. Condensate Pump: The condensate pump shall have the minimum capacity of 30 GPH at 20 ft. head. It shall be complete with integral float switch, pump, motor assembly, and reservoir. Condensate pump shall be Hartell Model A3X, or approved equal.

PART 3. EXECUTION

3.01 INSTALLATION

- A. Install Control Room Air Conditioners in accordance with the manufacturer's installation procedures.
- B. Coordinate the Work of this Section to ensure that the installation of the Control Room Air Conditioners is not in conflict with the Work performed under other Sections of these Specifications.

- C. Verify that the electrical wiring installation is in accordance with the manufacturer's submittal and in accordance with the installation requirements as specified in Division 16 - ELECTRICAL.

3.02 FIELD TESTS

- A. Provide a qualified technical representative of the manufacturer to advise on field tests.
- B. Start-up, test, adjust Control Room Air Conditioners and verify capacity and efficiency in the presence of the manufacturer's representative.
- C. Provide qualified technical representatives of the manufacturer to instruct and train the Authority's Maintenance Personnel in the operation and maintenance of the Control Room Air Conditioners for a minimum 8 hours.

END OF SECTION

SECTION 15750
CONTROL ROOM AIR CONDITIONERS

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

- 15750A01 1. Control Room Air Conditioners performance data with rated capacities clearly indicated.
 2. Shop drawings indicating dimensions, weight loadings, required clearances, methods of assembly of components, and mounting details.
 3. Electrical wiring diagrams for electrical power supply, interlock and control.
 4. Installation and start-up procedures.

Catalog Cuts

- 15750B01 Submit manufacturers catalog cuts

Certificates

- 15750E01 Submit certified shop test reports.

Manuals, Warrantees/Guarantees

- 15750I01 Submit operation and maintenance manuals, including replacement and spare parts lists.

END OF APPENDIX "A"

DIVISION 15

SECTION 15850

AIR CONDITIONING UNITS

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for Air Conditioning Units.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Design and performance of components and methods specified herein shall comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and with the latest industry standards including, but not limited to, those of the entities listed below.

New York State Energy Conservation Construction Code

New York State Building Code

American Society of Mechanical Engineers (ASME)

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

Air-Conditioning and Refrigeration Institute (ARI)

Underwriters Laboratories, Inc. (UL)

National Electrical Code (NEC)

In addition, specific provisions cited herein shall govern for the associated specific application.

- B. Design and performance requirements of the air conditioning units shall be as specified in the Air Conditioning Units Schedules shown on the Contract Drawings.

1.03 QUALITY ASSURANCE

- A. Air Conditioning Units, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein, for not less than three (3) years.
- B. Entities performing the work of this Section shall have experience on at least two (2) projects involving complexities similar to those required under this Contract.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver Air Conditioning Units with factory-installed wooden skids and lifting lugs; pack components in factory-fabricated protective containers.
- B. Handle Air Conditioning Units carefully to avoid damage to components, enclosures, and finish.
- C. Store Air Conditioning Units in clean, dry spaces and protect them from weather.
- D. Comply with the manufacturer's rigging instructions for unloading Air Conditioning Units and moving them to final location for installation.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

1.06 WARRANTY

- A. Equipment manufacturer shall provide in writing to PATH a two (2) year warranty on all parts and defects, and a five (5) year warranty for compressors.
- B. Warranty shall include all labor and parts.
- C. This warranty period shall start after PATH acceptance of the system.
- D. If within the warranty period as described above, upon written notice from PATH, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted to satisfy the Engineer at no additional cost to the Authority.
- E. Warranty shall run to PATH and shall grant PATH a direct right of action against the manufacturer and the Contractor.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements of this Section, furnish and install factory-fabricated Air Conditioning Units of one of the following manufacturers or approved equal:

Mitsubishi Electric

Fujitsu General America, Inc.

Sanyo Commercial Solution

2.02 GENERAL

- A. Air Conditioning Units shall be of sizes, arrangements and capacities specified in the Schedules shown on the Contract Drawings.
- B. Air Conditioning Units shall be factory assembled and tested, and shall consist of casings, fans, fan motors, coils and head pressure controls.
- C. Refrigerant R-410A or R407.

