

- E. Spacers and centralizers shall be fabricated from approved plastic and shall allow for a free flow of grout.

### **PART 3. EXECUTION**

#### **3.01 INSTALLATION**

##### **A. Drilling**

1. Holes for soil anchors shall be drilled using auger or rotary methods and shall remain fully cased until sufficient grout has been placed to stabilize the drill hole.
2. Holes for rock anchors shall be drilled using rotary, percussion, or rotary percussion methods.
3. All holes shall be flushed clean with either high-pressure water or air and sounded to verify that the hole is the minimum required length.

##### **B. Insertion of Anchor**

1. Prefabricated anchors shall be handled using appropriate strongbacks and sufficient pick locations to preclude detrimental bending. Anchors exhibiting any permanent deviations shall be rejected and replaced at no cost to the Authority.
2. Stressing (unbonded) and minimum bond lengths of anchors shall be as shown on the Contract Drawings. Each anchor shall be inspected by the Engineer in the field prior to installation to ensure conformance with shop drawing details.

##### **C. Grouting**

1. As shown on the Contract Drawings, anchors shall be either installed immediately after filling casing with grout or installed first and subsequently grouted using a grout tube attached to the bottom of the bond length of the anchor.
2. Grout shall be mixed by continuous mixing equipment and pumped using a positive displacement piston type pump.
3. Grout shall be placed in anchor holes in a continuous operation. If an interruption should occur, the grout shall be recirculated through the pump. The minimum volume placed shall be the theoretical volume of the hole reduced by the volume of installed anchor elements.
4. Pressure-injected soil anchors shall be fitted with Tube a Manchets along their bond lengths. The Contractor shall establish the number and spacing of the grouting points based on his experience and the results of the Performance Tests. After each injection of pressure grout, the Contractor shall flush clean the grout tube(s) to allow for subsequent stages of grouting.
5. The Contractor shall determine the criteria for grouting pressure and grout quantities for each stage of pressure grouting.
6. Anchor grout shall cure a minimum of seven days prior to stressing.

### 3.02 FIELD TESTS

#### A. Stressing and Testing

1. A certified, calibrated hydraulic jack and pump shall be used to apply the test load. The jack and pressure gauge (100 psi increments or less) shall be used to measure the applied load. In addition, a certified, calibrated electric resistance load cell and read out shall be provided to measure all test loads.
2. Stressing and load cell equipment shall be placed over the anchor in such a manner that the jack, bearing plates, load cell and stressing anchorage are axially aligned with the anchor and the anchor is centered within the equipment.
3. Performance, proof and creep tests shall be performed by incrementally loading and unloading anchors in accordance with the loading schedule(s) shown on the Contract Drawings.
4. For both Performance and Proof tests each increment of loading or unloading shall be recorded with a micrometer dial gauge accurate to 0.001 inches, and loading increments shall be maintained until the rate of movement is either zero or the change in the last five minutes is less than 0.004 inches.
5. Unless otherwise shown on the Contract Drawings, the Contractor shall establish an independent reference system to determine the amount of movement the stressing system imposes on the structure.
6. All anchors shall be either Proof or Performance Tested. The number and location of Performance Tests are shown on the Contract Drawings.
7. The Engineer will select anchors for lift-off testing as indicated on the Contract Drawings. These lift-off tests shall be performed after anchor lock-off as indicated on the Contract Drawings. The Contractor shall adjust the lock-off load to compensate for losses as indicated by the lift-off tests.
8. All field testing shall be performed in the presence of the Engineer and shall be subject to his review and approval.

#### B. Acceptance Criteria

1. The creep rate for anchors shall be less than 0.004 inches in last five minutes for proof and/or performance tests.
2. The measured elastic extension of soil anchors shall not exceed the extension computed assuming the stressing length plus fifty percent of the bond length, or be less than the elastic extension computed assuming ninety percent of the stressing length.
3. The measured elastic extension of rock anchors shall not exceed the extension computed assuming the stressing length plus twenty-five percent of the bond length, or be less than the elastic extension computed assuming ninety percent of the stressing length.

#### C. Inspection

1. The Engineer may inspect anchors at the fabrication plant, after shipment, and before and during installation. The Engineer will inspect all anchor installations and testing.

2. Cooperate with the Engineer and furnish services as he may require to make these inspections and obtain data.
  3. The Engineer shall keep a record of each anchor installed.
    - a. Dates of drilling, installation and grouting
    - b. Anchor designation
    - c. *Type and size of anchor*
    - d. Length of stressing and bond lengths
    - e. Location and inclination of anchor
    - f. Drill type and size
    - g. Type and volume of grout used
    - h. The time anchor grouting is started, interrupted, resumed and stopped
    - i. Description of any unusual circumstances affecting the installation of the particular anchor
  4. The Engineer will keep a record of all field tests specified in 3.02A above.
- D. Corrections and Deficiencies
1. The Contractor shall notify the Engineer immediately, in writing, of the failure of an anchor to meet any requirement of this Section. Such written notification shall include all information required for the evaluation of remedial measures, including all information required for redesign.
  2. The Contractor shall replace all anchors not meeting the acceptance criteria, and provide any additional redesigned items resulting from the anchor replacement, at no cost to the Authority.
  3. All abandoned drill holes and anchors shall be fully grouted.

**END OF SECTION**

## SECTION 02164

### PRESTRESSED SOIL AND ROCK ANCHORS

#### APPENDIX "A"

##### SUBMITTALS

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

- A. Qualifications of anchor specialist.
- B. Certified mill test reports for anchor steel.
- C. Grout mix, including non-shrink additives and compressive strength test results from a certified testing laboratory.
- D. Complete description of the drilling and grouting equipment.
- E. Shop drawing(s) of the anchor showing details and dimensions of stressing and bond lengths, corrosion protection, and the anchorage.
- F. A complete description of the stressing and testing equipment and their arrangement, including but not limited to electronic load cell, hydraulic jack, jacking frame and reference frame with dial gauge(s).
- G. Certified calibration curves for load cells and hydraulic jacks for both loading and unloading cycles for range of specified testing.
- H. The proposed sequence of anchor installation and testing.
- I. As-built drawings of installed anchors.

END OF APPENDIX "A"

**DIVISION 2**  
**SECTION 02184**  
**MISCELLANEOUS STRUCTURAL RECONSTRUCTION**

**PART 1. GENERAL**

1.01 SUMMARY

The work shall consist of the following:

- A. Drilling and grouting anchors, reinforcing bars, anchor bolts and bars.
- B. Field drill holes in existing structural steel; and
- C. Drilling tension bars and testing.

1.02 REFERENCE

NYS DOT – Standard Specifications

1.03 DESIGN/PERFORMANCE REQUIREMENTS

- A. The temporary support work shall be constructed to substantially conform to the drawings. The materials used in the temporary support construction shall be of the quality necessary to sustain the stresses required by the temporary work design.

1.04 RESTRICTIONS AND QUALITY CONTROL

- A. The required hole diameter will be indicated on the plans.
- B. No flame cutting or flame drilling will be permitted.
- C. *All damage to the existing steel, as determined by the Engineer, shall be repaired by the Contractor, at no additional cost to the Authority. All repairs shall be done in a manner satisfactory to the Engineer.*
- D. Train traffic shall not be permitted on the supported portion of the 1-Line subway tracks until the load is transferred by other means than hydraulic such as shims or rod adjustment.

## 1.05 SUBMITTALS

- A. Product Data: Submit data for proprietary materials, manufacturer's specifications (including finishes and/or materials), Material Safety Data Sheets (MSDS), and installation procedures.
- B. Test Reports: Code approvals and performance data that includes recommended loading for each application.
- C. Contractor shall submit, for the Engineer's review, calculations that are prepared and sealed by a registered Professional Engineer, showing that the product can achieve the holding capacity using the appropriate design procedure as required by the applicable Code. The calculations shall indicate diameter and embedment, with consideration of all applicable reduction and modification factors.

## PART 2. PRODUCTS

### 2.01 MATERIALS

Drilling and Grouting:

- A. Grout material shall conform to NYS Standard Specification 701-07 Anchoring Material-Chemically Curing.
- B. Reinforcement steel – Section 03200.
- C. Structural steel – Section 05120.
- D. Tension Bars and Anchor Bars -ASTM A722

## PART 3. EXECUTION

### 3.01 PREPARATION

All equipment proposed for use shall be approved by the Engineer prior to actually performing the work.

### 3.02 INSTALLATION

- A. Drilling and Grouting, Reinforcing Bars, Anchors, Bars, Anchor Bolts or Tension Bars
  - 1. All holes shall be drilled by means of rotary impact drill. If reinforcing steel is encountered, the reinforcing steel shall be cut and removed by means of a core drill. The remainder of drilling shall be done with the rotary impact drill.
  - 2. Holes shall be surface dry and shall have had all foreign and loose material removed immediately prior to grouting.
    - a. Drilling with a lubricant will not be permitted. Water is not considered a lubricant. Drilling methods shall not cause spalling, or other damage to concrete. Concrete spalled, or otherwise damaged by the Contractor's operations, shall be repaired in a manner satisfactory to the Engineer, and shall be done at the expense of the Contractor.

- b. Holes shall be surface dry and shall have had all foreign and loose material removed immediately prior to grout placement.
- c. Grout shall be mixed and placed in strict accordance with the manufacturer's instructions, unless modified here, or elsewhere, in the contract documents. No grout shall be placed at a temperature below that recommended by the grout manufacturer.
- d. Prior to bolt placement in the grouted hole, all material which might interfere with bond between the bolt and the grout shall have been removed. This includes, but is not limited to: moisture, grease, dirt, mill scale, and rust. The hole diameter shall be in accordance with the grout manufacturer's recommendation.
- e. If the bolt is inserted in a hole with an axis predominantly horizontal, care shall be taken to prevent grout from running down the face of the concrete. These precautions shall be done in a manner satisfactory to the Engineer.

B. Field Drill Holes in Existing Steel

1. Paint Removal. If the steel is painted, then prior to the beginning of any other work operations, the paint shall be removed for a minimum distance of 4 inches on each side of the centerline of work location. In cases where the contractor can clearly demonstrate, through exposure monitoring, that other work practices and engineering controls, under the oversight of a certified industrial hygienist, can effectively maintain actual worker exposure below the permissible exposure level, exceptions to this requirement may be granted by the Engineer.
2. The required hole diameter will be indicated on the plans.
3. No flame cutting or flame drilling will be permitted.
4. All damage to existing steel, as determined by the Engineer, shall be repaired by the Contractor, at no cost to the Authority. All repairs shall be done in a manner satisfactory to the Engineer.

C. Testing Drilled Tension Bars

1. All tension bars shall be tested.
2. The equipment shall consist of a load cell, jacking system, a frame to distribute the jack load, couplers to connect the jack to the tension bars, and appropriate safety devices.
3. The temporary bridging system can be utilized to test the tension bars.
4. Supports for the frame used to distribute the jack load shall be located outside a circle centered at the tension bar anchor. The circle shall have a diameter equal to two inches plus twice the anchor embedment length, but need not exceed 24 inches.
5. Prior to starting the testing, the Contractor shall supply the Engineer with a certificate of calibration for the load cell performed within the previous six months by an independent testing agency.
6. The frame and jack shall be positioned so that the load is applied along the axis of the tension bar anchor.

7. Chains or cables shall be used to connect the various pieces of the tensioning system so that free-flying projectiles will not be created by the failure of a tension bar coupling or other portion of the testing system.
8. The test load for tension bars are in the contract documents.
9. Tension bars shall be deemed to pass if the specified test load is attained without permanently displacing the bars.
10. This load testing is designed to be non-destructive. Loading shall be stopped as soon as the test load is reached.
11. Concrete spalled or otherwise damaged by the load testing shall be repaired in a manner satisfactory to the Engineer. Such repair shall be done at the Contractor's expense. All tension bars which fail a load test, or are otherwise damaged, shall be replaced at the Contractor's expense. All such replaced tension bars shall be load tested.

**END OF SECTION**

## SECTION 02184

### MISCELLANEOUS STRUCTURAL RECONSTRUCTION

#### APPENDIX "A"

#### SUBMITTALS

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

- A. Shop Drawings
  - 1. As per Division 1, "Shop Drawings, Catalog Cuts and Samples."
  - 2. Connection Design and Detailing, prior to submitting job standards.
  - 3. Job standards, prior to submitting detailed shop drawings.
  - 4. Prior to the commencement of fabrication, approval of shop drawings.
  - 5. Erection drawings.
- B. Catalog Cuts, Material Certification, Welder Qualifications, Welding Procedure Specifications, and Test Results
  - 1. As per Division 1, "Shop Drawings, Catalog Cuts and Samples."
  - 2. Catalog cuts and manufacturer's literature on grout specified under this section.
  - 3. Prior to commencing fabrication, mill certificates for high strength bolts
  - 4. Inspection and test results from field tests within five calendar days of inspections and tests.
- C. Quality Control Documents
  - 1. Copy of the suppliers shop's Quality Control Program. The program, at a minimum, shall include the following:
    - a. 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; and
    - b. 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.
  - 2. Notification, in writing, 15 days prior to commencing operations.
- D. Design Computations
  - 1. Calculations for connection design and detailing shall accompany submittal A.2. in this appendix.
  - 2. Computations for job standards shall accompany submittal A.3. in this appendix.

END OF APPENDIX "A"

**SECTION 02221**  
**EXCAVATION, BACKFILLING AND FILLING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section specifies requirements for excavation, backfilling and filling.
- B. Definitions
  - 1. As used herein, excavation shall mean the removal of existing pavement, concrete foundations and all materials other than bedrock (ledge rock) encountered within the limits of excavation that are not specified to be removed under the Section 02073.
  - 2. As used herein, backfilling shall mean the filling of excavations made for construction purposes and shall extend only to existing grades or design grades, whichever are lower.
  - 3. As used herein, filling shall mean the placement of fill material in conformance with requirements of this Section at or above existing grades.

**1.02 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. Where shown on the Contract Drawings or where required for protection of adjacent utilities or structures or where required for performance of the Work, secure the sides of excavations against movement as follows:
  - 1. Install sheet piling or sheeting held in place by waling and bracing members. Top of sheeting shall extend at least six inches above ground.
  - 2. Do not excavate below the bottom of sheet piling or sheeting except as necessary to install sheeting.
  - 3. Fill voids behind sheeting immediately with material conforming to I-12 designation defined in 2.01A.1 or otherwise approved by the Engineer.
- B. For excavations extending to a depth of 5 feet or more, and where sheeting is not required, excavate slopes to a safe angle of repose, or protect trench excavations by use of a portable trench shield.
- C. Perform excavation around and adjacent to existing structures, pipes and conduits which are to remain in place, without damage to or movement of existing construction. Use hand excavation to locate and expose near-surface structures, pipes and conduits. When excavation is to be performed under such structures, pipes and conduits, support them in a manner as approved by the Engineer to ensure uninterrupted operation of the supported items.

### 1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements
- B. Section 02073 – Cutting, Patching and Removal.
- C. Section 02220 – Trenching and Backfilling for Utilities
- D. Section 02224 – Rock Excavation
- E. Section 02896 – Environmental Requirements for Handling and Disposal of Soil Materials

### 1.04 REFERENCES

- A. ASTM International (ASTM)
  - 1. D422 - Standard Test Method for Particle - Size Analysis of Soils
  - 2. D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method
  - 3. D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>))
  - 4. D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
  - 5. D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
  - 6. D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
  - 7. D4318 - Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
- B. New Jersey Interagency Engineering Committee (NJIEC)
  - 1. Standard Soil Aggregate Gradations
- C. Occupational Safety and Health Administration (OSHA)
  - 1. Title 29 CFR Part 1926, Safety and Health Regulations for Construction

### 1.05 SUSTAINABLE DESIGN REQUIREMENTS

- A. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section 01352 and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the Work proposed by

the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.

## 1.06 QUALITY ASSURANCE

### A. Inspection and Testing

1. The Engineer will perform Quality Assurance testing on delivered field samples of material submitted from each source, for conformance with 2.01. Gradation and maximum density will be determined in accordance with ASTM D422 and Procedure C of ASTM D1557, respectively. If deemed appropriate by the Engineer, Atterberg Limits will be determined on fine grained soils in accordance with ASTM D4318.
2. If the sample from a source is approved and if the Engineer requests, conduct the Engineer's representative to that source. Additional samples will be selected and tested.
3. The Engineer will notify the Contractor of approval of material source within seven days after receiving samples. Approval of a source of fill material shall be subject to material continuing to meet the requirements of 2.01.
4. When performing Quality Assurance testing, the Engineer will determine the density of compacted fill or backfill by in-place density tests or from undisturbed samples cut from the compacted fill or backfill as required. Notify the Engineer 24 hours prior to start of filling to allow the Engineer time to make provisions for such testing.
5. To evaluate whether material has been compacted to specified density the Engineer will compare results of in-place density tests with results of control tests on material of the same designation using Procedure C of ASTM D1557.
6. If fill or backfill has not been sufficiently compacted as determined by in-place density tests, the compaction effort shall be continued and moisture content shall be adjusted as necessary until the specified compaction is obtained.
7. The Engineer will check conformance to elevations shown on the Contract Drawings and required tolerance for surface straightness.
8. Provide labor and equipment to take samples as directed and to assist the Engineer in other tests.

### B. Testing Requirements for Fill and Backfill

1. Control Tests
  - a. Fill and backfill material field samples will be tested in the laboratory by the Engineer as part of the Quality Assurance program. These control tests consist of determining maximum density and optimum water content by Procedure C of ASTM D1557 and gradation by ASTM D422. When deemed appropriate by the Engineer, Atterberg Limits will be determined on fine grained soils.
2. In-Place Density Tests

- a. Quality Control consisting of in-place density testing, as a minimum, shall be performed by the Contractor to determine densities achieved after compaction efforts. An in-place Quality Control plan shall be submitted to the Engineer for review and approval. This plan shall address, as a minimum, items such as in-place test type and frequencies for different materials; equipment type, calibration and maintenance; operator identity and qualifications.
- b. Quality Assurance testing will be performed by the Engineer after compaction operations, at the standard frequencies already established by Port Authority testing bulletins. Test methods may either be sand-cone (ASTM D1556), rubber balloon (ASTM D2167), or nuclear device (ASTM D2922), with moisture content for nuclear method determined by ASTM D3017. Tests will measure the density of the layer immediately below each compacted layer and the density of the uppermost or final layer.