2.03 AIR CONDITIONING UNITS

- A. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be factory wiring, piping, control circuit board, fan and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit shall be charged with dry air before shipment from factory.
- B. Unit Cabinet:
 - 1. The casing shall have a white finish.
 - 2. Multi-directional drain connection and refrigerant piping, offering three direction pipe alignments for all refrigerant piping and two direction pipe alignments for condensate draining shall be standard.
 - 3. There shall be a separate, metal back-plate that secures the indoor unit firmly to the wall. The back plate shall be securely attached to the wall.
- C. Fan:
 - 1. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor.
 - 2. The fan shall be statically and dynamically balanced and powered by a motor with permanently lubricated bearing.
 - 3. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
 - 4. An integral, motorized, multi-position, horizontal air sweep flow louver shall provide for uniform air distribution, up and down.
 - 5. The indoor fan shall operate at five selectable speeds: Super High, High, Medium, Low and Quiet.
 - 6. The indoor unit sound level shall not exceed 43 dBA at super high speed.

D. Filter:

1. Return air shall be filtered by means of easily removed, washable, Catechin, Antioxidant Pre-Filter and an Anti-allergy enzyme filter - blue, pleated type. Provide filter with minimum 20% efficiency rating based on ASHRAE 52.2.

E. Coil:

1. The indoor unit coil shall be of nonferrous construction with smooth aluminum plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phosphor copper or silver alloy.
4. The coils shall be pressure tested at 450 psig.
5. A sloped, corrosion resistant condensate Styrofoam insulated plastic pan with drain shall be provided under the coil.

F. Electrical:

1. The indoor unit electrical power shall be 208-230 volts, 1-phase, 60 hertz.
2. The air conditioning system shall be equipped with A-Control - a system directing that the indoor unit be powered directly from the outdoor unit using a 3-wire connection plus ground.
3. The indoor unit shall not have any supplemental electrical heat elements.
4. Unit shall be provided with lockable disconnect switch.

G. Control:

1. The unit shall have a wireless controller to perform input functions necessary to operate the system.
2. The wireless controller shall have a Power On/Off switch, Mode Selector - Cool, Dry, Heat, Auto Modes - Temperature Setting, Timer Control, Fan Speed Select and Auto Vane selector.
3. The indoor unit shall perform Self-diagnostic Function and Check Mode switching.
4. Temperature changes shall be by 1°F increments with a range of 59-89°F.
5. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless or a wired controller, providing emergency operation and controlling the outdoor unit.

6. The air conditioning system shall be capable of automatically restarting and operating at the previously selected conditions when the power is restored after power interruption.
7. Control system shall control the continued operation of the air sweep louvers, as well as provide On/Off, System/Mode function.
8. The indoor unit shall have the option of a field installed, multi-function, hard-wired, wall-mounted remote controller.

H. Air Cooled Condenser:

The outdoor air cooled condensing units shall be specifically designed to work with the indoor air conditioning units. The outdoor units must have a thermally fused powder coated finish. The outdoor units shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.

1. Unit Cabinet:

- a. The casing shall be fabricated of galvanized steel, bonderized, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection.

2. Fan:

- a. Each outdoor unit shall be furnished with a direct drive propeller type fan.
- b. The outdoor unit fan motor shall be a direct current (DC) motor and shall have permanently lubricated bearings.
- c. The fan motor shall be mounted for quiet operation.
- d. The fan shall be equipped with a raised guard to prevent contact with moving parts.
- e. The outdoor unit shall have horizontal discharge airflow.
- f. The outdoor unit sound level shall not exceed 51 dBA.

3. Coil:

- a. The outdoor unit coil shall be corrugated aluminum plate fins on copper tubing.
- b. The coil shall be protected with an integral metal guard.
- c. Refrigerant flow from the outdoor unit shall be regulated by means of an electronically controlled, precision, leanier expansion valve.

4. Compressor:

- a. The compressor shall be a high performance, hermetic, inverter driven, variable speed dual rotary.
- b. The compressor motor shall be direct current (DC) type equipped with a factory supplied and installed inverter drive package.
- c. The outdoor unit shall have an accumulator.
- d. The compressor shall be equipped with an internal thermal overload.
- e. The outdoor unit must have the ability to operate over the full cooling capacity range with a maximum height difference of 40 feet and shall have refrigerant tubing length of 65 feet between indoor and outdoor units.
- f. There shall be no line size changes, traps shall not be used, and no additional refrigerant oil shall be required.
- g. The compressor shall be mounted so as to avoid the transmission of vibration.