#### 1.07 SUBMITTALS

- A. Submit proposed material suppliers and sources for each designation of fill or backfill to be used under this contract to the Chief of Materials, Materials Engineering Division, Engineering Materials Laboratory, Port Authority Technical Center, 241 Erie Street, Jersey City, N.J. 07310-1397. The submittal document must contain, as minimum information, the Contract location, title and number; designation of intended material use; source and supplier of material being submitted. Sample submittal paperwork must be received by the Chief of Materials of Materials at least three weeks prior to delivery of material to site. Do not deliver any material until the Engineer has checked and approved material supplier and source. Delivered material must receive on-site approval as per 3.04A prior to use.
- B. The Contractor shall be responsible for Quality Control procedures. Before the actual start of earth work, the Contractor must submit a Quality Control Plan for review and approval by the Engineer.
- C. Where sheet piling or sheeting is required as shown on the Contract Drawings, submit detailed Shop Drawings and design calculations of the sheeting and bracing system to the Engineer for review in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS. Submit such drawings and calculations three weeks prior to commencement of such excavation. Shop Drawings and calculations shall be prepared by a Professional Engineer, licensed in the State in which the work will be performed, who has a minimum of five years experience in the design of soil retaining structures. The Shop Drawings shall be sealed and signed by the Professional Engineer.
- D. Sustainable Design Submittal Requirements
  1. Excavation of non-soil materials shall be documented in accordance with the project's Construction Waste Management Plan.

**PART 2 - PRODUCTS****2.01 MATERIALS****A. Fill**

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

	Total Percent Passing by Weight NJIEC Designation:		
	I-7	I-10	I-12
Sieve Sizes			
4 inch		100	100
2 inch		80-100	
1 inch	100		
3/4 inch		60-100	70-100
1/2 inch	80-100		
No. 4		40-100	
No. 8	35-100		
No. 16	29-90	20-70	
No. 50	5-50	5-40	0-75
No. 100	0-8	0-30	
No. 200	0-2	0-20	0-5

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

**B. Backfill**

1. Unless otherwise shown on the Contract Drawings, material shall conform to the requirements for I-12 designation, subject to 2.01B.2.
2. Where the entire backfill is above the water table, material conforming to the requirements for I-10 designation may be used in lieu of I-12 designation, except under foundations, pavement and utilities.

**C. Sources**

1. When fill and backfill material are provided by the Authority, the location of the stockpile and NJIEC Designation (if applicable) are shown on the Contract Drawings. Samples of material will not be required for testing.
2. Material excavated at the construction site shall be used for fill or backfill to the extent that it conforms to the requirements specified in 2.01A.1 and 2.01B.1, or as noted on contract drawings. Samples shall be submitted for testing by the Engineer for conformance with the requirements of this Section.
3. If sufficient quantities of material are unavailable from sources described in 2.01C.1 and 2.01C.2, furnish material from sources off site.

**PART 3 - EXECUTION****3.01 PREPARATION****A. Clearing and Grubbing**

1. Remove trees, clear and grub areas to be excavated or in which construction is to be performed, as follows:
  - a. Remove trees, stumps, all roots larger than 2 inches in diameter and all matted root systems.
  - b. Remove all topsoil, debris, organic matter and any other objectionable material not suitable for use as fill or for support of structures or pavements.
  - c. Backfill all holes and other low spots resulting from clearing and grubbing with material conforming to 2.01B before proceeding with compaction of fill or with other construction in the area.

**B. Protect excavations as follows:**

1. Prevent water from entering excavated areas and, if it does, remove it immediately to maintain a dry condition at all times.
2. Dispose of water in a manner not to cause injury to the public health or damage to public or private property.
3. If water enters excavated areas and weakens or disturbs underlying soil, remove the weakened or disturbed soil and replace it.
4. Restore all areas impacted by excavation to their original condition, matching pavement types and sections to meet original pavement grades.
5. Comply with all other provisions of the Specifications that may impose additional or stricter requirements.

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

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

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

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

**3.02 EXCAVATION****A. General**

1. Excavation shall consist of the removal of materials and the removed materials shall be segregated as suitable and unsuitable and stockpiled at a location at the construction site designated by the Engineer.
2. When excavation of bedrock (ledge rock) is required on the Contract Drawings, the provisions for removal are specified in Section 02224.
3. Excavate to elevations required for installation of permanent construction in such manner as not to disturb the subgrade below such elevations.
4. Where existing foundations or other existing construction are encountered which may cause hard spots, remove them to a minimum of two feet below subgrade for pavement or structures.
5. Should bottom of excavation be weakened or disturbed or carried below required depth:
  - a. Under footings - compact bottom as specified and replace over-excavation with concrete of the same Class and Type as that specified for the footing or foundation.
  - b. Elsewhere - Compact bottom as approved by the Engineer and backfill with material conforming to I-12 designation defined in 2.01A.1.
6. The Contractor shall reuse excavated soil material as backfill unless otherwise directed by the Engineer.

B. Dewatering

1. Where excavations are to extend below the water table, prior to placement of any permanent construction or filling any excavated area, lower the water table in such an area to two feet below the elevation of the required subgrade and maintain this condition until the construction or pavement is placed thereon.
2. Dewater in a manner to prevent the loss of ground due to the migration of soil fines into the dewatering system.

C. Trenching for Utilities

1. Conform to the requirements specified in Section 02220.
2. Shape bottom of trench to uniform invert section.
3. When excavating in soft soils which may be subject to lateral movement or bottom heave, conform to requirements shown on the Contract Drawings.

D. Disposal of Excavated Material

1. All debris and all material in excess of that required for backfill or fill shall be disposed of away from Authority property.
2. The Contractor shall remove all excavated pavement and dispose of off Authority property.
3. If directed by the Engineer not to use any or all excavated soil material as backfill, the Contractor shall remove such unsuitable soil material. The Contractor will be compensated for the transportation and disposal of such unsuitable soil material and

the furnishing of suitable backfill material in accordance with the Net Cost Work provisions of Division 1 of the Specifications.

4. Disposal of excavated materials shall conform to the requirements specified in Section 02896.

E. Restrictions

1. Do not place fill until the Engineer has inspected and approved the Work and indicated where backfill may be placed.
2. Leave all pipe joints exposed until all tests on such pipe, required by other Sections of the Specifications, have been performed.
3. Remove all temporary structures, sheet piles, sheeting, bracing and forms and all organic materials and debris of every nature, taking care, upon the removal of sheet piling, sheeting and temporary supports, not to cause movement of adjacent ground or structures or create the danger of a slide.

- F. Excavation and filling activities shall comply with the requirements of the project's Erosion and Sedimentation Control Plan.

### 3.03 PLACEMENT AND COMPACTION

A. Equipment

1. Steel vibratory rollers shall have provision for regulation of vibration frequency. The Engineer shall be informed of the type and size of equipment to be used before the start of any compaction efforts.
2. Placement and spreading equipment shall be reviewed and approved by the Engineer.
3. Unless otherwise shown on the Contract Drawings, pneumatic-tired rollers shall have minimum weight of 20 tons and a tire pressure of between 60 and 150 psi.
4. When mechanical tampers are to be used, the Engineer shall be informed of the type and size for approval before compaction efforts with this equipment can begin.

B. Compaction Requirements

1. Backfill and Fill shall be compacted to achieve a density of 95 percent of the maximum density as determined by Procedure C of ASTM D1557, except where alternate density requirements are approved by the Engineer or shown on the Contract Drawings.

C. Subgrade, Excavated and Existing Surfaces

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

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

D. Backfill and Fill

1. Moisture content of fill material shall be within a range of plus or minus two percent of optimum, as determined by Procedure C of ASTM D1557.
2. Backfill, conforming to I-12 gradation, and fill conforming to I-7 and I-12 gradation, shall be placed in 14-inch, loose layers and compacted with a minimum of six passes of an approved vibratory roller operated at a speed not to exceed three miles per hour.
3. Passes shall be overlapped a minimum of 6 inches.
4. Backfill and Fill, conforming to I-10 gradation, shall be placed in 12-inch, loose layers and compacted with a minimum of six passes of an approved pneumatic-tired roller.
5. In areas where a 14-inch layer over existing material is not adequate to support the construction equipment, increase thickness of first lift as approved by the Engineer.
6. In areas adjacent to structures and utilities as shown on Contract Drawings, compaction equipment shall be restricted and as directed by the Engineer.
7. In areas where use of a roller is impractical, place fill in maximum 8-inch, loose layers and compact with approved mechanical tampers to specified density.
8. Compact backfill as specified above for fill. In pipe trenches, each layer of backfill shall be not more than 8 inches in thickness before compaction. Backfill shall be placed on both sides of the pipe, simultaneously.
9. The surface of filled or backfilled areas, which are to receive pavement or on which a structure is to be placed, shall be within plus or minus 1/2 inch of the elevations shown on the Contract Drawings and shall be free of depressions or projections greater than 1/2 inch when tested with a 16-foot straight edge.
10. The surface of filled or backfilled areas at other locations shall be within plus or minus one inch of elevations shown on the Contract Drawings unless a closer tolerance is necessary to meet requirements of other Sections of the Specifications or the Contract Drawings.

3.04 FIELD TESTS

- A. Conduct compaction and other specified tests in accordance with the approved Quality Control Plan.
- B. The Engineer will conduct independent testing as described in Quality Assurance herein.

C. Proof-Rolling in Pavement Areas or Under Footings

1. After excavation has been performed to the elevation of pavement subgrade, proof-roll the area shown on the Contract Drawings with two passes of a pneumatic-tired roller in the presence of the Engineer.
2. If, in the sole determination of the Engineer, the proof-rolling produces noticeable weaving of the surface, excavation of unsuitable material may be required below pavement subgrade, within the limits and to the depth ordered by the Engineer.
3. In no case will the depth of such removal of unsuitable material exceed three feet below the pavement subgrade.
4. Remove all such unsuitable material and replace it with suitable backfill material in accordance with the requirements of 2.01B.

**END OF SECTION**

**SECTION 02224**  
**ROCK EXCAVATION**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section specifies requirements for drilling, blasting and other methods used for rock excavation.
  
- B. Definitions
  - 1. As used herein, "rock excavation" shall mean the removal of boulders larger than ½ cubic yards in size and bedrock (ledge rock) which cannot be removed by the use of suitable earth excavating equipment, such as backhoes, or power shovels with buckets equipped with teeth, but which must first be broken by drilling and blasting or by use of equipment such as a hydraulic rock splitter, hydraulic impact hammer, or percussion drilling and chipping tools. "Rock excavation" shall also include the removal of any seams or pockets of decomposed rock underlying the surface of the aforementioned bedrock.
  - 2. "Controlled blasting" is defined to mean breaking rock in which the various elements of the blast (hole size, depth, spacing, burden, charge size, distribution, delay sequence) are carefully designed and controlled to provide a distribution of charges that will fracture the rock to the required lines and to minimize overbreak, flyrock, stressing, vibrations, settlement, and fracturing of the rock beyond the contour lines.

**1.02 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. Use of Explosives for Rock Excavation
  - 1. Unless otherwise shown on the Contract Drawings, design blasting and delay patterns in such a manner that seismographic measurements of peak particle velocity at all adjacent structures and completed construction shall not exceed two (2.0) inches per second except for concrete which has not attained at least seventy percent of its specified compressive strength, the peak particle velocity shall not exceed one (1.0) inch per second.
  - 2. Only controlled blasting with line drilling and limited perimeter charges will be permitted within 30 feet of the adjacent structures or completed construction. Such blasting shall not exceed the vibration limits herein and other restrictions shown on the Contract Drawings.
  - 3. Blasting will be permitted near NYCT structures only with light charges subject to the approval of the Engineer and in accordance with the regulations of the Fire Department. The Contractor shall provide a detailed monitoring plan, providing for measurements of both particle velocity and displacements at critical locations of the NYCT structure. The monitoring plan shall include threshold and upset

levels of both particle velocity and settlement together with an action plan for their implementation. The Contractor shall secure an approved seismologist to install and operate suitable velocity gauges to continuously monitor particle velocity and an independent licensed surveyor to monitor displacements. The threshold maximum particle velocity above ambient caused by the blasting will be 0.5 inch per second. Values exceeding this level will be reviewed and evaluated by the Engineer.

4. Blasting, where approved, shall be restricted to normal working hours, from 7am to 7pm Monday through Friday except legal holidays.
  5. No blasting will be permitted until all personnel in the danger area have been removed to a place of safety and all pedestrians and ground traffic have been prevented from entering the danger area. Provide a warning system and familiarize all personnel on the construction site with the system. The danger area shall be patrolled before each blast to make certain that it has been completely cleared and guards shall be stationed to prevent entry until the area has been inspected following the blast. Each blast shall be coordinated with the Engineer.
- B. Where it is not feasible to break rock by drilling and blasting, or where blasting can not be performed in conformance with the requirements specified on the Contract Drawings or in this Section, break rock by mechanical methods using equipment such as hydraulic rock splitters, chipping hammers, rock drills, hoe rams, or non-explosive chemical demolition agents as approved by the Engineer.
- C. Job Conditions
1. Take all necessary precautions to protect adjacent structures and utilities and repair any structures or utilities damaged to the satisfaction of the Engineer.
    - a. Do not use hoe rams within 25 feet of subway structures or their underpinnings.
    - b. Tractors, cranes, excavators, etc used in the vicinity of the elevated subway structure shall be isolated from the ground. Since the elevated structure is used as a negative return path, with a consequent potential between it and the ground, any contact between the structure and the *grounded equipment could result in burning of the steel.*
    - c. Coordinate rock excavation work with provisions specified for instrumentation and monitoring, Section 02229.
    - d. Repair structures, roadways and properties damaged by construction activities to the satisfaction of the Engineer. Also repair damage to any portion of the subway structure or its finish to the satisfaction of the Engineer. Repairs shall be made at no additional cost to the Contract.
    - e. Protect mini-caisson piles and their bracing members, existing slurry and caisson walls, new slurry and jet grout walls, rock anchors, tie-backs, new foundations, inclinometer casings, observation wells and other works made for this project.
  2. Drilling in the vicinity of an active utility shall be subject to the limitations prescribed by the utility company or agency operating the utility.

- a. Protect active utilities (including any active drainage trenches on the rock surface) at the site.
  - b. Notify the Engineer and Utility Owner in writing within 24 hours after active and/or inactive utilities are encountered during construction.
  - c. When such utilities are exposed, survey and plot their locations and elevations, and submit record drawings to the Engineer.
  - d. Remove, relocate or leave utilities in place as shown or as directed by the Engineer.
  - e. Methods used to break and remove rock next to utilities shall be subject to the limitations prescribed by the utility company or agency operating the utility.
  - f. Repair any active utilities damaged during construction to the satisfaction of the Utility and Engineer.
3. Subsurface Conditions
- a. Refer to the Available Drawings for the logs of old and recent borings in the site area.
  - b. Available rock core obtained from recent borings may be viewed upon arrangement with the Authority. Oriented rock core data may be obtained by request from the Authority.
  - c. These boring and laboratory data represent ground conditions at borehole locations and do not necessarily apply elsewhere, and are referenced solely as information to bidders. Interpretation of the data for purposes of bidding and construction is the responsibility of the Contractor.

1.03 RELATED SECTIONS

- A. Section 02221 – Excavation, Backfilling, and Filling
- B. Section 02229 - Instrumentation

1.04 REFERENCES

- A. National Fire Protection Association (NFPA) - 495 - Explosive Materials Code
- B. New York City Building Code, Title 27, Subchapter 19, Article 12 Explosives and Blasting

1.05 SUSTAINABLE DESIGN REQUIREMENTS

- A. None

## 1.06 QUALITY ASSURANCE

- A. Provide a competent person with relevant experienced in the method(s) used to break and remove rock, and be responsible for designing each drill pattern and directing the execution of the rock removal and stabilization. Such person shall have satisfactorily completed at least four projects of a nature similar to the work described in this Section.
- B. Controlled Blasting
1. Retain the services of a recognized blasting consultant to review and approve all controlled blasting designs and details. The blasting consultant shall demonstrate a minimum of 10 years experience on similar projects.
  2. Blasting supervisors shall have a minimum of five years of experience in designing, supervising, loading, and firing of blasts for rock excavations, as applicable, and shall have all licenses and permits required by local agencies and others having jurisdiction.

## 1.07 SUBMITTALS

- A. Rock Excavation Plan. This submittal shall be a general narrative containing at least the following information and shall be submitted not less than two weeks prior to beginning any work involving rock excavation or explosives.
1. The commencement date of rock excavation.
  2. A list of equipment, which will be available on the site for performing the work Including a description of the heavy equipment, which will be available on site to clear the debris generated by the Contractor's rock fragmentation operations.
  3. Manufacturers' data sheets for all chemical demolition agents, explosives, primers and initiators to be employed.
  4. Methods of protecting or stabilizing adjacent structures.
  5. Procedures for interfacing with traffic control, where applicable, and for clearing excavated material and debris in accordance with Section 02221.
  6. Intended direction of rock movement (throw), delay plan, and method of controlling flyrock.
  7. A description of the pre-blast warning system to be used.
  8. Qualifications Submittals: Written evidence of the qualifications of the competent person or persons who will be in direct charge of rock excavation, rock support engineer or geologist, blast supervisor, and blasting consultant retained by the Contractor to review and approve all blasting designs and details.
- B. Fragmentation Plan. This shall be a brief description of drilling for the round and shall be submitted to the Engineer no later than 24 hours prior to drilling, only if there are substantial differences from original. All fragmentation designs shall include the following as applicable:

1. Plan and section views of proposed drilling pattern, including number, diameters, spacing, depth and orientation of drill holes, free faces, burden and sub-drilling.
  2. Types, grade, size, weight, and quantities of explosives proposed for use in each hole and for each total blast. Indicate maximum pounds of explosives per delay, distribution of the charge in the holes, priming of each hole and stemming of holes.
  3. Type, manufacturer, sequence and number of delays, diagram for delay pattern, type and capacity of initiation devices.
  4. Location of the blast or chemical demolition agent break including station or column line limits.
  5. Safety precautions.
  6. Signature of blasting supervisor.
- C. Blast Report. Furnish an as-built drawing of each blast no later than 24 hours after the shot is fired. This shall be a complete description of the blast and shall include as a minimum the following information:
1. Date, time and location of the blast.
  2. A drawing of the blast which clearly indicates the locations of the drill holes, the location, placement and quantity of all explosive charges used. Diagram shall note any changes or deviations from the submitted blast plan.
  3. Powder factor, i.e., the weight of explosives per cubic yard of rock in place as determined from the blast pattern. Total number of delays used, number of holes for each delay period, maximum charge per delay and type of detonators.
  4. General description of drilling action, noting especially any soft zones or voids encountered.
  5. Weather conditions, inventory of all explosives on hand at start of day and end of day, a description of any unusual occurrences including unanticipated rock fall, misfires, remaining unstable ground, groundwater problems, work delays, equipment malfunctions, and the location, elevation, and time of each occurrence.
  6. An evaluation of the blast indicating areas of significant overbreak and planned adjustments to the blast design for the next blast.
  7. The name and signature of the person responsible for designing, loading and firing of the shot.
  8. Review of blast design and techniques shall not relieve the Contractor of responsibility for adequacy, accuracy, safety, proper supervision, and compliance with these specifications and/or the OSHA Regulations (29 CFR 1926.900-. 914) that govern the use of explosives.
- D. Underpinning Designs
1. Where underpinning of existing foundations on rock is required in accordance with New York City building code, and not otherwise shown on the Contract Drawings, submit detailed drawings and reports signed and sealed by a

Professional Engineer, licensed in the State of New York, or engineering geologist, who has a minimum of five years experience in the design of underpinning structures in rock.