5. Electrical:

- a. The air conditioning unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
- b. Each air conditioning unit shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts.
- c. The outdoor unit shall be controlled by the microprocessor located in the indoor unit and outdoor unit.
- d. Unit shall be provided with lockable NEMA 4 disconnect switch.

PART 3. EXECUTION

3.01 INSTALLATION

- A. Install Air Conditioning Units in accordance with the manufacturer's installation procedures.
- B. Coordinate the Work of this Section to ensure that the installation of the Air Conditioning Units is not in conflict with the Work performed under other Sections of these Specifications.

- C. Verify that the electrical wiring installation is in accordance with the manufacturer's approved submittal and in accordance with the installation requirements as specified in Division 16 - ELECTRICAL.

3.02 FIELD TESTS

- A. Provide a qualified technical representative of the manufacturer to advise on field tests.
- B. Start-up, test, adjust Air Conditioning Units and verify capacity and efficiency in the presence of the manufacturer's representative.
- C. Provide qualified technical representatives of the manufacturer to instruct and train the Authority's Maintenance Personnel in the operation and maintenance of the Air Conditioning Units for a minimum 8 hours.

END OF SECTION

SECTION 15850
AIR CONDITIONING UNITS

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

- 15850A01 1. Control Room Air Conditioners performance data with rated capacities clearly indicated.
 2. Shop drawings indicating dimensions, weight loadings, required clearances, methods of assembly of components, and mounting details.
 3. Electrical wiring diagrams for electrical power supply, interlock and control.
 4. Installation and start-up procedures.

Catalog Cuts

- 15850B01 Submit manufacturers catalog cuts

Certificates

- 15850E01 Submit certified shop test reports.

Manuals, Warrantees/Guarantees

- 15850I01 Submit operation and maintenance manuals, including replacement and spare parts lists.

END OF APPENDIX "A"

DIVISION 15
SECTION 15861
FANS

PART 1. GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for Fans.
- B. Types of fans specified in this Section are:
 - 1. Propeller Fans
 - 2. Roof Exhaust Fans
 - 3. Inline Duct Mounted Fans

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Design and performance of components and methods specified herein shall comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and with the latest industry standards including, but not limited to, those of the entities listed below.

Air Movement and Control Association (AMCA)

American National Standards Institute (ANSI)

American Society for Testing and Materials (ASTM)

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

Anti-Friction Bearing Manufacturers Association (ABMA)

National Electrical Manufacturers Association (NEMA)

Occupational Safety and Health Administration (OSHA)

Steel Structures Painting Council (SSPC)

Underwriters Laboratories Inc. (UL)

In addition, specific provisions cited herein shall govern for the associated specific application.

- B. Design and performance requirements of fans shall be as specified in the Fan Schedules, shown on the Contract Drawings.

1.03 QUALITY ASSURANCE

- A. Fans, of types and sizes required, shall have been satisfactorily used for purposes similar to those intended herein for not less than three years.
- B. Entities performing the work of this Section shall have experience on at least two projects involving complexities similar to those required under this Contract.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans with factory-installed wooden skids and lifting lugs; pack components in factory-fabricated protective containers.
- B. Handle fans carefully to avoid damage to components, enclosures, and finish.
- C. Store fans in clean, dry spaces and protect them from weather.
- D. Comply with the manufacturer's rigging instructions for unloading fans to final location for installation.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with the requirements of this Section, furnish and install fans of one of the following manufacturers or approved equal:

Greenheck Fans Corp.

Penn Ventilators

Cook (Loren) Co.

2.02 MATERIALS

Materials for fans shall be as specified below.