#### 1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Comply with NFPA 495 and Federal, State and local laws and ordinances governing the handling, use and storage of explosives that would be applicable if this Contract were being performed for a private corporation.
- B. No explosives shall be stored on the construction site overnight, unless approved by the Fire Department in writing.
- C. Store non-explosive chemical excavation materials in a lockable storage container, fire resistant, heat insulated, and suitable for flammable materials.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Non-electric detonation systems shall be used on this project unless another detonation system is approved by the Engineer. The use of cap and fuse or safety fuse is prohibited. Primacord will be considered for approval provided it is covered with sand. The Contractor will be allowed to use one electric blasting cap per round to initiate the shot. The electric blasting cap shall not be tied into the blasting circuit until traffic has been stopped and the area has been secured.
- B. Use blasting mats or some other positive means of controlling flyrock approved by the Engineer.
- C. Where blasting or hoe-ramming is not feasible or otherwise allowed, a non-toxic, non-explosive chemical demolition agents will be considered for approval.

#### 2.02 EQUIPMENT

- A. Hoe-rams, drills, and other rock-splitting equipment shall be of the limited noise and vibration producing type and be approved by the Engineer.
- B. Blast monitoring equipment shall meet the following requirements:
  - 1. Be equipped with a self-triggering device.
  - 2. Be capable of measuring vibrations in all three planes in a range from at least 0.01 inches per second to 4.0 inches per second or greater.

3. Automatically calculate peak particle velocity (maximum of transverse or vertical or longitudinal directions) and frequency during recorded time period.
4. Be capable of providing hard copy of the waveform and a summary of the results.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Do not commence rock removal or blasting until all overburden materials that are required to be excavated have been removed as specified in Section 02221.
- B. Remove all rock and muck loosened by blasting, other removal operations or left in a weakened condition thereby, even though outside of or below the neat excavation lines. Replace with concrete to the neat excavation lines, all such loose rock removed beyond the limits of the neat excavation lines, except that, in areas to receive crushed stone, such loose rock shall be replaced with compacted crushed stone or may remain in place, if, in the opinion of the Engineer, such loose rock will not result in excessive voids.
- C. Remove rock at least to the neat excavation lines for rock excavation shown on the Contract Drawings unless otherwise directed by the Engineer. No subsequent Work shall be started on the excavated rock surface until the Engineer has approved the excavation.
- D. All foundations that are to bear on rock shall be carried down to hard, undisturbed rock meeting the requirements shown on the Contract Drawings. The highest acceptable elevations are shown on the Contract Drawings. Where, in the opinion of the Engineer, the excavated rock surface does not meet the requirements shown on the Contract Drawings; continue down to hard, unshattered rock to the satisfaction of the Engineer. All rock bearing surfaces shall be sound, non-displaced rock leveled to a slope not exceeding 1 vertical to 12 horizontal.

### **3.02 DRILLING REQUIREMENTS**

- A. Vertical rock cut surfaces along the perimeter of the excavated area shall be line drilled utilizing guide bits and guide couplings to control the predrilled hole orientations where shown on the Contract Drawings.
- B. Rock excavation shall be performed in lifts. The height of each lift shall be indicated on the General Excavation Plan, but shall not exceed 10 feet in height.
- C. After each lift of rock is excavated, allow sufficient time for the Engineer to examine the exposed rock face to check for indications of instability. After inspecting the rock face, should the Engineer determine the rock to be unstable, remedial work such as rock

bolting shall be implemented. An adjustment in the Contract Price will be made when remedial measure must be implemented to stabilize the exposed rock face.

### 3.03 BLASTING

- A. Controlled blasting techniques shall be used for all blasting on this project.
- B. Design each blast before beginning drilling and loading in accordance with the required Fragmentation Plan and Blast Report submittals as specified herein.
- C. Do not deviate from the approved blast plan. The blast plan shall be included as part of a permanent blast report filed with the Engineer showing comments on blast results and any recommended changes to be incorporated in the following blast. Comply with any alterations in the blast design ordered by the Engineer. Approval of the blast plan by the Engineer shall not relieve the Contractor of his responsibility for the safety, accuracy, and adequacy of the plan for obtaining adequate breakage to ensure that the excavated material can be handled by equipment at the construction site.
- D. The approved blaster shall supervise the loading of all holes.
- E. Blasting on the perimeter of rock excavation shall be controlled so as to avoid, as far as feasible, shattering of rock outside the neat excavation lines shown on the Contract Drawings. Prior to blasting, drilling for unloaded holes shall be performed as follows:
  - 1. Where line drilling is shown on the Contract Drawings, drill a row of 3-inch diameter holes evenly spaced at a rate of 2-1/2 holes per linear foot. Line holes shall not deviate more than 3 inches from their required plane over the length of the hole.
  - 2. Where channel drilling or line drilling and broaching are shown on the Contract Drawings, the Contractor shall effect a complete separation of rock by drilling overlapping 3-inch diameter holes or by line drilling and broaching. Maintain a minimum 6-inch clearance from centerline of drill hole to edge of adjacent structure. Remove remaining rock by chipping.
  - 3. In other areas, drill holes on the perimeter of rock excavations shall be spaced at a distance of 12 inches, or less, center to center. The Contractor, at his option, may elect to perform line drilling in such areas.
- F. Each blast shall be covered with blasting mats before firing. The Engineer may, if in his opinion it become necessary for the purpose of reducing the hazards and damage from blasting, inspect and modify such operations to the extent necessary to produce the result intended by the Contract.
- G. Halt operations if damage is noted or if blasting limits or settlement allowances are exceeded. Perform all remedial work required due to blasting at no additional cost to the Authority.

- H. The specific requirements of this Section are not intended to interfere with the ability of the Contractor to alter spacing of holes and explosive loadings within the perimeter of rock excavation so that adequate rock breakage may be obtained.
- I. All excavated broken rock shall become the property of the Contractor and disposed of away from the construction site in a legal and environmentally acceptable way.
- J. Wet down rock and muck as required to limit dust and fumes emitted to the atmosphere.

### 3.04 CHEMICAL DEMOLITION AGENT EXCAVATION

#### A. Drilling

1. Complete line drilling as shown on Contract Drawings and as specified herein.
2. Drill production holes using an air hammer drill and appropriate drill bit specific to the rock type. Hole diameter shall be between 1-1/2 inches and 2 inches as determined by the manufacturer's representative.
3. Holes should be drilled no further than 1 foot to 2 feet apart as determined by the manufacturer's representative.
4. Depth should be 65 percent to 90 percent of the required removal depth, depending on the type of rock/material to be removed as determined by the manufacturer's representative.

#### B. Placement

1. Follow manufacturer's materials handling data sheets and mixing requirements.
2. Clean holes before filling using air hose to remove excess dust from drilling.
3. Pour product into hole in accordance with manufacturer's recommended procedures.

- C. Cracking or Cutting Time - Maximum expanding time shall be limited to 48 hours.

### 3.05 CLEANING OF ROCK SURFACES

- A. Clean all rock bearing surfaces exposed during excavation to permit a thorough inspection and assessment of the condition of the rock by the Engineer.
- B. All standing water shall be removed from the area to be inspected to permit proper examination of the rock.
- C. Provide suitable means of access for inspection of the excavated and scaled areas by the Engineer.

### 3.06 FIELD TESTING AND MONITORING

#### A. Test Blasting

1. Before beginning production blasting, perform four test blasts at a location approved by the Engineer.
2. These blasts will be monitored by the Contractor and the Engineer and will be used for determining the characteristics of the rock in transmitting vibrations. A maximum charge per delay will be mutually established from the four initial blasts and modified further as necessary as the work progresses.

#### B. Monitoring of Blasts

1. Blast induced vibrations shall be monitored by the Contractor's monitoring consultant for every blast. Data shall be made available to the Engineer upon request.
2. Provide the monitoring consultant with the precise time of each blast so that off-site seismographs can be installed by the noise and vibration monitoring consultant.
3. Cooperate with the Engineer in establishing a signal system that will allow the vibrations to be monitored by the Engineer in this manner.

#### C. Open Excavations

1. Engage a qualified rock support engineer or geologist with at least four years relevant experience in support of rock excavations to monitor excavation stability. The qualified rock support engineer or geologist shall be on-site at least every 5<sup>th</sup> day of rock excavation work.
2. After each lift of rock is excavated, allow sufficient time for the rock support engineer or geologist to examine the exposed rock face to check for indications of instability. Should he or she determine the rock to be unstable or potentially unstable, install rock bolts or perform other remedial work to stabilize the rock face. No adjustment in the Contract Price will be made when remedial measures must be implemented to stabilize the exposed rock face.

- D. The Engineer will monitor fugitive dust emissions from all operations.

END OF SECTION

## DIVISION 2

### SECTION 02260

### JET GROUTING

#### PART 1. GENERAL

##### 1.01 SUMMARY

- A. This Section specifies the requirements for the installation of jet grout columns.
- B. The Contractor shall furnish all labor, materials, tools and equipment, and perform all operations necessary for installation of jet grout columns.
- C. The work covered by this Section includes:
  - 1 Delivery and assembly of plant, equipment, utilities, materials and supplies necessary for performance of the jet grouting operations.
  - 2 Drilling jet grouting holes to form a series of overlapping grout columns at the locations shown on the Contract Drawings.
  - 3 Collection and disposal off Authority property of return flow materials generated by the jet-grouting process.
  - 4 Performance of a test program to verify the required dimensions and engineering properties of the jet grout masses.
  - 5 Continuous core sampling of selected grout columns by core drilling as specified herein.
- D. Definitions
  - 1 Jet Grouting: The process of mixing soil in place with a stabilizing grout mix delivered at high pressure through radial nozzles at the end of a monitor inserted in a borehole. The mixing of soil and grout is accomplished by rotating and drawing up the monitor from the bottom of the borehole.
  - 2 Grout Column: A vertical cylinder of soil-grout mass formed by jet grouting.
  - 3 Return Flow: All materials, including grout, water and soil particles, which are discharged as a result of jet grouting operations at or near the point of entry of drill, grout rods or pipes into the ground.

##### 1.02 REFERENCES

Codes and standards in these notes are to be the latest editions in effect at the time the work is being done unless otherwise noted, and are considered to be a part of this Specification.

American Society of Testing and Materials (ASTM)

- C42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
- C109 Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens) C150 Specification for Portland Cement
- D2113 Practice for Diamond Core Drilling for Site Investigation

International Society for Rock Mechanics (ISRM), Committee on Standardization of Laboratory and Field Tests:

“Suggested Methods for Determining Water Content, Porosity, Density, Absorption and Related Properties and Swelling and Slake Durability Index Properties,” International Journal of Rock Mechanics, Mining Science and Geomechanics Abstracts, Vol. 16, pp. 141 156, 1979.

### 1.03 SUBMITTALS

See Appendix "A" for submittal requirements.

### 1.04 DESIGN AND PERFORMANCE REQUIREMENTS

#### A. Job Conditions

- 1 Subsurface Information: Refer to data listed in Available Documents.
2. Product Delivery, Handling, and Storage:
  - a. Deliver all material in undamaged, unopened containers bearing manufacturer's original labels.
  - b. Store and handle grout materials in accordance with manufacturer's recommendations. Grout materials that become caked due to moisture absorption are not to be used for this work.

#### B. Design Requirements Design dimensions, locations and elevations are indicated on Contract Drawings.

#### C. Quality Assurance

- 1 The entity performing the work shall be an established jet-grouting firm with a record of at least five years of experience in performing jet-grouting operations. Do not commence work until the entity has been approved by the Engineer.
- 2 Assign an experienced, full-time supervisor who has been in responsible charge of supervising jet grouting operations for at least five years. The supervisor shall be present at the work site at all times during jet grouting operations. The supervisor shall be knowledgeable of all aspects of jet grouting as currently practiced, including methods related to drilling of grout holes, grout formulation, properties and admixtures, mixing methods, grout pumping and vertical grout injection.
- 3 Laboratory testing as specified herein shall be performed by the Authority.
- 4 Quality Control Procedures: Quality control procedures shall be established by the Contractor and approved by the Engineer prior to job startup. Such procedures shall be followed to ensure that the completed project shall comply with all requirements indicated on the Contract Drawings.

## PART 2. PRODUCTS

### 2.01 MATERIALS

#### A. Portland cement and water

- 1 Portland cement shall conform to ASTM C150, Type II.
- 2 Water used for drilling grout holes in grout mixing and in grout injection shall be clean, potable and free of sewage, oil, acid, alkali, salts, suspended solids, organic material and other deleterious materials.

#### B. Admixtures: Materials used in the mix in addition to Portland cement and water shall be subject to the approval by the Engineer.

## PART 3. EXECUTION

### 3.01 PREPARATION

Prior to installing jet grout columns:

- A. Provide a plan showing the surveyed location of each of the jet grout columns, and the number/letter identifying it.
- B. Locate existing underground utilities and subsurface structures in the area of work, and include the locations in the plan required by 3.01.A.

## 3.02 INSTALLATION

### A. Equipment

- 1 All equipment used for drilling grout holes; lowering, raising and rotating jet monitors, mixing grout, supplying pressurized grout and air or air-water to jet monitors, and jet monitors used to construct the soil-grout columns shall have proven performance records for use in ground conditions equivalent to this site.
- 2 Spare parts, back-up equipment, and maintenance personnel shall be available to maintain jet grouting equipment in satisfactory operating condition at all times during execution of the jet grouting work, and to ensure uninterrupted grout injection in case of mechanical breakdown or equipment malfunction during the course of the work.
- 3 Jet Grouting Monitors: Use jet grouting monitors having performance characteristics, operating ranges, and capacities suitable for producing grout columns of the diameters and depths shown on the Contract Drawings, and as specified herein.
- 4 Proportioning of Grout Mixes: The grout plant shall include calibrated meters for measuring accurately the volume of water and any liquid admixtures used in each batch of grout, and calibrated scales for measuring accurately the weight of cement, and any solid admixtures used in each batch of grout.
- 5 Monitoring of grouting performance: Equipment used to measure and record jet grouting parameters shall consist of automatic, real time data collection systems.
- 6 Equipment for Exploratory Corings: Soil-grout masses shall be cored in post-jet grouting exploratory corings with a nominal PQ size (minimum diameter 3.345 inches) triple tube diamond bit core barrel meeting the requirements of ASTM D2113.

### B. Production Jet Grouting

- 1 Production jet grouting shall be performed to construct soil-grout columns at locations and with dimensions shown on the Contract Drawings and as specified herein. As determined by the Engineer, if jet grout columns cannot be located as shown on the Contract Drawings, due to interference with existing structures or utilities, modify the column locations as directed by the Engineer. As directed by the Engineer, the Contractor shall be compensated on a net cost basis for jet grout columns required in addition to those shown on the Contract Drawings, due to interference with existing structures or utilities.
  - 2. The general design criteria for the jet grouting are as follows:
    - a. Minimum column diameter shall be as shown on the Contract Drawings.
    - b. The minimum overlap between adjacent grout columns at any point of intersection shall be as shown on Contract Drawings.
    - c. The minimum unconfined compressive strength of the soil-grout mass-produced by jet grouting shall be as shown on Contract Drawings.
- 2 Equipment for mixing, holding and pumping grout shall be in a secure location and shall be operated to minimize spillage of material. No material will be allowed to flow in the adjacent water body or storm drains.
- 3 The arrangement of the grouting equipment shall provide continuous circulation of grout prior to its injection. The equipment and lines shall be prevented from becoming fouled by determining the set time of the grout mix, monitoring the time that has elapsed from when a batch of grout has been mixed, maintaining grout ready to be injected in constant circulation, and periodically flushing the grout system with water. Grout that cannot be placed, for any reason, within 2 hours after mixing shall be disposed of off Authority property at no additional cost to the Authority.
- 4 During jet grouting, free return flows shall be maintained at all times. If the Contractor observes a reduction in flow rate, measures shall be implemented immediately to re-establish the original flow rate.
- 5 The Contractor shall conduct all jet grouting in a manner such that there is no heave, settlement or loss of support of or damage to the existing structures and utilities.
- 6 The Contractor shall provide the Engineer with cube samples from the grout mix two times during each workday. Samples shall be taken from production grout batches. A minimum of six grout cubes shall be cast each time sampling is performed. The unconfined compressive strength of one of these samples shall be tested at 7 days; the strength of the other sample shall be tested at 14 and 28 days.

### C. Test Program

- 1 Execute a test program as shown on Contract Drawings prior to the start of production jet grouting to

evaluate the effectiveness of the methods and equipment to produce soil-grout masses meeting the geometric and material property requirements shown on the Contract Drawings and as specified herein.

2. Drill post-jet grouting exploratory corings as required by the Contract Drawings, and in 3.02.D.

2 As determined by the Engineer, if the test results show that the jet grout columns do not meet the geometric and material property requirements shown on the Contract Drawings and as specified herein, the Contractor shall modify his installation procedure in order to produce jet grout columns which meet such requirements. The Contractor shall perform such modifications at no additional cost to the Authority. In addition, the Engineer may require additional jet grout columns in the test section per 3.02.F.2.

#### D. Post-Jet Grouting Exploratory Corings

1 Coring of jet grouted zones shall be performed by the Contractor as required on Contract Drawings a minimum of 48 hours after completion of the jet grouting to evaluate grout column diameter and continuity, and to obtain soil-grout mass samples for unconfined compressive strength and unit weight testing. Notify the Engineer 24 hours in advance, so that coring can be observed by the Engineer. Provide core samples to the Engineer for testing.

2 Continuous core sampling observed by the Engineer shall be performed by the Contractor over the full depth of the jet-grouted zone in each exploratory hole. A triple tube core barrel shall be used to minimize core losses and disturbance to samples obtained. The Contractor shall provide wooden core boxes for storage of core samples, labeled to indicate coring number, depths of coring intervals, and run numbers. Core samples from more than one coring shall not be placed in the same box.

3 The Contractor shall prepare a log summarizing the results of each post-jet grouting exploratory coring and include the log when samples are provided to the Engineer.

4 After completion of post-jet grouting exploratory corings, the core holes in the grout columns shall be backfilled by the Contractor with non-metallic grout. The corings shall be filled with grout from the bottom up by using a tremie pipe. The Contractor shall provide soil grout mass with a minimum compressive strength of 750 psi at 7 days. Core holes shall be grouted within 24 hours of removal of core samples.

#### E. Laboratory Testing

1 The Contractor shall be responsible for preserving and storing samples from the post-jet grouting exploratory corings at the construction site prior to providing the samples to the Engineer for testing. Sample preservation shall include the wrapping of samples in plastic to preserve the original moisture content of the samples while they are being transported and stored prior to testing. All samples for testing will be selected by the Engineer.

2 Grout cube samples shall be tested by the Engineer for unconfined compressive strength in accordance with ASTM C109.

3 Soil-grout mass core samples shall be tested by the Engineer for unconfined compressive strength in accordance with ASTM C42.

4 Testing frequency of core samples from post-jet grouting exploratory corings for the test section, and production jet grouting, shall be as required on Contract Drawings.

#### F. Corrections of Deficiencies

1 The Contractor shall notify the Engineer immediately, in writing, of the failure of a jet grout column to meet any requirement of this Section. Such written notification shall include all information required for the evaluation of remedial measures, including all information required for redesign.

2 Any jet grout columns, which do not meet the requirements of this Section, shall be replaced or supplemented by the Contractor, as directed by the Engineer, at no additional cost to the Authority.

3 Any jet grout column lost or damaged as a result of mechanical failure of equipment, inadequacy of grout, air, or water supplies, or improper drilling, grout mixing or injection procedures, shall be replaced by another jet grout column, or columns, by the Contractor, as directed by the Engineer, at no additional cost to the Authority.

4 If a jet grout column fails to comply with the requirements of this Section and the Engineer determines that additional jet grout columns are required, the Authority will perform all required redesign and detailing. In such an event, the Authority will use its best efforts to complete the redesign within the time set forth on the Contract Drawings.

5 The Contractor at his option, and at any time that he determines that a jet grout column will not satisfy the

requirements of this Section, may subject to the provisions of 3.02.F.1, abandon such a jet grout column and replace it with a new jet grout column, rather than await direction or approval from the Engineer. However, the Contractor in exercising this option, assumes the risk that such replacement jet grout columns have been installed at the proper locations, as determined by the Engineer. Such abandonment shall be for the Contractor's convenience, and subject to all applicable provisions of the contract.

6 Any post-jet grouting exploratory coring that cannot be completed to the full depth required, or for which the number or percentage recovery of soil-grout mass samples obtained is determined by the Engineer to be insufficient to adequately characterize the soil-grout mass at the coring location, because of mechanical failure, improper functioning of equipment, or improper drilling and sample procedures, shall be replaced by the Contractor at no additional cost to the Authority.

### 3.03 FIELD TESTS

#### A. Inspection

- 1 Cooperate with the Engineer and furnish services as may be required for inspection and obtaining data.
2. The Contractor shall keep jet grout performance records for each jet grout column during the test program, and production jet grouting operations. The Contractor shall submit such records on a daily basis to the Engineer. At a minimum, the records shall contain the following information.
  - a. Grout hole data, including hole identification number, location, date and time of drilling, diameter, total depth, and spacing.
  - b. In each grout hole, description of depth and extent of obstructions, cavities, soft spots or cobbles, and boulders; depth of ground water, depths of drilling fluid losses; and any major interruptions in drilling work.
  - c. Beginning and completion times and dates for injection of each grout column.
  - d. All grout mix data, including mix proportions and setting times.
  - e. Grout and air or air-water jet pressures used to construct each grout column, including variation with depth.
  - f. The rate of grout injection for each grout column, including variation with depth.
  - g. Rates of rotation and withdrawal of jet grout monitor for each grout column, including variation with depth.
  - h. Estimated amount of return flow materials produced as result of each grout column installed, and volumes of return flow materials removed from site for disposal off Authority property.
  - i. Other pertinent observations such as grout escapes, ground heave or other unusual behavior.

### END OF SECTION SECTION 02260

### JET GROUTING

### APPENDIX "A"

### SUBMITTALS

- A. Submit documentation verifying compliance with the quality assurance requirements of clause 1.04.C. Documentation shall be submitted for approval a minimum of 30 working days prior to commencement of any operations related to jet grouting.
- B. Submit the method for surveying the location of the center of each jet grout column.
- C. Submit a plan showing the surveyed locations of the jet grout columns a minimum of two week prior to starting work. If there is any reason why the jet grout columns cannot be installed as shown on Contract Drawings, provide an explanation with the plan submittal.
- D. Jet Grouting Operations: Submit a minimum of 30 working days prior to the commencement of jet grouting, working drawings, method descriptions, computations, and manufacturers literature, as necessary to present

the following information:

- 1 Plant, equipment and material descriptions, including performance records and manufacturers specifications, verifying that the equipment has proven performance record for project site ground conditions.
  - 2 Arrangement of grout mixing and injection equipment, including schematic diagram showing layout of grout and water lines and directions of flow circulation.
  - 3 Methods and equipment for drilling and supporting grout holes, including advancement near tie-rods and through obstructions, cobbles, and boulders.
  - 4 Methods for locating all utilities below ground or street surface which are in the area of, and could potentially interfere with, the installation of the grout columns.
  - 5 Method and sequence of grout column installation, including proposed jet grouting system, i.e., triple fluid.
  - 6 Proposed values of grout, air, and air-water jetting pressures, rates of jetting monitor rotation and withdrawal as applicable for the particular type of jetting system being used, and proposed values of grout mix water/cement ratio, and rate of grout injection for producing the grout columns.
  - 7 Calibration records for all pressure gauges, flow meters and scales from an approved laboratory testing agency and certification of master gauge calibration.
  - 8 Methods and equipment for measurement and recording of jet grouting parameters, including injection pressures, jetting monitor rotation and withdrawal rates, and grout volumes injected.
  - 9 Grout mix designs, types and purposes of all admixtures, sources of mix materials, and material data.
  - 10 Method of installing steel reinforcement.
  - 11 Equipment and procedures for drilling and sampling any exploratory corings.
  - 12 Methods and equipment for management of return flow, including collection, volume measurement, storage, transportation and disposal.
  - 13 Forms to be used for recording of jet grouting performance data.
- A. Submit Jet Grouting Performance Records for the test program and production jet grouting operations as required by clause 3.03.A.2.
- B. Coring Logs: Submit logs for post jet-grouting exploratory holes to be cored as part of the test program and production jet grouting operations. Each coring log shall be included when the core samples are provided to the Engineer.

END OF APPENDIX "A"

**SECTION 02378**  
**MINI-CAISSON PILES**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. This Section specifies requirements for small diameter, cast-in-place, drilled mini-caisson piles.
- B. Furnish all labor, materials, tools and equipment, and perform all operations necessary to install concrete-filled mini caisson piles drilled into bedrock at the locations shown on the Contract Drawings and as specified herein. The work consists of drilling through concrete diaphragm slabs, underlying overburden including boulders and into rock, installing steel casing into rock, installing steel reinforcement within the casing, filling with concrete and removing pile tops to design elevation.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Provide an installation method that minimizes ground loss and resultant settlement of nearby structures.
- B. Utilize materials and dimensions for the piles substantially similar to the piles which have been proven by loading tests.
- C. Installation Alignment and Tolerances
  - 1. The pile casing alignment shall not deviate by more than two percent from plumb.
  - 2. Piles at cut-off level shall not deviate by more than one-half inch horizontally from the specified locations shown on the Contract Drawings.

1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements
- B. Section 03200 – Concrete Reinforcement
- C. Section 03301 – Portland Cement Concrete, Long Form
- D. Section 03303 – Placement of Portland Cement Concrete

1.04 REFERENCES

- A. Building Codes of the City and State of New York

- B. American Concrete Institute (ACI)
  - 1. 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete
  - 2. SP-66(04) – ACI Detailing Manual-2004
  - 3. 318 - Building Code Requirements for Structural Concrete and Commentary
- C. ASTM International (ASTM)
  - 1. A252 - Standard Specification for Welded and Seamless Steel Pipe Piles
  - 2. A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
  - 3. A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
  - 4. C33 - Standard Specification for Concrete Aggregates
  - 5. C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars(Using 2-in. or [50-mm] Cube Specimens)
  - 6. C150 - Standard Specification for Portland Cement
  - 7. C311 - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
  - 8. C494 - Standard Specification for Chemical Admixtures for Concrete
  - 9. C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
  - 10. C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
  - 11. D1143 Standard Test Methods for Testing of Piles Under Axial Compressive Load
- D. American Welding Society (AWS)
  - 1. D1.1 - Structural Welding Code - Steel
  - 2. D1.4 - Structural Welding Code - Reinforced Steel
  - 3. D1.5 - Bridge Welding Code
- E. American Petroleum Institute (API)
  - 1. 5CT(N80) – Specification for Casing and Tubing

## 1.05 SUSTAINABLE DESIGN REQUIREMENTS

- A. Sustainable Design General Requirements
  - 1. The Authority requires the Contractor to implement practices and procedures to meet the Contract's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Section 01352 and in this Section are implemented to the fullest extent. Substitutions, or other changes

to the Work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.

B. Sustainable Design Performance Criteria

1. Concrete shall contain post-industrial and/or post-consumer recycled content of either fly ash or Ground Granulated Blast Furnace Slag as follows:
  - a. Fly Ash: Concrete products shall incorporate flyash as a replacement for up to 30 percent (by weight) of the portland cement. All design mixes are subject to review and approval by the Engineer.
  - b. GGBF (Ground Granulated Blast Furnace) Slag: Concrete products shall incorporate GGBF Slag as a replacement for up to 40 percent (by weight) of the portland cement. All design mixes are subject to review and approval by the Engineer.
  - c. Steel reinforcing bars shall contain a minimum of 60 percent (by weight) recycled content, calculated by adding the post-consumer recycled content percentage to one-half of the post-industrial recycled content percentage. Certify the recycled content in accordance with the Sustainable Design Submittal Requirements of this section.
2. Concrete shall be manufactured (or assembled) within 500 miles (by air) of the project site. The location shall be documented in accordance with the Sustainable Design Submittal Requirements of this section.
3. The origin of the raw materials from which the product(s) were manufactured shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.

1.06 QUALITY ASSURANCE

- A. The Contractor performing this work shall be a firm regularly engaged in the installation of concrete-filled, drilled mini-caisson piles. The Contractor or approved Subcontractor shall have experience successfully completing at least five projects of similar size and complexity using this type of pile within the last five years. The experience shall include installing such piles drilled through obstructions and bedrock, using non-displacement rotary duplex drilling techniques or equivalent non-displacement methods.
- B. Assign an experienced, full-time supervisor who has been in responsible charge of supervising the installation of concrete-filled drilled mini-caisson pile operations for at least five similar projects in the prior five years. The supervisor shall be present at the Work site at all times during the pile installation. Provide written verification of the supervisor's experience for review and approval of the Engineer.
- C. Do not begin production pile installation work prior to receiving approval of pile load tests from the Engineer. Ordering material prior to the approval is discouraged and is solely at the risk of the Contractor. Review and approval by the Engineer does not constitute a guarantee that the pile installation will be accepted by the Authority.

1.07 SUBMITTALS

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

1. List of referenced projects demonstrating past experience in similar piling work to the Engineer no later than 30 calendar days after the Notice to Proceed. The list shall include the name and location of the project, the Authority's name and address, and the names and telephone numbers of a representative of the designer, and the Authority for whom the work was performed and who can attest to successful completion of the Work. Include a project summary for each referenced project. The project summary shall contain the start and completion dates of the project, subsurface conditions, total number of piles installed, details of piles, installation techniques and any other information relevant to demonstrate Contractor's experience in similar piling work.
2. Prepare a Work Plan describing the construction methods and equipment to be used for pile installation. The Work Plan shall be submitted to the Engineer at least 10 days before the start of pile installation, including the proposed method of installation of all piles; a detailed description of model, size and type of drilling equipment; and procedures for cleaning out the piles. Include layout drawings showing the proposed sequence of pile installation with proper coordination with the proposed phasing and scheduling of the total project.
3. Shop drawings including, but not limited to, pipe diameter, wall thickness, details of pipe used, size and details of reinforcement for steel core, including procedure for splicing steel core and details of alignment spacers, and method of pile cutoff and sealing the tunnel structure from leakage of drilling fluid or groundwater into the tunnel.
4. Proposed concrete mix and method of placement.
5. Verification of welder qualifications where applicable.
6. Proposed method to measure volume of concrete placed to form pile.
7. Certified mill test reports properly marked, for the reinforcing steel and steel pipe to the Engineer for a review. The ultimate strength, yield strength, elongation and material properties composition shall be submitted. For API N-80 pipe casing, coupon test results may be submitted in lieu of mill certification.
8. Installation records for each pile. The records shall be submitted within 24 hours after installation is completed for the pile. The records shall include the following, at a minimum:
  - a. Date of installation.
  - b. Pile Number and design load.
  - c. Type, outside diameter, thickness and grade of casing(s).
  - d. Type and size of drill rig.
  - e. Surface elevation of working platform.
  - f. Depth of drilling in overburden and rock.
  - g. Depth and elevation of bedrock surface.
  - h. Depth and elevation of bottom of casing.
  - i. Depth and elevation of bottom of rock socket.
  - j. Depth, elevation and description of Obstructions encountered.
  - k. Pile cut-off elevation.
  - l. Total length of pile.
  - m. Slope of pile.
  - n. Size, length, grade and position of reinforcing steel.
  - o. Elevation and type of reinforcing bar splices used.

- p. Concrete mix and minimum concrete strength.
  - q. Theoretical and actual volume of concrete required to fill pile.
  - r. The time pile installation started, interrupted, resumed and to complete each operation.
  - s. Description of any unusual circumstances affecting installation.
9. As-built drawings showing the surveyed location of all piles installed and identifying abandoned piles. Actual pile tip elevations, inclinations and pile cutoff elevations shall be shown on the as-built drawing.
  10. Pile socket video inspections.
- B. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.
    - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
      - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
      - 2) The manufacturing location of the supplied product(s).
      - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
      - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
      - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
  2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  3. Product cut sheets for materials that meet the SDMCF.
  4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
  5. Provide concrete mix design to verify the percentage of recycled material included, by weight.
  6. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

## 1.08 PROJECT CONDITIONS

## A. Job Conditions

1. Furnish and construct the piles in accordance with the specifications, drawings and the referenced codes and regulations.
2. Four compression pile load tests have been completed at the site; a copy of the pile load test report is available upon request to the Authority.
3. Protect existing structures, including the subway tunnel, slurry walls, operating facilities and utilities to the satisfaction of the Engineer.
4. Unless stricter requirements are shown on the Contract Drawings, all excavation spoil from each day's operation shall be transported daily to a disposal area. The work area shall be cleaned following each day's operations. Do not dispose of slurry, concrete, and excess concrete in storm drains.

## B. Site Conditions

1. The Available Information Drawings include boring logs for subsurface conditions at the site. These Drawings are provided for use by the Contractor at his discretion. The Contractor shall be aware that the subsurface conditions may include boulders, cobbles, concrete debris, wood, concrete, fractured rock, quartzite, and other obstructions that must be penetrated by the piles. Active and detensioned tiebacks are also present that must not be penetrated or damaged.
2. Inspect the site prior to the start of work to evaluate the conditions affecting the work. No claim for additional costs will be allowed because of lack of knowledge of any existing conditions discernible from observation at the site, adjoining property, subway tunnel and other available sources of information.
3. Five recent test borings have been made at the location of the mini-caisson piles; a copy of the boring logs, drilling logs, and core photos are available upon request to the Authority.
4. Consult the Contract Drawings and the official records of existing utilities, both surface and subsurface, and excavate test pits at work locations to observe existing conditions and limitations as they apply to this work and their relation to other construction work.
5. Protect existing utilities that are to remain within the pile installation work zone, in accordance with the requirements of Authorities having jurisdiction over the same. Repair any construction-induced damage to the utilities or replace the damaged utilities in kind, in a timely manner to the satisfaction of the utility Owners.

## C. Storage, Delivery and Handling

1. Materials used for concrete shall be stored in accordance with ACI 304.
2. Deliver reinforcing bars marked with metal tags indicating size, length, grade and mark numbers.