- A. Propeller Fans

Wheel:	Cast Aluminum
Shaft:	Forged steel
Housing:	Galvanized steel

B. Roof Exhaust Fan

Wheel: Aluminum
Shaft: Forged Steel
Housing: Aluminum

C. Inline Duct Mounted Fans

Wheel: Galvanized steel
Shaft: Forged steel
Housing: Acoustical Lined Galvanized steel

2.03 CONSTRUCTION FEATURES

A. Propeller Fans

Belt driven, axial type sidewall fans shall be fabricated as follows:

1. Propellers shall be constructed with cast aluminum blades and hubs. Propellers shall be securely attached to fan shafts. All propellers shall be statically and dynamically balanced.
2. Motors shall be permanently lubricated, heavy duty type, carefully matched to the fan load and furnished at the specified voltage, phase and enclosure. Motors shall be totally enclosed fan cooled premium efficiency type.
3. Ground and polished steel fan shafts shall be mounted in permanently lubricated, sealed ball bearing pillow blocks. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds. Drives shall be sized for a minimum of 150 percent of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to wheel and motor shafts. Motors sheaves shall be adjustable for system balancing.
4. Drive frame and panel assemblies shall be galvanized steel. Drive frames shall be formed channels and fan panels shall have prepunched mounting holes, formed flanges, and a deep formed inlet venture. Drive frames and panels shall be bolted construction or welded construction.
5. The exhaust fans shall bear the AMCA Certified Ratings Seals for both sound and air performance.

Exemption (4)

1

1

2.04 SHOP PAINTING

- A. All fans shall be provided (inside and outside) with color dark grey Hi-Pro polyester, or approved equal corrosion resistant coating including all accessories but not limited to the housing, wheels, curbs, liners, dampers, damper access sections.

2.05 SHOP TESTS

- A. Balance fan wheels statically and dynamically prior to final operating tests with motor and drive in place.
- B. Test, rate and certify fans in accordance with AMCA Standard 210 at an AMCA approved laboratory; fans shall bear AMCA seals. In lieu of shop performance tests, unless otherwise specified in the Schedules shown on the Contract Drawings, certified

performance characteristic curves of prototype fans of similar units may be submitted for approval.

- C. Sound rate fans in accordance with AMCA Standard 300; fans shall bear AMCA seals. Sound rating shall be based upon actual fan tests or upon prototype tests of similar units.

PART 3. EXECUTION

3.01 INSTALLATION

- A. Install fans in accordance with manufacturer's installation procedures.
- B. Coordinate all trades to ensure that the installation of fans is not in conflict with the work performed by other trades.
- C. Verify that electrical wiring installation is in accordance with manufacturer's submittal and in accordance with installation requirements of Division 16. Ensure that rotation is in direction indicated and intended for proper performance.

3.02 FIELD TESTS

- A. Provide a qualified technical representative of the manufacturer to advise on field tests.
- B. Start-up, test and adjust fans in presence of manufacturer's authorized representative.

END OF SECTION

SECTION 15861

FANS

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

- 15861A01
1. Catalog cuts of centrifugal fans and accessories
 2. Fan schedules
 3. Certified performance operating curves for pressure-volume relation for each fan, drive, and motor system.
 4. Certified sound power levels at rated capacity at each active band.
 5. Details of fan construction components, dimensions, materials, gauges, finishes, weights, required clearances, and locations and sizes of field connections.
 6. Specialties and accessories.
 7. Motor and electrical operating data.
 8. Electrical wiring diagrams.
 9. Drive construction and rating.
 10. Installation procedures

Manufacturer Test Reports

- 15861F01 Submit certified shop test reports.

Manuals, Warrantees/Guarantees

- 15861I01 Submit operation and maintenance manuals, including replacement and spare parts lists.

END OF APPENDIX "A"

ANALYSIS OF BID

02-02-12P02:53 RCVD

THE PORT AUTHORITY OF NY & NJ

PROJECT PATH - Christopher St. Substation # 1 - Electrical Upgrade

BID DATE ~~1/28/2012~~ 2/2/12

THIS IS NOT PART OF THE CONTRACT

SHEET 1 of 2

CONTRACTOR Mass. Electric Construction Co.