**PART 2 - PRODUCTS****2.01 MATERIALS****A. Permanent Steel Casing**

1. Pile casing shall be new and unused pipe with a minimum wall thickness and diameter shown on the Contract Drawings:
  - a. Drilling casing meeting the minimum tensile requirements of ASTM A252, Grade 3.
  - b. Mill secondary steel pipe, conforming to API N-80 and all requirements above shall be free from defects (dents, cracks, tears) and with two coupon tests per truckload delivered to the fabricator.
2. Splices
  - a. No splices shall be used in the installation, unless required by considerations of limited head-room or other installation constraints. Casing splices, if required, shall be submitted to the Engineer for approval.
  - b. Splices shall be made by a continuous full penetration butt weld across the entire cross-section against a tight fitting inside backing ring or using a tight fitting splicer of the same thickness as that of the pipe. Splice welds shall conform to the requirements of AWS D1.1, Structural Welding Code.
  - c. If threaded splices are used, the splice shall develop 100 percent of the design capacity of the specified steel pipe cross-section in tension, shear and compression.
3. The nominal diameter of steel pipes at any cross-section along the length of the pipe shall be as indicated on the Contract Drawings. Out of roundness for the pipe shall be in accordance with ASTM A252 and within 1 percent of the pipe diameter

**B. Reinforcing Bars (Steel Core)**

1. Diameter and grade shall be as shown on the Contract Drawings. Where threads are cut into a Grade 60 reinforcing bar, the next larger bar number designation from that shown on the Contract Drawings shall be used.
2. Reinforcing steel shall be deformed steel bars meeting or exceeding ASTM A615 mechanical, physical, and dimensional properties.
  - a. ASTM A615 Grade 75, 80, or 90.
  - b. ASTM A722 Grade 150.
3. Splice the mating ends of the steel core sections using welded splices or mechanical connections in accordance with the requirements of ACI 318.
  - a. Weld reinforcing bars (steel core) in accordance with requirements of AWS D 1.4.
  - b. Use only welders qualified by tests prescribed in AWS D1.1 or D1.5, as applicable.
  - c. A full welded splice shall have bars butted and welded to develop in tension or compression at least 125 percent of specified yield strength of the bar.

- d. A full mechanical connection shall develop in tension or compression at least 125 percent of specified yield strength of the bar.
- e. Threadbar reinforcing bars shall be spliced using approved threaded couplers which develop the ultimate tensile strength of the bars without evidence of any failure and jam nuts installed in accordance with the manufacturer's instructions.

#### C. Concrete

1. The concrete shall be a pumpable mix consisting of a non-shrink mixture of Portland cement, mineral filler, plasticizer, sand, and water so proportioned and mixed as to provide a concrete capable of maintaining the solids in suspension without appreciable water gain, yet which will laterally penetrate and fill any voids in foundation material. The materials shall be so proportioned as to provide a hardened concrete having a minimum ultimate compressive strength of 3,600 psi in seven days and 6,000-psi in 28 days. The mix design shall also conform to the following:
  - a. Substitute either fly ash or slag at the minimum rate of 25 percent by weight of cement. The maximum rates of substitution shall be 30 percent for fly ash and 40 percent for slag. Fly ash and slag substitution in the same mix may be permitted upon approval by the Engineer.
2. Chlorides from any source shall not be permitted in the grout mix.
3. Cement shall conform to ASTM C150, Type II, III, or V.
4. Sand shall conform to ASTM C33, Size No. 1.
5. Fly Ash: Conforming to ASTM C311 and ASTM C618, Class F or Class C, except the maximum loss on ignition shall be less than 4 percent.
6. Slag: Conforming to ASTM C989, Grade 120.
7. Mixing water shall be clean, potable, and free from substances that may be injurious to cement and steel.
8. Mineral filler shall be finely powdered siliceous material that will chemically react with calcium hydroxide in the presence of moisture at ordinary temperatures to form compounds possessing cementitious properties.
9. Plasticizer shall be a compound that will increase the flowability of the mixture, assist in the dispersal of cement grains, and neutralize the setting shrinkage of the cement mortar.
10. Expansive admixtures shall only be added to grout used for filling sealed encapsulations and pile cap covers.
11. Molding and testing of concrete specimens shall be in accordance with ASTM C109.

#### D. Miscellaneous Materials

1. Plates and Shapes: structural steel plates and shapes for pile top attachments shall conform to ASTM A36 or ASTM A572 compatible with the grade of the steel core.
2. Centralizers and spacers shall be fabricated from PVC pipe or steel tube, or material non-detrimental to the reinforcing steel. Wood shall not be used.

3. Centralizers and spacers shall be securely attached to the reinforcement, sized to position the reinforcement within one-half inch of plan location from the center of pile, to allow concrete tremie pipe insertion to the bottom of the drill hole, as well as to permit concrete to freely flow up the drill hole and casing and between adjacent reinforcing bars.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL**

- A. Prior to drilling, locate existing underground utilities in the areas of work. Provide adequate means of support and protection for utilities during excavation, drilling, concreting, and backfilling operations.
- B. Prior to bringing drill equipment onto the site, examine the existing site conditions to ensure that all equipment selected for pile installation can operate properly for the intended purpose. Use the Work Plan submitted to the Engineer describing the construction methods and equipment to be used for pile installation. Deviations from the Work Plan must be submitted to the Engineer and approved prior to implementation.
- C. Piles shall be installed in such a manner as to ensure that no damage is sustained either to adjacent structures or to previously formed piles. The Contractor shall be responsible for damage to existing structures and utilities.
- D. Control and properly dispose of all drill fluids, cuttings and construction related waste, including excess concrete in accordance with all local codes and regulations which would apply if the Authority were a private corporation, and keep premises clean and free of water. Disposal of waste and spoil on local streets and into sewers will not be permitted.
- E. The methods selected for this work shall be such that they will provide suitable protection to the public.

#### **3.02 INSTALLATION**

- A. Equipment
  1. Install piles with the equipment needed to satisfy the requirements described herein and on the Contract Drawings.
  2. The drill casing shall be watertight and of the flush-joint type.
  3. The maximum diameter of the cutting shoe, if used, shall not exceed the outer diameter of the drill casing by more than 1/4 inch.
  4. Concrete shall be mixed in an approved high-speed mixer capable of producing sufficient high quality colloidal concrete to fill each pile without interruption.
- B. Installation
  1. Pile installation operations shall be performed only in the presence of the Engineer.

2. Provide equipment and methods capable of attaining the required pile depth and capacity. The equipment shall be situated at the proper location such that the final location of the pile will not deviate more than permitted by Article 1.03C of these Specifications.
3. Do not install piles within 15 feet of concreted piles that are less than 24 hours old.
4. Control procedures and operations to preclude undermining, disturbing, inducing movements and vibration to adjacent structures and utilities that exceed the specified Alert Level values shown on the Drawings. If such values are exceeded, or if any unacceptable damage occurs, operations shall be halted and the equipment and/or procedures shall be modified so that no further disturbance occurs. Damage shall be repaired to the satisfaction of the Engineer.
5. Advance the pile to bedrock using non-displacement drilling methods, such as
  - a. Rotary duplex drilling methods.
  - b. "Spinning down" the pipe using a cutting shoe at the bottom of the pipe with separate clean-out of materials from within the pipe.
  - c. Other such methods approved by the Engineer that can advance the pipe without pre-drilling ahead of the pipe. Positive circulation or flushing to clean out an augered hole by water injection and collecting returns upward along the outside of the drill casing and discharging on the ground shall not be allowed. The use of air to clean the casing shall also be prohibited.
6. Measure water pressures beneath the subway tunnel prior to coring its base slab. If water pressures are artesian with respect to the working level such that water could enter the subway tunnel, implement procedures and operations to prevent water and soil from flowing into the tunnel. This shall be accomplished by
  - a. Working through a temporary casing and maintaining an adequate weight of fluid inside the casing to counterbalance the ground water pressures at all times during installation.
  - b. Reducing the water pressures below the base of the subway. By other approved methods. In any event, the Contractor shall monitor and record fluid levels used in advancing the casing to bedrock.
7. All holes in overburden shall be stabilized by steel casing. Use of drilling mud or other fluid shall not be used to support uncased holes.
8. Conduct drilling and cleaning procedures in such a manner as to prevent ground loss or ground movement beyond the borehole. If a separate drill tool is used for advancing the pipe, it shall be located no more than 6-inches ahead of the pipe at all times.
9. If obstructions, such as boulders, are encountered, piling operation shall progress through the obstruction by means of coring, using a tri-cone roller bit, churn drill, or appropriate cutting bit. Use of a down-the-hole hammer, will be permitted, provided the hammer never leads the casing by more than 6 inches, and that the return comes up the casing. However, if an obstruction is encountered at a location that indicates the obstruction could be a tieback supporting the adjacent slurry wall, piling operations shall follow direction by the Engineer.
10. Return drill fluid with cuttings shall be controlled by diverters, or other methods approved by the Engineer that produce a closed system allowing all drill spoil to

be placed in settling tanks for separation of fluid from solids for eventual disposal.

11. The pile casing shall be advanced and seated into un-weathered bedrock and cleaned of all soil, material and water so as to provide a clean casing for inspection. The casing shall then be visually inspected under adequate light. The Engineer shall be notified prior to each such inspection to verify the adequacy of the pipe. The purpose of the inspection is to verify that the pipe has no holes or gaps; is fully seated into the bedrock; is free of all mud, water, and other extraneous materials; is free of any significant distortion or reduction in cross-sectional area; and satisfies the verticality requirements.
12. After inspection of the pipe, the rock socket shall be drilled to the required depth and flushed with water until substantially clean of fines. Selected sockets will be inspected by downhole video camera for approval by the Engineer to ensure that the rock is continuous and unweathered in the socket zone. The video inspection shall be provided by the Contractor as requested by the Engineer. If required, the socket shall be extended until video inspection shows the required length in rock is attained.
13. Flush the rock socket clean of all extraneous material immediately prior to installing the core reinforcing
14. Lower the steel reinforcement along with the centralizers to the base of the pile prior to concreting. Partially inserted reinforcing bars shall not be driven or forced into the pipe. The surface of the reinforcement shall be free of deleterious substances such as soil, mud, grease, loose rust, mill scale, ice, or oil that might contaminate the concrete or coat the reinforcement and impair bond between the bar and concrete.
15. Provide centralizers and spacers attached to the reinforcing bar with a maximum spacing of 10-feet. The upper and lower most centralizer shall be located no more than 5-feet from the top and bottom of the pile. The centralizers shall be placed such that they permit free flow of concrete without misalignment of the reinforcement and the casing.
16. Place concrete in the piles by means of a tremie pipe extending to the bottom of the socket. Pump concrete through the tremie pipe until uncontaminated concrete returns from the top of the casing. Keep the concrete agitated prior to placing and place concrete within one hour of mixing. Place concrete in one continuous operation to prevent cavities, air pockets, and honeycombing or cold joints forming in the concrete. If the concreted pile cannot be completed during the scheduled work shift, extend work hours so that the pile is tremie filled with concrete without interruption.
  - a. Each batch of concrete shall have the same volume and contain the same whole number of sacks of cement, unless a modification is approved by the Engineer. Materials shall be accurately measured by weight or volume before mixing. Time of mixing shall be not less than three minutes.
  - b. The concrete shall be agitated continuously and may be held in the mixer or agitator for a period not exceeding initial set time of the concrete. The Contractor shall submit the concrete set time information with the shop drawings.

- c. If there is a lapse in pumping of concrete, the concrete shall be re-circulated through the pump or through the mixer drum until it is pumped to the hole.
  - d. Mix and place sufficient concrete to over pour any laitance from the top of the casing.
17. The Engineer will make on-site inspection of the concrete placement.
- a. During construction, samples of concrete mix selected at random by the Engineer shall be taken daily when concrete is placed in piles (six sets of samples per day). The Contractor shall be responsible for such testing, the cost of same deemed to be included in the cost of the piles.
  - b. The samples shall be molded, cured in a properly constructed curing box, tested in accordance with ASTM C109, and shall reach a compressive strength after seven days equal to at least 60 percent of the design strength. If this requirement is not met, Contractor shall modify the proportions of the mix subject to the approval of the Engineer. If the required design strength is not attained after 28 days then Contractor shall install replacement pile(s) as required.
  - c. The Engineer may also require the Contractor to modify the mix design if an excessive amount of concrete is lost from a pile hole into voids in the in-place materials.

#### C. Corrections of Deficiencies

1. The Contractor shall notify the Engineer immediately, in writing, if a pile fails to meet any requirement of this Section. Such written notification shall include all information required for the evaluation of remedial measures, including all information required for redesign.
2. If a pile encounters an obstruction that could be a tieback, immediately notify the Inspector and Engineer for direction. Confirm the notifications in writing within one day of encountering the obstruction.
3. If a pile fails to comply with the location or inclination requirements of 1.03 C, the Engineer will calculate the load capacity requirements of that pile or, if in a pile group, each pile in that pile group, based on the actual, "as-built" locations and inclinations. If the calculation indicates that the loading on that pile or, if in a pile group, on any pile in that pile group, exceeds 110 percent of the design load, then the Contractor shall perform such remedial work as the Engineer in his sole discretion may approve, including, but not limited to, furnishing and installing additional piles at locations approved by the Engineer and modifying concrete or reinforcement steel.
4. In the case of a pile with some deficiency that affects load capacity, the Engineer will calculate the load capacity requirements of that pile, based on its actual "as built" location and inclination. If the calculation indicates that the loading on the pile exceeds some reduced allowable loading less than the design load, including a zero loading, as determined in the sole judgment of the Engineer, then the Contractor shall perform such remedial work as the Engineer in his sole discretion may approve, including but not limited to furnishing and installing additional piles at locations approved by the Engineer and modifying concrete or reinforcement steel.

5. If a pile fails to comply with the requirements of this Section and the Engineer determines that modification to concrete or reinforcement steel, or the installation of additional piles is necessary, the Authority will perform all required redesign and detailing. In such event, the Authority will use its best efforts to complete redesign as soon as practicable.
6. The Contractor, at his option and at any time that he determines that a pile will not satisfy the requirements of this Section for a reason other than encountering an underground obstruction or tieback, may, subject to the provisions of this Section, abandon such pile and replace it with a new pile or piles rather than await direction or approval from the Engineer. However, the Contractor, in exercising this option, assumes the risk that such replacement pile or piles have been installed at the proper design location and alignment so as to carry satisfactorily the design load as determined by subsequent analysis performed by the Engineer. Such abandonment shall be for the Contractor's convenience and subject to all applicable provisions of the Contract.
7. Abandoned piles, when inside the subway, shall be cut off at the top of the tunnel base concrete. Other piles shall be cut off 3-feet below ground level. Abandoned piles shall not be extracted from the ground.
8. Changed Pile Locations
  - a. If concrete and reinforcing require modification due to changed pile locations, the Authority will provide redesign and detailing.
  - b. In the event that such changed pile locations are due to encountering a tieback whose location is not shown or a natural obstruction above the till stratum during installation, the Contractor shall perform the pile installation, concrete and reinforcing Work in accordance with such modified design and details and the Contractor will be compensated for any additional related work in accordance with Schedule of Unit Prices for Classified Work, if the Engineer determines the Prices therein are applicable, or if the Engineer determines said Prices are not applicable, then in accordance with the clause "Compensation of Extra Work".
  - c. The Contractor shall perform this Work in accordance with such modified design and details at no additional cost to the Authority in the event that the changed pile locations are not due to encountering an underground obstruction during installation.

### 3.03 FIELD TESTS

#### A. Inspection

1. Cooperate with the Engineer and furnish services as may be required for inspection and obtaining data.
2. The Engineer will keep an independent record of each pile installed. Such report shall include the following data:
  - a. Date of installation.
  - b. Pile Number and design load.
  - c. Type, outside diameter, thickness and grade of casing(s).
  - d. Type and size of drill rig.
  - e. Surface elevation of working platform.

- f. Depth of drilling in overburden and rock.
- g. Depth and elevation of bedrock surface.
- h. Depth and elevation of bottom of casing.
- i. Depth and elevation of bottom of rock socket.
- j. Depth, elevation and description of Obstructions encountered.
- k. Pile cut-off elevation.
- l. Total length of pile.
- m. Slope of pile.
- n. Size, length, grade and position of reinforcing steel.
- o. Elevation and type of reinforcing bar splices used.
- p. Concrete mix and minimum concrete strength.
- q. Theoretical and actual volume of concrete required to fill pile.
- r. The time pile installation started, interrupted, resumed and to complete each operation.
- s. Description of any unusual circumstances affecting installation.
- t. Socket video inspection of the pile.

**END OF SECTION**

**SECTION 02711**  
**SUBDRAINAGE SYSTEM**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. This Section specifies requirements for perforated polyvinyl chloride pipe (PVCP) and perforated high density polyethylene pipe (HDPE) subdrainage systems.
- B. Definition of terms relating to HDPE shall be in accordance with ASTM F412.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. As defined in this Section

1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements
- B. Section 02221 – Excavation, Backfilling and Filling
- C. Section 02274 - Geotextiles

1.04 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO)
  - 1. M252 - Standard Specification for Corrugated Polyethylene Drainage Pipe
  - 2. M288 - Standard Specification for Geotextile Specification for Highway Applications
  - 3. M294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm Diameter
- B. ASTM International (ASTM)
  - 1. C33 - Standard Specification for Concrete Aggregates.
  - 2. D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
  - 3. F412 - Standard Terminology Relating to Plastic Piping Systems.
  - 4. F758 - Standard Specification for Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport and Similar Drainage.
  - 5. F794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

6. F949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings.

#### 1.05 SUSTAINABLE DESIGN REQUIREMENTS

##### A. Sustainable Design General Requirements

1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall implement the requirements related to these goals, as defined in Specification Section 01352 and the articles below. Substitutions or other changes to the work proposed by the Contractor will not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.

##### B. Sustainable Design Performance Criteria

1. The post-industrial and/or post-consumer recycled content (by weight) of all PVC piping shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
2. The manufacturing location (final assembly) of all products shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
3. The origin of the raw materials from which all products were manufactured shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.

#### 1.06 QUALITY ASSURANCE

- A. Any entity performing the Work of this Section shall have at least three years of installation experience on projects with piping systems of types and sizes similar to that required under this Contract.
- B. Pipe will be visually inspected by the Engineer when delivered to the construction site. Damaged material or material not meeting the requirements of 2.02 shall be removed from the construction site, and replaced at no cost to the Authority.
- C. Pipe may be inspected at the place of manufacture by the Engineer.

#### 1.07 SUBMITTALS

- A. Submit certificates from manufacturers of the following items certifying that the following materials comply with the requirements specified in 2.02:
  1. Perforated Polyvinyl Chloride Pipe (PVCP)
  2. Perforated High Density Polyethylene Pipe (HDPE)
  3. Geotextile Fabric

- B. Submit certified test data covering gradation and composition of the washed aggregate proposed for use, together with one 75-pound representative sample of the material to the Manager, Materials Engineering Division, Port Authority Technical Center, 241 Erie Street, Jersey City, New Jersey 07310-1397.
1. Submit the sample in a clean, sturdy container or bag which shall not permit loss of any of the material.
  2. Clearly label the container or bag of the sample with: Contract location, title and number; the name of the material supplied and location of the source.
  3. The Engineer will approve or disapprove the proposed material within 21 days after receipt of the sample.
  4. Do not deliver material to the construction site from any source until the Engineer has approved the material from that source.
- C. Submit Catalog Cuts of pipes and geotextile fabric for the Engineer's approval.
- D. Submit for Engineer's approval methods for prevention of accumulation of groundwater and alternate methods of line and grade control where applicable.
- E. Submit "As-Built" drawings in accordance with Section of Division 1 entitled "Utility Record Drawings."
- F. Sustainable Design Submittal Requirements
1. The Contractor shall submit the Sustainable Design certification for items listed herein. Sustainable Design submittals shall include the following:
    - a. A completed Sustainable Design Materials Certification Form (SDMCF) appended to Section 01352. Information to be supplied for this form shall include:
      - 1) Cost breakdowns for the materials included in the Contractor's work. Cost breakdowns shall include total cost plus itemized material costs.
      - 2) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).\*
      - 3) The manufacturing location of the supplied product(s).\*
      - 4) The location (source) of the raw materials used to manufacture the supplied product(s).\*
      - 5) The VOC content of all adhesives, sealants, paints and coatings applied on site as part of this work.\*
      - 6) Include total cost for all wood products and itemized costs for all FSC-certified wood products.\*

\*If applicable- requirements are defined per the Sustainable Design Performance Criteria, in Section 01352.
  2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the Sustainable Design Materials Certification Form.
  3. Product cut sheets for materials that meet the Sustainable Design Materials Certification Form.

4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
5. The Sustainable Design submittal information shall be assembled into one package per Section or trade and sent to the Engineer.

#### 1.08 DELIVERY, STORAGE AND HANDLING

- A. Comply with manufacturer's instructions for unloading, storing and moving pipe.
- B. PVC/P and HDPE pipe which is stored at the construction site shall remain covered in a manner approved by the Engineer until pipe installation is performed.
- C. Care shall be taken when storing pipe and appurtenances so as not to damage Authority or other public or private property. Any property so damaged shall be repaired at no cost to the Authority.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. For Perforated High Density Polyethylene Pipe, manufacturer shall be one of the following or approved equal.
  1. Hancor, Inc.
  2. Advanced Drainage Systems, Inc.

#### 2.02 MATERIALS

- A. Perforated High Density Polyethylene Pipe (HDPE)
  1. AASHTO M252, for pipes 3 inches to 10 inches in diameter.
  2. AASHTO M294, for pipes 12 inches to 36 inches in diameter.
  3. Pipe shall have Class 2 slotted perforations, unless otherwise shown on the Contract Drawings.
- B. Washed Aggregate shall be crushed stone conforming to ASTM C33 size No. 6, 67, 7 or an approved equal with maximum size of 25 mm (1-inch) and minimum size of 2.36 mm (No. 8).
- C. Geotextile (fabric) meeting the physical requirements of Class "A" for Drainage applications of AASHTO M 288 and in accordance with Section 02274.

- D. Perforated Polyvinyl Chloride Pipe (PVCP): Perforated PVCP conforming to ASTM F794 or corrugated PVCP conforming to ASTM F949 or Smooth-Wall PS46 PVCP conforming to ASTM F758.
- E. Geotextile Wrap (Sock): Pipe with circular perforations, and pipe with slotted perforations greater than 1/16 inch least dimension, shall be furnished with manufacturer's recommended geotextile wrap (sock) to prevent entry of aggregate through the perforations.

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Where the subdrain is to cross existing utilities, the Contractor shall verify their elevation and horizontal location through excavation of the test pits shown on the Contract Drawings.

#### **3.02 INSTALLATION**

##### **A. Excavation**

1. Excavate pipe trench in accordance with Section 02221 in the location and to the depth shown on the Contract Drawings.
2. If ground water is encountered, prevent accumulation of water in trench by methods approved by the Engineer.

##### **B. Subdrain Installation**

1. Place geotextile fabric in trench and then place washed aggregate in maximum 6-inch lifts to the invert elevations shown on the Contract Drawings. Compact each lift of washed aggregate with two passes of a vibrating pad compactor.
2. Immediately prior to placement in the trench, all pipe shall be inspected in the presence of the Engineer to verify that it is internally clean and free of damage. Damaged units shall be removed from the construction site and replaced to the satisfaction of the Engineer and at no cost to the Authority.
3. Lay pipe with bell or grooved end up grade.
4. When lowering pipe into the trench and joining the units, take precautions to ensure that the interior of the pipeline remains clean.
5. Prior to the start of construction, the method for control of alignment and grade shall be submitted for approval. The method shall be a laser system or grade board setup to establish a reference grade and alignment control directly above or within the pipe. Use of other equipment may be substituted if, in the opinion of the Engineer, the alternate system produces equivalent accuracy.
6. Make up pipe joints in accordance with the manufacturer's instructions. Do not cover pipe until the Engineer has approved the installation.

7. Place the balance of the washed aggregate in maximum 6-inch lifts to the elevation shown on the Contract Drawings. Compact each lift with two passes of a vibrating pad compactor.
8. Complete geotextile fabric encasement of the washed aggregate as shown on the Contract Drawings and in accordance with the Section 02274.
9. Close all openings in the pipeline with watertight plugs when pipelaying is stopped at the conclusion of the work period or interrupted for any reason.

C. Pipe Installation (HDPE and PVCP)

1. Installation of HDPE and PVCP shall be in accordance with the applicable provisions of ASTM D2321.

3.03 PROTECTION

- A. Care shall be taken not to damage or displace installed pipes during construction.
- B. Where pipe is damaged or displaced, take remedial measures as directed by the Engineer at no cost to the Authority.

**END OF SECTION**

**DIVISION 2**

**SECTION 02842**

**TEMPORARY TRAFFIC BARRIERS**

**PART 1. GENERAL**

1.01 SUMMARY

- A. This Section specifies requirements for temporary traffic barriers.
- B. Coordinate the Work of this Section with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.
- C. Materials and constructions of this Section constitute temporary facilities that are and shall remain the property of the Contractor unless otherwise shown on the Contract Drawings.

1.02 REFERENCES

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

	<u>American Society for Testing and Materials (ASTM)</u>
ASTM A 36	Structural Steel
ASTM A 123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 307	Carbon Steel Externally Threaded Standard Fasteners
ASTM D 1751	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
	<u>West Coast Lumber Inspection Bureau (WCLIB)</u>
	Standard Grading Rules

1.03 SUBMITTALS

Refer to Appendix "A" for submittal requirements.

**PART 2. PRODUCTS**

2.01 MATERIALS

A. General

Provide new materials or, if acceptable to the Engineer, undamaged previously used materials in serviceable condition conforming to requirements specified in this Section. Provide materials suitable for the use intended.

B. Precast Concrete Barriers

1. White Portland cement proportioned to produce 3000 psi reinforced concrete.
2. Joint fillers shall conform to ASTM D 1751

C. Timber Barriers and Curbs

1. Lumber

Douglas Fir or Hem-Fir, WCLIB Standard Grade, Dressed on 4 sides (S4S).

2. Penetrating Sealer

Transparent colorless wood sealer which is effective in retarding transmission of moisture at cross-grain cuts and which shall not interfere with paint finish.

3. Paint Finish

Exterior alkyd resin reflectorized paint in colors shown on the Contract Drawings.

D. Connector, Anchors, Accessories

Fabricated ASTM A 36 shapes, plates and bars welded into assemblies required, with ASTM A 307 steel bolts, lag bolts and other fasteners as required. Finish each assembly and fastener with ASTM A 123 hot-dip zinc coating.

E. Concrete Barrier Flags

Aluminum, 6 x 6 inch, with weather-resistant reflective silver sheet suitable for daylight and night hours.

F. Concrete Barrier Lights

High intensity flashers of type specified in "Maintenance of Traffic and Work Area Protection" of Division 1 - GENERAL PROVISIONS.

G. Timber Barrier Markers

Light-retroreflective markers as shown on the Contract Drawings.

2.02 CONSTRUCTION FEATURES

- A. Fabricate exposed traffic approach end of barriers with a gradual taper with no blunt ends, arranged to redirect the path of a vehicle parallel to the line of normal traffic flow.

- B. Fabricate concrete barriers with a cross section of a portable, concrete safety shape barrier as shown on the Contract Drawings.

1. Fabricate in lengths of 20 feet or less with the rectangular footing cut out at regular intervals to ensure storm water runoff.
2. Furnish connections at vertical joints that will develop the full strength of the barrier system and ensure that the individual elements are aligned to provide a smooth, continuous barrier face.
3. Provide barrier lights as shown on the Contract Drawings.

- C. Fabricate timber barriers and curbs of type and size shown on the Contract Drawings. Paint as shown on the Contract Drawings, or if not shown, paint white with rails of alternating orange and white stripes that slope down toward the side on which traffic is to pass. All paint shall be reflectorized.

### **PART 3. EXECUTION**

#### **3.01 PREPARATION**

Provide and place temporary traffic control devices in accordance with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1.

#### **3.02 INSTALLATION**

- A. Install barriers and curbs at locations shown on the Contract Drawings.
- B. Provide bituminous pavement shimming and leveling as required to ensure smooth, continuously aligned barriers and curbs.
- C. Provide 1/2 inch wide joints between ends of barriers and curbs. At concrete barriers, fill joint with premolded bituminous joint filler.
- D. Secure barriers against lateral displacement by use of drift pins or anchor bolts drilled into roadway surface.
- E. Connect, and continuously operate, concrete barrier lights.

#### **3.03 ADJUSTMENTS**

- A. Maintain, clean, relocate and replace barriers and curbs as required to protect motorists, pedestrians and workers throughout the Work of this Contract.
- B. Remove barriers away from Authority property, when the need has ended, when replaced by approved use of permanent construction, or when directed by the Engineer.
- C. Complete, or if necessary, restore permanent construction. Replace construction that cannot be satisfactorily repaired. Remove temporary paving that is not intended for or acceptable for integration into permanent paving.

END OF SECTION

**SECTION 02842**

**TEMPORARY TRAFFIC BARRIERS**

**APPENDIX "A"**

**SUBMITTALS**

Submit shop drawings of concrete barriers, including details of vertical joint connections, and details of proposed method of relocating concrete barriers in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 – GENERAL PROVISIONS.

END OF APPENDIX "A"

**DIVISION 2**

**SECTION 02894**

**HANDLING, TREATMENT AND DISPOSAL OF NON-HAZARDOUS SOIL  
MATERIALS  
(NEW YORK)**

**PART 1. GENERAL**

**1.01 SUMMARY**

- A. This Section specifies requirements for the handling, treatment, and disposal of non-hazardous soil materials described in Appendix B to this Section.
- B. The method of disposal shall either be on-site treatment followed by off-site disposal or removal off-site for ultimate disposal. This may consist of incineration or other destructive method, or recycling. The treatment method shall be approved by both the New York State Department of Environmental Conservation (NYSDEC) and the Engineer.

**1.02 DEFINITIONS**

- A. "RCRA" means the Resource Conservation and Recovery Act and "TSCA" means the Toxic Substance Control Act.
- B. "Non-Hazardous Soil Materials" means solid debris, clay, silt, sand, and organic materials that are not designated as hazardous waste".
- C. "Solid Waste Facility" (SWF) means any system, site, equipment or building which is utilized for the storage, collection, processing, transfer, transportation, separation, recycling, recovering or disposal of non-hazardous soil material.
- D. "Disposal" shall mean the removal of non-hazardous soil materials from the site and placement of material in a SWF.

**1.03 WORK AREA CONDITIONS**

- A. Throughout the Work of this Section, representatives of NYSDEC may be at the Area of Work. The Contractor shall cooperate with and give such assistance to such representatives as may be directed by the Engineer.
- B. An environmental consulting and/or laboratory entity shall be utilized as stipulated in Appendix C to this Section.
- C. If required in Appendix B of this section, a Safety Officer shall be present at the site at all times of Work of this Section. Such Safety Officer shall not be a substitute for the competent person stipulated in Division 1 hereof.

- D. Display or have available at all times at the site a copy of the approved Health and Safety Plan (HASP) in accordance with 1.04 F. herein.

#### 1.04 QUALITY ASSURANCE

- A. The Contractor shall have a minimum of 3 years experience in successfully completing projects similar in size and scope to the Work under this Section.
- B. The Contractor shall hold current, valid off-site transportation permits stipulated in Appendix D of this Section, and shall possess a spill prevention, countermeasures and containment plan (SPCC).
- C. The Contractor shall conduct its operations for Work of this Section in accordance with the environmental consulting and/or laboratory entity report as stipulated in Appendix C to this Section.
- D. Employ for Work of this Section, workers trained in accordance with OSHA 29 CFR 1926.21.
- E. If required in Appendix B in this Section, the Safety Officer designated for Work of this Section shall hold the following current, valid certifications:
  - 1. First Aid and Cardiopulmonary Resuscitation (CPR).
  - 2. *Completion of OSHA (29 CFR 1910.120 (e)(4)) Training or EPA Training Course 165.5 entitled "Hazardous Materials Incidental Response Operations".*
  - 3. *Completion of OSHA (29 CFR 1910.120 (e)(4)) Management and Supervisor Training.*
- F. In addition to the requirements of the Section of Division 1 GENERAL PROVISIONS entitled "Safety Provisions", the Contractor shall provide for Work of this Section a site-specific Health and Safety Plan (HASP). Such plan shall conform to the requirements of OSHA 29 CFR 1910.120 (d)(4) including, but not limited to, the following:
  - 1. The HASP shall be approved by a certified industrial hygienist, and read and signed by all affected personnel.
  - 2. Identify key personnel responsible for site safety, including the name and qualifications of Safety Officer.
  - 3. Address levels of personal protection to be employed during Work, setting forth specific criteria for choices of protective clothing and equipment.
  - 4. Designate Work area exclusion zone(s) and decontamination zone(s) as defined by OSHA. Describe how zone(s) will be marked/barricaded and made known to all persons at this site.
  - 5. Establish site emergency procedures, for example, escape routes, signals for evacuating work parties, emergency communications, procedures for response to fire and explosions. Describe emergency equipment to be made available on site, such as portable extinguishers, first aid kit, etc.
  - 6. Identify, provide location of, and list arrangements with the nearest medical facility.
  - 7. Set forth a program for air monitoring in the Work area (exclusion zone). List and describe equipment to be used.

8. Provide action levels based on air monitoring to upgrade personal protection against airborne contaminants.
  9. Set forth procedures for decontamination of personnel, materials and equipment.
- G. The disposal facility utilized by the Contractor for receipt of materials transported away from the site shall hold current valid permits and licenses stipulated in Appendix D to this Section.

#### 1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

### **PART 2. PRODUCTS**

(Not Used)

### **PART 3. EXECUTION**

#### 3.01 PREPARATION

- A. Prior to starting Work of this Section make an inspection accompanied by the Engineer, to determine physical condition of adjacent existing structure(s) or construction that is to remain.
- B. The Contractor shall prepare and submit to the Engineer for approval a written description of such conditions including photographic documentation when requested by the Engineer.

#### 3.02 REMOVAL AND DISPOSAL

- A. Remove material, prepare for off-site transportation and perform operations in accordance with Appendix B to this Section.
- B. Perform operations with care adjacent to existing constructions that are to remain and in confined areas. Do not operate power equipment within confined areas or within 2 feet of existing constructions that are to remain. Provide protection of such constructions, and use hand removal methods at locations within 2 feet of such constructions.
- C. Take all necessary precautions to prevent contamination of adjacent property and construction.
- D. Unless specifically approved in writing by the Engineer, the Contractor shall not stop enroute either before or after picking up non-hazardous soil materials from Authority property to pick up additional material from any party.

**END OF SECTION**

**SECTION 03100**  
**CONCRETE FORMWORK**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section specifies requirements for cast-in-place concrete formwork.

**1.02 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. Design calculations for formwork and shoring shall be prepared by a Professional Engineer licensed in the State of New York. 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 Specification (NDS) for Wood Constructions" of the American Forest and Paper Association.
- C. Wood formwork in PATH public areas, including areas adjacent to PATH Tracks, shall be made from fire retardant treated wood.
- D. For all other products furnished for the Work of this section, the contractor shall comply with the reference standards of the local building code.
- E. Shop Drawings
1. All formwork and shoring shop drawings shall be signed and sealed by a Professional Engineer licensed in the State of New York. 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).

## 1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements

## 1.04 REFERENCES

- A. American Concrete Institute (ACI)
  1. 347 - Guide to Formwork for Concrete
  2. 117 - Standard Specifications for Tolerances for Concrete Construction and Materials
  3. 318 - Building Code Requirements for Reinforced Concrete
- B. ASTM International (ASTM)
  1. D1751 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types)
  2. D5516 – Standard Test Method for Evaluating the Flexural Properties of Fire-Retardant Treated Softwood Plywood Exposed to Elevated Temperatures
  3. D5664 – Standard Test Method for Evaluating the Effects of Fire-Retardant Treatments and Elevated Temperatures on Strength Properties of Fire-Retardant Treated Lumber
  4. E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
  5. E96 – Standard Test Methods for Water Vapor Transmission of Materials
  6. E1745 – Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
- C. American Forest and Paper Association (AF&PA)
  1. ANSI/AF&PA NDS - National Design Specification (NDS) for Wood Constructions
- D. West Coast Lumber Inspection Bureau
- E. American Plywood Association (APA)
- F. Douglas Fir Plywood Association (DFPA)
- G. West Coast Lumber Inspection Bureau
  1. Standard Grading and Dressing Rules No. 17
- H. For FSC-certified wood products, refer to the Forest Stewardship Council - United States, 1155 30th Street, NW Suite 300, Washington, D.C, <http://www.fscus.org/>
- I. American Wood-Preservers' Association (AWPA)
  1. C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Process
  2. C27 - Plywood - Fire-Retardant Treatment by Pressure Process

## 1.05 SUSTAINABLE DESIGN REQUIREMENTS

### A. Sustainable Design General Requirements

1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section 01352 and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the Work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.