CONTRACT NO. PAT-624.154

Unit No.	Descriptions ⁽¹⁾	Quantity	Unit ⁽²⁾	Unit Price	Amount
1	General Conditions	1	LS		6,741,000.00
2	Structural		-		
3	Removals	1	LS		847,000.00
4	Structural Modifications	1	LS		1,659,000.00
5	Bridge Crane	1	LS		220,000.00
6	Stairwell Supports	1	LS		99,000.00
7	Architectural	1	LS		1,094,000.00
8	HVAC	1	LS		936,000.00
9	Plumbing	1	LS		78,000.00
10	Fire Protection	1	LS		159,000.00
11	Electrical:		-		
12	Traction Power		-		
13	35KV AC Switchgear	1	LS		1,126,000.00
14	D.C. Traction Power Equipment	1	LS		2,552,000.00
15	Auxiliary Power Distribution	1	LS		1,158,000.00
16	Power Cables & Bus (Temp and Final Stages) - (Including length to Tunnels A & B)	1	LS		1,682,000.00
17	SCADA and Control System	1	LS		2,260,000.00
18	Raceways (MV and Traction Power Related)	1	LS		1,394,000.00
19	Low Voltage Distribution Equipment	1	LS		945,000.00
20	Misc. Traction Power Work	1	LS		407,000.00

ANALYSIS OF BID



THE PORT AUTHORITY OF NY & NJ

PROJECT PATH - Christopher St. Substation # 1 - Electrical Upgrade

BID DATE 1/24/2012
SHEET 2 of 2

THIS IS NOT PART OF THE CONTRACT

CONTRACTOR Mass. Electric Construction Co.

CONTRACT NO. PAT-624,154

Unit No.	Descriptions ⁽¹⁾	Quantity	Unit ⁽²⁾	Unit Price	Amount
21	Washington/Caisson	1	LS		450,000.00
22	Building Electrical	1	LS		577,000.00
23	Electronics	1	LS		216,000.00
24	Environmental	1	LS		60,000.00
	Total Lump Sum	1	LS		24,660,000.00

1. Separate and list all items or operations of work included in your estimate in accordance with Specifications.
When listing subcontracts, the prime contractor will have each subcontractor complete an analysis of bid form.
2. Unit of measure, i.e., SF, CY, Bbls, Pcs, Ea., etc.
3. Include all charges, such as moving on site, removal, rental, etc.
4. In case of conflict between information hereon (whether supplied by the Authority or the bidder) and the terms or prices contained or inserted in the Contract Booklet or Contract Drawings, said Booklet and Drawings shall control.
5. The Analysis of Bid is not part of the contract. No information hereon (whether supplied by the Authority or the bidder) and no information deduced from information hereon, including quantities of materials or work, shall be deemed to vary, alter or modify any provision of the Contract, including provisions therein as to compensation and performance. The unit prices contained hereon serve the sole purpose of informing Port Authority as to components of the bidder's price quoted in the Contract. The items of materials or work contained hereon shall not be deemed to be an exhaustive list of the items of materials or work required by the Contract Drawings and Specifications in their present form.

02-02-12 P02:54 RCVD

**PORT AUTHORITY TRANS - HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102**

October 18, 2011

ADDENDUM NO. 1

TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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

Wherever in the Contract Booklet “Replacement and Upgrade of Christopher Street Substation” appears, change it to read “Replacement and Upgrade of the Christopher Street Substation”.

Page 143J - In D.1.), delete the last sentence in its entirety and substitute “Contractor shall coordinate with the NY City agencies to acquire necessary permits, approvals required for street or lane closure or any work during construction.”

Page 143K - In the first line of c.(i.), change “Firday” to read “Friday”.

Page 143M - Delete the text of H.1.)b. in its entirety and substitute “Only one station/platform may be closed at any time.

PORT AUTHORITY TRANS – HUDSON CORPORATION

Peter J. Zipf, P.E.
Chief Engineer
The Port Authority of New York and New Jersey

INITIALLED BY THE BIDDER:



02-02-12P02:48 RCVD

**PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102**

October 19, 2011

ADDENDUM NO. 2

TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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 initialed by each bidder before submitting his bid.

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CHANGES IN THE CONTRACT BOOKLET

Page 14 - In the second line of the clause entitled "Questions By Bidders", change "(212) 435-3953" to read "(201) 395-3453"

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E..
Chief Engineer
The Port Authority of New York and New Jersey

INITIALED BY THE BIDDER:

 _____

02-02-12P02:49 RCVD

PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102

October 21, 2011

ADDENDUM NO. 3

TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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 initialed 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 initialed.