### B. Sustainable Design Performance Criteria

1. Fifty percent wood-based materials used on this Project, whether permanently-installed or temporary, shall be certified in accordance with the Forest Stewardship Council (FSC) guidelines.
  - a. Applicable products include, but are not limited to, structural framing and general dimensional framing, flooring, finishes, furnishings, miscellaneous blocking, fire rated plywood back panels used for equipment mounting, architectural panels, plywood, and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers.
  - b. Certified wood material suppliers may be researched through the following websites: [www.rainforest-alliance.org/greenbuilding](http://www.rainforest-alliance.org/greenbuilding), [www.smartwood.org](http://www.smartwood.org), <http://www.certifiedwoodsearch.org/searchproducts.aspx>, [http://www.fscus.org/certified\\_companies/](http://www.fscus.org/certified_companies/).
  - c. Any FSC-certified wood products deemed unavailable must be reported by the Contractor to the Engineer.
  - d. Wood products previously purchased and used on prior projects, which are reused on this Project, are exempt from the FSC certification requirement. Appropriate documentation certifying reused wood products must be submitted.
  - e. Documentation of all FSC-certified wood products shall be in accordance with the Sustainable Design Submittal Requirements herein. Wood products submitted without acceptable documentation will be rejected.
2. The manufacturing location (final assembly) of forms shall be documented in accordance with the sustainable design submittal requirements of this Section.

## 1.06 QUALITY ASSURANCE

- A. Tolerances shall be within the "Suggested Tolerances" specified in ACI 117, 301 and 347 unless otherwise indicated.
- B. Formwork shall not be constructed until submittals have been accepted.

## 1.07 SUBMITTALS

- A. All submittals shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 – GENERAL PROVISIONS.
- B. Shop Drawings
1. Formwork and shoring shop drawings for areas accessible to the public and/or concrete exposed to view in the finished construction at least 21 days prior to ordering any material or constructing any formwork.
  2. A layout of all embedded items, including electrical and telephone conduit and plumbing and drainage pipes, at least 15 days prior to concrete placement.
- C. Catalog Cuts, Material Certification and Test Results
1. Material certifications, brand names and test results (where required) for all formwork materials. Submit at least 35 days prior to concrete placement.
  2. Certification of recycled content and origin of materials for LEEDS rating.
  3. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
    - a. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
    - b. Include proof of approval for use in New York City.
- D. Samples
1. Form ties and spreaders with manufacturer's specifications, submit at least 21 days prior to ordering any material.
  2. Tapes for form joints with manufacturer's literature.
  3. Waterstops and premolded expansion joint filler.
  4. Form liners with manufacturer's specifications, submit at least 21 days prior to ordering any material.
  5. Form coating agent with manufacturer's literature.
- E. Design Computations
1. Design computations for areas accessible to the public and/or concrete exposed to view in the finished construction shall be submitted to the Engineer (as indicated in Section 1.02 A) at least 21 days prior to ordering any material or constructing any formwork.
- F. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.

- b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
  - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
  - 2) The manufacturing location of the supplied product(s).
  - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
  - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
  - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
- 2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
- 3. Product cut sheets for materials that meet the SDMCF.
- 4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
- 5. Documentation for all FSC-certified wood products. Provide copies of vendor invoices for each certified wood product, itemizing product costs and FSC chain-of-custody certification tracking numbers.
- 6. Documentation that all plywood, composite wood and agrifiber products installed within the Project's weatherseal do not contain added urea-formaldehyde resins.
- 7. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. Earth Forms

- 1. Use only for footings where shown on the Contract Drawings.

#### B. Lumber Forms

- 1. 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.
- 2. FSC-certified products shall be provided to comply with the project's Sustainable Design goals (see Article 1.05 - Sustainable Design Requirements).

## C. Plywood Forms

1. Use for exposed finish concrete. Forms shall conform to US 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 by 8-foot) panels.
2. 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.
3. 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.
4. FSC-certified products shall be provided to comply with the project's Sustainable Design goals (see Article 1.05 - Sustainable Design Requirements).

## D. Prefabricated Forms

1. Prefabricated forms shall be as listed below and where shown on the Contract Drawings:
  - a. Pan Type Void Forms: Removable steel or reinforced plastic of sizes and profiles required to produce completed Work shown.
  - b. 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

1. Sheet steel, suitably reinforced and designed for the particular use shown on the Contract Drawings.

## F. Form Liners

1. Smooth, durable, grainless, and non-staining hardboard, unless otherwise shown on the Contract Drawings.
2. FSC-certified products shall be provided to comply with the project's Sustainable Design goals (see Article 1.05 - Sustainable Design Requirements).

## G. Framing, Studding, and Bracing Stud or No. 3 Structural Light Framing grade.

1. FSC-certified products shall be provided to comply with the project's Sustainable Design goals (see Article 1.05 - Sustainable Design Requirements).

## H. Form Ties and Spreaders

1. 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

1. 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, or an approved equal, unless otherwise shown on the Contract Drawings (the maximum allowable VOC content for form release agents is 250 grams/liter):
1. GRACE ® Release Crete, Grace Construction Products
  2. "Synthex;" Industrial Synthetics Company
  3. "Nox-Crete Form Coating;" Nox-Crete Company
- K. Vapor Barrier
1. Provide vapor barrier which conforms to ASTM E1745, Class A. The membrane shall have a water-vapor transmission rate of no greater than 0.008 gr./ft-squared/hour when tested in accordance with ASTM E96. The vapor barrier shall be placed over prepared base material where indicated below slabs on grade. Vapor barrier shall be no less than 15 mil. thick. Provide Stego Wrap (15 mil.) Vapor Barrier by Stego Industries LLC, Griffolyn Vaporguard by Reef Industries or Perminator 15 by W.R. Meadows.
- L. Bituminous Joint Filler: ASTM D1751
- M. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Lumber or plywood formwork in PATH public areas, including areas adjacent to PATH Tracks shall be fire-retardant treated wood with pressure impregnated with fire-retardant chemicals to comply with performance requirements of AWWA C20 (lumber) and AWWA C27 (plywood) respectively. Each treated item shall be identified with classification marking of Underwriters Laboratories, Inc., U.S. Testing, or Timber Products Inspection, indicating surface burn characteristics and New York City BSA or MEA approval number.
1. Flame spread rating: 0-25, per ASTM E84 when tested for a 30 minute period; flame front shall not progress more than 10-1/2 feet beyond the centerline of the test burner at any time during the test.
  2. AWWA Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
  3. Interior Type A High Temperature (HT): Low-hygroscopic formulation.
  4. Use treatment that does not promote corrosion of metal fasteners and anchors.
  5. Treatment type shall have been tested for strength retention after exposure to elevated temperatures; ASTM D5664 for lumber, ASTM D5516 for plywood.
  6. Treatment chemicals shall be free of halogens, sulfates, ammonium sulfate and formaldehyde.
  7. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.
  8. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping.
  9. Lumber and plywood shall be kiln-dried after treatment to a maximum moisture content of 19 percent and 15 percent, respectively.
  10. Treatment type shall permit end cuts and drilled holes; do not rip saw or plane surfaces of fire-retardant treated lumber.

**PART 3 - EXECUTION****3.01 PREPARATION****A. Earth Forms**

1. Trench earth forms 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**

1. 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 personnel, 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. 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**

1. 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. All corners and edges of concrete shall be protected during and after stripping. 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**

1. Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

**E. Framing, Studding and Bracing**

1. 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 2 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

1. 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 shall be corrected to the satisfaction of the Engineer at no cost to the Authority.

## B. Chamfered Corners

1. 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

1. Form ties shall be of sufficient strength and used in sufficient quantities to prevent spreading of the forms. Place ties at least 1 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

1. 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

1. Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

## F. Construction Joints

1. 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

1. 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 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, shall meet the requirements of ACI 318 (Section 6.3). Approved coatings for aluminum shall be as follows unless otherwise shown on the Contract Drawings:

- a. Conlux
  - 1) Primer - Bond Plex 46 or 66 (water borne urethane)
  - 2) Topcoat - Epolon Multi-Mil 39 (epoxy polyamide)
- b. Sherwin Williams
  - 1) Topcoat - Heavy Duty Epoxy B67/B60B3 (epoxy polyamide), self-priming
- c. Benjamin Moore
  - 1) Primer - Epoxy Rust Inhibitive Primer (epoxy polyamide)
  - 2) Topcoat -Epoxy Enamel (epoxy polyamide)
- d. Or approved equal.

#### H. Openings for Items Passing Through Concrete

- 1. 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.

#### I. Screeds

- 1. 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. Screenshot Supports

- 1. 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

- 1. 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

- 1. 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

1. 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.
- 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 03200**  
**CONCRETE REINFORCEMENT**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. This Section specifies requirements for furnishing and installing concrete reinforcement.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. None

1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements

1.04 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO)
1. M32 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
  2. M55 - Standard Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement
  3. M221 - Standard Specification for Steel Welded Wire Fabric, Deformed for Concrete Reinforcement
  4. M31 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  5. M284 - Standard Specification for Epoxy -Coated Reinforcing Bars
- B. American Concrete Institute (ACI)
1. 315 - Details and Detailing of Concrete Reinforcement
  2. 318 - Building Code Requirements for Structural Concrete and Commentary
- C. ASTM International (ASTM)
1. A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
  2. A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
  3. A185 - Standard Specification for Steel Welded Wire, Reinforcement, Plain, for Concrete
  4. A497 - Standard Specification for Welded Wire Reinforcement, Deformed for Concrete
  5. A615 - Standard Specification for Deformed and Plain Carbon – Steel Bars for Concrete Reinforcement

- 6. A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
  - 7. A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Steel Bars
- D. American Welding Society (AWS)
- 1. D1.4 - Structural Welding Code - Reinforcing Steel
- E. Concrete Reinforcing Steel Institute (CRSI)
- 1. Manual of Standard Practice
  - 2. Placing Reinforcing Bars

## 1.05 SUSTAINABLE DESIGN REQUIREMENTS

- A. Sustainable Design General Requirements
- 1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section 01352 and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the Work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.
- B. Sustainable Design Performance Criteria
- 1. Steel products shall contain a minimum of 75 percent (by weight) recycled content, calculated by adding the post-consumer recycled content percentage to one-half of the post-industrial recycled content percentage. Certify the recycled content in accordance with the Sustainable Design Submittal Requirements of this Section.
  - 2. The manufacturing location (final assembly) of all products shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
  - 3. The origin of the raw materials from which all products were manufactured shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.

## 1.06 QUALITY ASSURANCE

- A. If requested by the Authority, the Contractor shall provide samples from each heat of reinforcing steel delivered in a quantity adequate for testing.
- B. If requested by the Authority, the Contractor shall provide samples of each welded of mechanical splice used in the Work in a quantity and of dimensions adequate for testing.
- C. No materials shall be cut or fabricated until shop drawings have been approved by the Engineer.

## 1.07 SUBMITTALS

- A. All submittals shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 – GENERAL PROVISIONS.
- B. Shop Drawings
  - 1. 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 in accordance with ACI 315.
  - 2. All proposed changes to the size, spacing, splicing or arrangement of the reinforcing steel shown on the Contract Drawings shall be clearly flagged as such on the shop drawings.
- C. Catalog Cuts, Material Certification and Test Results
  - 1. Catalog cuts for chairs, spacers, hangers and mechanical splices.
  - 2. Certification from the applicator of epoxy that the epoxy-coated reinforcing bars meet the requirements of ASTM A775 (AASHTO M284).
  - 3. Test results and certification from the galvanizer that the weight, application and testing of zinc coating conforms to specifications and ASTM A767.
  - 4. Certified mill test reports for all concrete reinforcement.
  - 5. Description of the reinforcing steel manufacturers marking pattern.
  - 6. Certification of recycled content and origin of materials for LEEDS Ratings.
- D. Samples
  - 1. Mechanical Splice Hardware.
  - 2. Material used to repair coating.
- E. Design Computations
  - 1. Design computations for all proposed changes to the size, spacing, splicing or arrangement of the concrete reinforcement shown on the Contract Drawings.
- F. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
  - 1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.
    - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
      - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
      - 2) The manufacturing location of the supplied product(s).
      - 3) The location (source) of the raw materials used to manufacture the supplied product(s).

- 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
  - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  3. Product cut sheets for materials that meet the SDMCF.
  4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
  5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

#### 1.08 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.*

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Reinforcing Bars: ASTM A615 (AASHTO M31), deformed, Grade 60, unless otherwise shown on the Contract Drawings. Reinforcing steel shall have the manufacturers mill marking rolled into the bar, which shall include the producer, size, type and grade. Coated bars where shown on the Contract Drawings shall comply with the following:
  1. Galvanized Reinforcing Bars:
    - a. ASTM A767, Class-I hot-dip galvanized, after fabrication and bending.
    - b. Coat sheared and cut ends and damaged coating with a zinc-rich formulation conforming to ASTM A767 in accordance with the material manufacturers' recommendations.
  2. Epoxy-coated Reinforcing Bars:
    - a. ASTM A775 (AASHTO M284)
    - b. Coat sheared and cut ends and damaged coating with an epoxy patching material conforming to ASTM A775 (AASHTO M284) in accordance with the patching material manufacturers recommendations.

B. Welded Wire Fabric

1. Types shall be as shown on the Contract Drawings and shall comply with the following:
  - a. Plain, ASTM A185 (AASHTO M55), flat sheets for size W5 and larger and coiled rolls for sizes below W5.
  - b. Deformed, ASTM A497 (AASHTO M221), flat sheets for sizes D5 and larger and coiled rolls for sizes below D5.
  - c. Galvanized wire fabric shall conform to ASTM A767.

C. Fabricated Steel Bar Mats

1. Fabricated steel bar mats shall be in accordance with ASTM A184, when shown on the Contract Drawings, and as follows:
  - a. Bar grade, size and spacing as shown on the Contract Drawings.
  - b. Welded connections, unless otherwise shown on the Contract Drawings.

D. Steel Wire

1. Steel wire shall comply with ASTM A82 (AASHTO M32), plain finish, unless otherwise shown on the Contract Drawings.

## 2.02 ACCESSORIES

A. Tie Wire

1. 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

1. 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:
  - a. For supporting epoxy-coated reinforcing bars, use plastic coated supports, or supports fabricated from or coated with a dielectric material;
  - b. For slabs-on-grade, use supports with horizontal plate runners;
  - c. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, use supports with plastic capped legs (CRSI, Class 1).
  - d. Where architectural concrete is shown on the Contract Drawings, use plastic side form spacers.

C. Mechanical Splices

1. Mechanical splices shall conform to ACI 318 requirements. Mechanical couplers shall develop a tensile strength which exceeds 125 percent of the yield strengths of the reinforcing bars being spliced at each splice. The reinforcing steel and coupler used shall be compatible for obtaining the required strength of the connection.
2. Hot-forged sleeve type couplers shall not be used. Acceptable mechanical couplers shall be Bar-Grip Couplers as manufactured by Barsplice Products, Inc., "Lenton Tapered Threaded Splices" as manufactured by Erico Products, Inc; and

"Threaded Coupler" as manufactured by Williams Form Engineering Corp; or approved equal.

### 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 this Section.

### 3.02 SPLICES

- A. Reinforcing bar splices shall only be used at locations shown on the Drawings. When it is necessary to splice reinforcing at points other than where shown, splice shall be in accordance with ACI 318, Class B unless otherwise shown on the Contract Drawings and acceptable to the Engineer.
- B. The length of the lap for reinforcing bars shall be at a minimum in accordance with ACI 318, and as shown on the Contract Drawings.
- C. Laps of welded wire fabric shall be in accordance with ACI 318. Adjoining sheets shall be securely tied together, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.
- D. Mechanical and welded splices shall be used only where shown on the drawings or when approved by the Engineer.
- E. Couplers, which are located at a joint face shall be the type which can be set either flush or recessed from the face as shown on the drawings. The Couplers shall be sealed during concrete placement to completely eliminate couplers or cement paste from entering. After concrete is placed, concrete intended for future connections shall be plugged and sealed to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged with plastic plugs, which have an O-ring seal.

**END OF SECTION**

## DIVISION 3

### SECTION 03300

#### PLACEMENT OF PORTLAND CEMENT CONCRETE

#### PART 1. GENERAL

##### 1.01 SUMMARY

This Section specifies requirements for casting Portland Cement concrete.

For requirements for furnishing Portland Cement concrete see Section 03301, entitled PORTLAND CEMENT CONCRETE, LONG FORM.

##### 1.02 REFERENCES

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

American Society for Testing and Materials (ASTM)

- |             |  |
|-------------|--|
| ASTM D 1751 | Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types) |
| ASTM D 1752 | Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction                         |

New Jersey Department of Transportation (NJDOT) Standard Specifications for Road and Bridge Construction

Port Authority Specification sections:

- |        |                          |
|--------|--------------------------|
| #03100 | Concrete Formwork        |
| #03200 | Concrete Reinforcement   |
| #03301 | Portland Cement Concrete |

##### 1.03 ENVIRONMENTAL REQUIREMENTS

- A. For Cold Weather Requirements see Section 03301, entitled PORTLAND CEMENT CONCRETE, LONG FORM.
- B. Reinforcement, forms and soils with which concrete will be in contact shall be completely frost-free.
- C. Comply with all provisions of this Section for placing and curing.
- D. For Hot Weather Requirements see Section 03301, entitled PORTLAND CEMENT CONCRETE, LONG FORM.

## 1.04 QUALITY ASSURANCE

- A. A pre-concrete construction meeting will be conducted as specified in Part 1.06 of Specification Section 03301 entitled PORTLAND CEMENT CONCRETE, LONG FORM.
- B. For concrete where riding surface tolerances are required, as indicated on the contract drawings, the following requirements shall 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 shall not exceed 1/4 inch in 16 feet. Tests shall be made in both the longitudinal and transverse direction of the slab and shall span joints. Any deficiencies shall be corrected as specified in 3.04A and 3.04B.
  - 2. The Engineer will survey the slab surface for vertical deviation from grade. Vertical deviation from the grade shown on the Contract Drawings shall not exceed plus or minus 0.04 foot at any point.
  - 3. Finished grade shall be determined by running levels at intervals of 25 feet longitudinally and transversely. Deficiencies shall be corrected as specified in 3.04A and 3.04B.
- C. Specified concrete finishes, as shown on the Contract Drawings, shall conform to the requirements set forth in 3.02D.2. Deficiencies shall be corrected as specified in 3.04D.