CHANGES IN THE CONTRACT BOOKLET

- Page i - In the line beginning "11", delete the text in its entirety and substitute "'CONSTRUCTION SITE SECURITY REQUIREMENTS"
- Page 14 - Delete the clause entitled "Port Authority Security Requirements" in its entirety and substitute therefor the following:

"11. 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

02-02-12P02:49 RCVD

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 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 Authority retained security guards. 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."

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E..
Chief Engineer
The Port Authority of New York and New Jersey

INITIALLED BY THE BIDDER:

A handwritten signature consisting of the letters 'CA' in a cursive style, positioned above a horizontal line.

02-02-12P02:49 RCVD

**PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102**

October 24, 2011

ADDENDUM NO. 4

TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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 initialed 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 initialed.

CHANGES IN THE CONTRACT BOOKLET

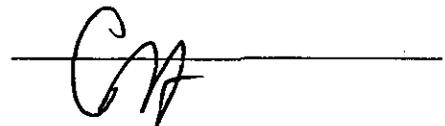
- Page 14 - In clause 11. entitled "CONSTRUCTION SITE SECURITY REQUIREMENTS", make the following changes:
- a. Wherever "The Port Authority of New York and New Jersey" appears, change it to read "PATH".
 - b. Wherever "The Authority" or "the Authority" appears, change it to read "PATH"

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E.,
Chief Engineer
The Port Authority of New York and New Jersey

02-02-12P02:49 RCVD

INITIALLED BY THE BIDDER:



**PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102**

October 26, 2011

ADDENDUM NO. 5

TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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 initialed 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 initialed.

CHANGES IN THE CONTRACT BOOKLET

Page 80 - Delete the first and third paragraph in their entirety and substitute the following respectively:

“The Port Authority of NY & NJ and its wholly owned entities shall be named as 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.” and,

“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 Port Authority of NY & NJ and its wholly owned entities 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.”.

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E..
Chief Engineer
The Port Authority of New York and New Jersey

INITIALED BY THE BIDDER:

02-02-12 P02:49 RCVD



**PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102**

October 28, 2011

ADDENDUM NO. 6

TO PROSPECTIVE BIDDERS ON CONTRACT **PAT-624.154** – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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 initialed 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 initialed.

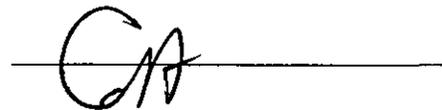
CHANGES IN THE CONTRACT BOOKLET

Page 154 - Immediately after page 154 insert page 154A through 154Y, which are attached hereto and made a part hereof.

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E..
Chief Engineer
The Port Authority of New York and New Jersey

INITIALLED BY THE BIDDER:



02-02-12P02:49 RCVD

PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102

November 2, 2011

ADDENDUM NO. 7

TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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 initialed 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 initialed.

CHANGES IN THE CONTRACT BOOKLET

- Page ii - Delete page ii in its entirety and substitute new page ii, which is attached hereto and made a part hereof.
- Page 31 - Delete the second paragraph from the bottom of the page without substitution.
- Page 33 - In the first paragraph of clause entitled "General Agreement", delete the last sentence without substitution.
- Page 34 - In footnote 19, delete "Exemptions from New Jersey State Sales Taxes" and substitute therefor "Exemption from New Jersey Sales and Use Taxes".
- Page 35
Through
- Page 38 - Delete page 35 through 38 in their entirety and substitute new page 35 through 38, which are attached hereto and made a part hereof.

02-02-12P02:49 RCVD

Page 46 - In the third through fifth lines of the second paragraph from the top of the page, delete “, and minus all prior advances and payments to the Contractor or for his account and minus payments by PATH to lessors of construction equipment” and substitute therefore “.”.

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E.,
Chief Engineer
The Port Authority of New York and New Jersey

INITIALED BY THE BIDDER:



02-02-12P02:50 RCVD

PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102

November 15, 2011

ADDENDUM NO. 8

TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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 initialed 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 initialed.

CHANGES IN THE CONTRACT BOOKLET

- Page 1 - In the second line of the first paragraph, change the day and date for receipt of Proposals to read "Tuesday, December 20, 2011".

- Page 14 - In the second and third line of the clause entitled "Inspection of Site". Delete "Bruno Signorelli" and substitute therefor "Mourad Rahman".

- Page 46 - In the third line of the second paragraph from the top of the page, after "clause" insert ", and minus all prior advances and payments to the Contractor or for his account".

- Page 193
Through
Page 200 - Delete page 193 through 200 in their entirety and substitute new page 193 through 200, which are attached hereto and made a part hereof.

- Page 205 - Delete page 205 in its entirety and substitute new page 205, which is attached hereto and made a part hereof.

- Page 251
Through
Page 253 - Delete page 251 through 253 in their entirety and substitute new page 251 through 253, which are attached hereto and made a part hereof.

- Page 259 - Delete page 259 in its entirety and substitute new page 259, which is attached hereto and made a part hereof.
- Page 267 - Delete page 267 in its entirety and substitute new page 267, which is attached hereto and made a part hereof.
- Page 294
Through
Page 295 - Delete page 294 through 295 in their entirety and substitute new page 294 through 295, which are attached hereto and made a part hereof.
- Page 323
Through
Page 324 - Delete page 323 through 324 in their entirety and substitute new page 323 through 324, which are attached hereto and made a part hereof.
- Page 434 - Delete page 434 in its entirety and substitute new page 434, which is attached hereto and made a part hereof.
- Page 923
Through
Page 924 - Delete page 923 through 924 in their entirety and substitute new page 923 through 924, which are attached hereto and made a part hereof.
- Page 1118 - Delete page 1118 in its entirety and substitute new page 1118, which is attached hereto and made a part hereof.

REVISED CONTRACT DRAWINGS

Drawings E114, E122, E301 and E624 have been revised as of 11/7/11. Copies of these drawings are forwarded herewith. Destroy the drawings of these numbers now in your possession and substitute therefor the revised drawings.

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E..
Chief Engineer
The Port Authority of New York and New Jersey

INITIALLED BY THE BIDDER:

GA

02-02-12P02:50 RCVD

PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102

November 17, 2011

ADDENDUM NO. 9

TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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 initialed 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 initialed.

CHANGES IN THE CONTRACT BOOKLET

- Page 1144 - Immediately below line 2.01B.3. insert "4. Siemens."
- Page 1145 - Make the following changes:
- A. In the first line of 2.03 after "install", delete "four identical" without substitution.
 - B. Delete the text of 2.03.C. in its entirety and substitute therefor "Total System Charging Capacity: 18MJ minimum".
 - C. Delete the text of 2.03.D. in its entirety and substitute therefor "Control Voltage: 120 Volts, 60 HZ".
 - D. Delete the text of 2.03.E. in its entirety and substitute therefor "Not Used"
- Page 1146 - In the first line of 2.06.A.2. delete "four" without substitution and after "units" insert ",quantities as required to provide charging capacity as specified in this Section,".

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E.,
Chief Engineer
The Port Authority of New York and New Jersey

INITIALLED BY THE BIDDER:



PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102

December 7, 2011

ADDENDUM NO. 10

TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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 initialed by each bidder before submitting his bid.

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CHANGES IN THE CONTRACT BOOKLET

- Page 588 - In the first line of 2.10A.1. delete “shop” in its entirety without substitution.
- Page 1005 - In the lower right hand portion of this page, delete “16630-29” in its entirety and substitute therefor “16330-29”.
- Page 1006 - In the lower right hand portion of this page, delete “16630-30” in its entirety and substitute therefor “16330-30”.
- Page 1008
Through
Page 1024 - Delete page 1008 through page 1024 in their entirety and substitute therefor new page 1008 through page 1024 and new page 1024A through page 1024F, which are attached hereto and made a part hereof.

02-02-12P02:50 RCVD

CONTRACT PAT-624.154
ADDENDUM NO. 10

-2-

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E..
Chief Engineer
The Port Authority of New York and New Jersey

INITIALLED BY THE BIDDER:



02-02-12P02:50 RCVD

**PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102**

December 12, 2011 .

ADDENDUM NO. 11

TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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 initialed 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 initialed.

CHANGES IN THE CONTRACT BOOKLET

Page 1 - In the second line of the first paragraph, change the date for receipt of Proposals to read "Tuesday, January 17, 2012".

REVISED CONTRACT DRAWINGS

Drawings A106 and E624 have been revised as of 12/7/11. Copies of these drawings are forwarded herewith. Destroy the drawings of these numbers now in your possession and substitute therefor the revised drawings.

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E.,
Chief Engineer
The Port Authority of New York and New Jersey

INITIALED BY THE BIDDER:



02-02-12P02:50 RCVD

PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102

December 21, 2011

ADDENDUM NO. 12

TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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 initialed 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 initialed.

CHANGES IN THE CONTRACT BOOKLET

Page 1048 - In 1.02 REFERENCE, make the following changes:

- A. In the first line after "Specifications", insert "(current revisions)".
- B. Delete the following without substitution:
"ANSI C37.16a Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors
– Preferred Ratings, Related Requirements and Application
Recommendations".

Page 1053 - In 2.02 F.1, make the following changes:

- A. In the first line, delete "ANSI C37.16/16a" and substitute therefor "IEEE C37.16".
- B. In the fifth line, delete "Table 11 of ANSI C 37.16a or ICE equivalent" and substitute therefor "Table 10 of IEEE C37.16".

Page 1054 - Make the following changes:

- A. In the third line from the top of the page, delete "Table 11, ANSI C37.16a" and substitute therefor "Table 10, IEEE C37.16".
- B. In the second line of g., delete "ANSI C37.16/16a" and substitute therefor "IEEE C37.16".

Page 1068 - In the second line of 2.05A.1., delete "ANSI C37.16/16a" and substitute therefor "IEEE C37.16".

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E..
Chief Engineer
The Port Authority of New York and New Jersey

INITIALED BY THE BIDDER:

 _____

02-02-12P02:50 RCVD

PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102

January 12, 2011

ADDENDUM NO. 13

**TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW
JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER
STREET SUBSTATION**

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 initialed 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 initialed.

CHANGES IN THE CONTRACT BOOKLET

Page 1 - In the second line of the first paragraph, change the day and date for receipt of Proposals to read "Thursday, January 26, 2012".

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E.
Chief Engineer
The Port Authority of New York and New Jersey

02-02-12P02:50 RCVD

INITIALLED BY THE BIDDER:

CA

**PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102**

January 20, 2012

ADDENDUM NO. 14

TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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 initialed 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 initialed.

CHANGES IN THE CONTRACT BOOKLET

Page 1052 - Immediately below 2.01B.3., insert "4. GE Rapid."

REVISED CONTRACT DRAWINGS

Drawings G007, E101, E107, E114, E121-E122, E204, E220, E228, E301, E309, E629, E631, E638-E639, E649, E805, E810, E814, E901-E902, E954, ES101, ES105, M018, S001, S010 AND S015 have been revised as of 12/23/11. Copies of these drawings are forwarded herewith. Destroy the drawings of these numbers now in your possession and substitute therefor the revised drawings.

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E.
Chief Engineer
The Port Authority of New York and New Jersey

INITIALED BY THE BIDDER:

02-02-12P02:51 RCVD



**PORT AUTHORITY TRANS-HUDSON CORPORATION
THREE GATEWAY CENTER - 3rd FLOOR
NEWARK, NJ 07102**

January 24, 2012

ADDENDUM NO. 15

TO PROSPECTIVE BIDDERS ON CONTRACT PAT-624.154 – NEW YORK AND NEW JERSEY PATH FACILITIES – REPLACEMENT AND UPGRADE OF THE CHRISTOPHER STREET SUBSTATION

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 initialed 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 initialed.

CHANGES IN THE CONTRACT BOOKLET

Page 1 - In the second line of the first paragraph, change the date for receipt of Proposals to read "February 2, 2012".

REVISED CONTRACT DRAWINGS

Drawings A102 and E115 have been revised as of 1/20/12. Copies of these drawings are forwarded herewith. Destroy the drawings of these numbers now in your possession and substitute therefor the revised drawings.

PORT AUTHORITY TRANS-HUDSON CORPORATION

Peter J. Zipf, P.E.
Chief Engineer
The Port Authority of New York and New Jersey

INITIALED BY THE BIDDER:

02-02-12P02:51 RCVD

CA