## 1.05 SUBMITTALS

- A. For submittals - see Appendix "A".
- B. Do not deliver any concrete to the construction site until all approvals as required in this section, and required by Section 03301, have been obtained.

## PART 2. PRODUCTS

### 2.01 MATERIALS

- A. Expansion Joints (Except For Bridge Decks) and Contraction Joints
  - 1. Vinyl plastic water stops shall be of types and sizes shown on the Contract Drawings and conforming to Corps of Engineers Specification for Polyvinylchloride Waterstops  
(Designation: CRD-C572-60, 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.

- B. For Control Joints see Section 03301, entitled PORTLAND CEMENT CONCRETE, LONG FORM.
- C. For Curing Materials see 2.02P, Section 03301, entitled PORTLAND CEMENT CONCRETE, LONG FORM.
- D. For Evaporation Retardant see 2.02Q, Section 03301, entitled PORTLAND CEMENT CONCRETE, LONG FORM.

### **PART 3. EXECUTION**

#### **3.01 PREPARATION**

- A. Construction Joints
  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. Joints shall be placed 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.
- B. Expansion and Contraction Joints
  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.
- C. Control Joints see 3.04 Section 03301, entitled PORTLAND CEMENT CONCRETE, LONG FORM.
- D. Preparation for Placing Concrete
  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, which 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. The repair crew shall be available at the time of examination.
  4. Check all 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 any base course or fill has been properly compacted in accordance with the contract requirements.
8. Vent holes (1/4 inch diameter, minimum) shall be provided in edge angles or embedded plates at joints where vibrating alone will not ensure elimination of voids. Such holes shall be located at high points and with uniform spacing along joints for escape of air during concreting operations. Evidence of voids adjacent to embedments shall be cause for rejection of work. All vent holes and procedures for placement of concrete at joints shall be submitted for review and approval with the shop drawings.

### 3.02 APPLICATION

#### A. Bonding New Concrete to Existing Concrete:

Where new concrete shall 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 limited so that the broomed material does not dry before being covered with additional material as required for final grade.

#### B. Placing Concrete:

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 shall permit rapid placing of concrete of the required consistency and shall preclude segregation
7. The method and equipment used to transfer concrete from mixer to forms shall 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 in a pile using a metal hopper and an elephant trunk. The hopper and elephant trunk shall be set above the top of pile to permit the escape of air as the concrete is placed. Elephant trunks shall be removed in sections while filling pile from bottom of reinforcing cage to top of pile. Elephant trunks shall extend a minimum distance of 10 feet below top of pile, or to bottom of reinforcing cage, whichever is greater. The top 15 feet of the concrete poured from the top of pile shall be vibrated or rodded. No cold joints shall 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 shall 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. Avoid 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. The concrete shall be placed to require as little rehandling as possible. The concrete shall be placed and spread using an approved mechanical spreading device that prevents segregation of the materials. Placing shall be continuous between contraction joints. Necessary hand spreading shall be done with shovels--not rakes.
13. Concrete shall be deposited as near to joints as possible without disturbing them but shall not be discharged onto a joint assembly unless placement is centered above the joint assembly.
14. Concrete shall be thoroughly consolidated 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. Vibrators shall not be permitted 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.

C. Concrete Placing and Finishing Equipment for Bridge Decks and other Riding Surfaces:

1. For slab or overlays 8 inches or more thick internal vibrators shall be used. Internal vibrators shall be gang-mounted and supplemented with manual vibrators subject to the following:
  - a. Manual, hand-held vibrators shall be used adjacent to joint assemblies and similar locations where gang-mounted vibrators are not practical.
  - b. All vibrators shall be checked 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 shall be allowed.
3. Manual tools, such as bull floats, trowels, brooms and other similar hand tools.

D. Consolidation and Finishing

1. Bridge Decks and other Riding Surfaces
  - a. Machine finishing shall conform to NJDOT Standard Specifications Subsection 405.13, Item B.
  - b. Finishing at and adjacent to joints shall conform to NJDOT Standard Specifications Subsection 405.13, Item C.
  - c. Hand finishing methods will not be permitted, except under the following conditions: in the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade; 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. An approved portable screed shall be used. A second screed shall be provided 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 or of other suitable material covered with metal. Consolidation shall be attained 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 not be 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 pavement 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 pavement 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, it shall be tested 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. Advancing shall be 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 pavement 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 assure that the surface across joints meets the smoothness requirements set forth in 1.04B. Straightedge testing and surface corrections shall continue until the entire surface is found to be 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.
  - f. The surface across the joints shall be tested with a 16-foot straightedge as the joints are finished and any irregularities in excess of 1/4 inch shall be corrected 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" shall be a surface of concrete obtained by the use of special forms as specified in the Section entitled "Concrete Formwork". All fins and other irregularities in the exposed surfaces of concrete shall be removed 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" shall be 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" shall be a surface of concrete obtained by the use of a wood float. A float finish shall be applied to horizontal surfaces immediately after screeding and before initial setting has begun.

- d. "Trowel Finish" shall be 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" shall consist of a monolithic layer of abrasive concrete having a minimum thickness of 3/4 inch and which shall be Emericrete, as manufactured by the Walter Maguire Company, Inc., 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" shall be a surface of concrete obtained by the use of a burlap drag, after screeding and floating the surface of the concrete. The burlap shall be dragged 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. The preparation of the surface prior to dragging shall be performed from a bridge that shall not come in contact with the fresh concrete at any point. The use of any burlap that causes irregularities or grooves greater than one-sixteenth inch in depth in the concrete surface will not be permitted. Burlap shall be rinsed or washed 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. Proper finish shall be achieved 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 is in a condition that the surface will be 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. "Tine finish" and acceptance criteria for "Tine finish" shall conform to the requirements of the NJ DOT Standard Specifications, Subsection 405.13, Item G.

j. "Saw Cut Grooved Surface" shall conform to the requirements of the NJ DOT Standard Specifications, Division 500. For deck slabs, conform to Subsection 501.15, Item 3. For overlays, conform to Subsection 518.06, Item C13.

k. Concrete Curbs and Sidewalks

(1) Give sidewalks a "Float Finish" and tool edges and joints for a width of two 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.

3. 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.

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, sides of slabs greater than 12 inches in thickness shall be cured in accordance with 3.03.

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.

3.03 For CURING requirements, see 3.05, Section 03301, entitled PORTLAND CEMENT CONCRETE, LONG FORM. For exterior slab and overlay work, wet-curing procedures shall be performed immediately after the concrete has been worked with a screed.

### 3.04 CORRECTION OF DEFICIENCIES

#### A. Diamond Grinding and Partial Depth Removal

1. Cured riding surfaces that do not meet the smoothness or finished grade requirements set forth in 1.04B shall be corrected, to obtain the specified smoothness deviation, as follows:
  - a. High spots between 1/4" and 1/2" and surfaces that exceed the finished grade requirements shall be identified and ground with diamond grinding equipment.
  - b. Low spots between 1/4" and 1/2" and surfaces that are below the finished grade requirements shall be corrected by partial depth removal of the entire slab to 1" below rebars by hydrodemolition, or hydromilling and constructing an overlay in conformance with these specifications.
  - c. Slab areas that exceed finished grade or smoothness criteria by more than 1/2" shall be removed as set forth in 3.04B.
2. The diamond grinding equipment shall be approved by the Engineer and have a minimum grinding head of 36 inches.
3. Where grinding is required, the entire width of the riding surface by the length of defective area shall be ground. In the sole opinion of the Engineer, if the deficiencies are closely spaced and grinding individual areas will adversely affect ride, the entire surface shall be ground.
4. Slurry produced from grinding operations shall be disposed of off Authority property.
5. Diamond grinding, partial depth removal and construction of an overlay, if required to correct deficiencies, shall be performed at no additional cost to the Authority.

#### B. Remove and Replace Slabs

Full concrete slabs shall be removed and replaced in a manner approved by the Engineer and at no additional cost to the Authority if any of the following deficiencies exist in the finished riding surface, unless the Engineer elects to accept the concrete:

1. Slabs showing high or low spots exceeding 1/2 inch when tested in accordance with 1.04B.
- C. If the slab concrete is found to have developed plastic shrinkage cracks, the contractor shall repair it at his cost with an approved epoxy or methacrylate repair system or remove as directed by the Engineer.
- D. If concrete finishes do not meet the requirements set forth for the specified finishes, the hardened concrete shall be re-finished as directed by the Engineer, at no additional cost to the Port Authority.

END OF SECTION

## SECTION 03300

### PLACEMENT OF CONCRETE

#### SUBMITTALS

#### APPENDIX "A"

The following shall be submitted to the Engineer for approval except as otherwise noted:

- A. Shop Drawings
  - 1. As per Division 1, "Shop Drawings, Catalog Cuts and Samples".
  - 2. Proposed number, location and details of contraction, control, expansion and construction joints at least 15 days prior to concrete placement.
  - 3. Test placement details at least 15 days before test placement.
- B. Catalog Cuts, Material Certification and Test Results
  - 1. As per Division 1, "Shop Drawings, Catalog Cuts and Samples".
  - 2. At least 35 days prior to concrete placement, the following:
    - a. Brand name and chemical composition of form oil, evaporation retarder and curing compounds (liquid membrane).
    - b. Source of expansion and/or contraction joints.
    - c. Certification of compatibility and five-year performance record for liquid membrane, if used under conditions specified in 3.03C.
- C. Samples
  - 1. As per Division 1, "Shop Drawings, Catalog Cuts and Samples".
- D. Construction Procedures, and Quality Control and Assurance Documents
  - 1. At least 35 days prior to concrete placement, the following:
    - a. Method of curing and curing materials.
    - b. Type, number and method of application of concrete vibrators.
    - c. Method of concrete placement in pipe piles (including elephant trunk size, length and material type).
    - d. Method of concrete placement and consolidation adjacent to joint assemblies and embedded hardware.
- E. Design Computations
  - 1. If required by the Engineer or noted on the contract drawings, design computations shall be signed and sealed by the Professional Engineer licensed in the state where Work is being done.

END OF APPENDIX "A"

**DIVISION 3****SECTION 03301****PORTLAND CEMENT CONCRETE, LONG FORM****PART 1. GENERAL**

## 1.01 SUMMARY

This Section and its appendices specify requirements for Portland Cement Concrete mix proportions, materials used in concrete mixes, 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):

Standard Specifications for Highway Bridges

M 182	Burlap Cloth Made From Jute or Kenaf
TP 26	Quality of Water to be Used in Concrete
T 277	Electrical Indication of Concrete's Ability to Resist Chloride
T 318	Water Content of Freshly Mixed Concrete Using Microwave Oven Drying

American Concrete Institute (ACI)

211	Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
213	Guide for Structural Lightweight Aggregate Concrete
222R	Corrosion of Metals in Concrete
301	Specifications for Structural Concrete for Buildings
302.1	Guide for Concrete Floor and Slab Construction
303.1	Cast in Place Architectural Concrete
304R	Guide for Measuring, Mixing, Transporting and Placing Concrete

- 304R Chapter 8: Concrete Placed Under Water
- 305R Hot Weather Concreting
- 306R Cold Weather Concreting
- 308 Standard Practice for Curing Concrete
- 318 Building Code Requirements for Reinforced Concrete
- 548.4 Standard Specification for Latex Modified Concrete Overlays

American Society for Testing and Materials (ASTM):

- C 31 Practice for Making and Curing Concrete Test Specimens in the Field
- C 33 Specification for Concrete Aggregates
- C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
- C 42 Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
- C 78 Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
- C 88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- C 94 Specification for Ready-Mixed Concrete
- C 109 Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)
- C 114 Test Methods for Chemical Analysis of Hydraulic Cement
- C 131 Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates
- C 138 Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
- C 143 Test Method for Slump of Hydraulic Cement Concrete
- C 150 Specification for Portland Cement
- C 156 Test Method for Water Retention by Concrete Curing Materials
- C 157 Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete
- C 171 Specification for Sheet Materials for Curing Concrete
- C 172 Practice for Sampling Freshly Mixed Concrete
- C 173 Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
- C 174 Measuring Length of Drilled Concrete Cores

- C 191 Test Method for Time of Setting of Hydraulic Cement by Vicat Needle
- C 227 Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
- C 231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
- C 260 Specification for Air Entraining Admixtures for Concrete
- C 289 Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
- C 309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- C 311 Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete
- C 330 Specification for Lightweight Aggregates for Structural Concrete
- C 494 Specification for Chemical Admixtures for Concrete
- C 535 Test for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- C 566 Test Method for Total Moisture Content of Aggregate by Drying
- C 567 Test Method for Unit Weight of Structural Lightweight Concrete
- C 618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
- C 979 Specification for Pigments for Integrally Colored Concrete
- C 989 Specification for Ground Granulated Blast Furnace Slag for Use in Concrete and Mortars
- C 1064 Test Method for Temperature of Freshly Mixed Portland Cement Concrete
- C 1116 Specification for Fiber-Reinforced Concrete and Shotcrete
- C 1152 Test Method for Acid-Soluble Chloride in Mortar and Concrete
- C 1218 Test Method for Water-Soluble Chloride in Mortar and Concrete
- C 1240 Specification for Silica Fume for Use in Hydraulic Cement Concrete and Mortar
- 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)
- C 1611 Slump Flow of Self Consolidating Concrete
- D 3665 Practice for Random Sampling of Construction Materials
- D 4580 Practice for Measuring Delaminations in Concrete Bridge Decks by Sounding
- D 4791 Test Method for Flat and Elongated Particles in Coarse Aggregate

- D 4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
- D 5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
- E 965 Standard Test Method for Measuring Pavement Macrot texture Depth Using a Volumetric Technique
- E 1347 Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry

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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°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°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°F.
3. Do not mix or place concrete when the ambient temperature is below 35°F, or when conditions indicate that the temperature will fall below 35°F within 72 hours, unless the areas to receive fresh concrete are insulated or enclosed, and maintain the concrete temperature at 50°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°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°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°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°F by scheduling work so that concrete can be placed during the coolest part of the day. Do not place concrete for structural decks, slabs or pavements when the rate of concrete surface evaporation exceeds 0.15 lbs/ft<sup>2</sup>/hr, as defined in ACI 305R, Figure 2.1.5. If ambient conditions exceed this limit, demonstrate through the use of windscreens, fogging or other suitable means that the concrete evaporation rate is less than 0.15 lbs/ft<sup>2</sup>/hr.
4. If the concrete temperature reaches 92°F as measured at the construction site in accordance with ASTM C 1064, it will be rejected.

#### 1.04 QUALITY CONTROL

##### A. General

1. Maintain a level of Quality Control sufficient to consistently provide the end result performance properties specified herein. In addition:
  - a. Provide 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.

##### 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 Program Administrator 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 Construction airport and/or highway concrete construction experience.
    - (2) NICET Level III certified engineering or materials technician in Civil Engineering Technology with 5 years of airport and/or highway concrete construction experience.
    - (3) New Jersey ACI Chapter's "Concrete Construction Technology" course with 5 years of airport and/or highway concrete construction experience.

- (4) ACI Concrete Transportation Construction Inspector 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 each test is to be performed.
  - a. Include the performance of gradation and moisture content of 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. Requirements 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 Division Laboratory. 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 Section 2.03C 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 according to scale 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 actual size, but shall be 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 in close proximity, 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, test pour, and to discuss the methods and procedures to achieve the specified concrete quality. The Contractor shall notify the Engineer and shall 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. The Contractor shall, 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. Minutes of the meeting shall be recorded, typed, and printed by the Contractor and distributed to all attendees of the meeting within 5 days of the date of the meeting.

C. The pre-concrete construction meeting shall not be scheduled until all of the following have been submitted for approval, as applicable to the Work of the Contract:

1. Mix Proportions
2. Admixture dosage charts showing the effects of concrete temperatures from 50°F to 90°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. For submittals - see Appendix "A".
- 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 has 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, as well as Type III where early strength gain is required and may be used, 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°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 a Lot of cement not to exceed every 50,000 pounds of cement to be used for production. Provide 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 m<sup>2</sup>/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 C618, Class N. Use one of the following products as manufactured by or an approved equal:
1. MetaMax manufactured by Engelhard, Iselin, New Jersey.
  2. PowerPozz 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 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. Trap rock or gneiss shall be used for all roadway 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 not be 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 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 Number 8, coarse aggregate. The ratio of coarse aggregate to fine aggregate by volume shall not be 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 Number 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, 2) Performance Category VI applications, 3) bridge decks, and 4) mixes containing ASTM C33 Size #8 aggregate. Bridge deck concrete mixes shall contain a minimum of 41% coarse aggregate and total minimum aggregate volume of 67%. Mixes containing ASTM C33 Size #8 stone not covered in Part 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.
  - I. Coarse Aggregate (Lightweight Concrete):
    1. Expanded clay or shale produced by the rotary kiln process conforming to ASTM C 330 shall be graded in accordance with the requirements for 3/4" to No. 4 sieve sizes shown in Table I of that specification.
    2. The oven dry unit weight of plant-tested, lightweight aggregate shall not vary 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 TP 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 not contain more than 0.05% chloride ions, and shall be used in accordance with the manufacturer's recommendations. Dosage charts, including the effects of concrete temperatures from 50°F to 90°F, shall be submitted 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 performed in accordance with ASTM C1611. 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:  
For cast in place or precast:
    - a. "DCI-S" as manufactured by W.R. Grace & Company.
    - b. "Eucon CIA" as manufactured by Euclid Chemical Company.
    - c. An approved equal.For precast applications only:
    - a. "Sika CNI" as manufactured by Sika Corporation.
    - b. "Rheocrete CNI" as manufactured by Master Builders Technologies
    - c. 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. A retarder and/or other admixtures shall be used to assure 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°F to 90°F.
  
- P. Viscosity Modifying and/or Self-Consolidating Admixtures: may be required for tremie concrete applications at the rate recommended by the manufacturer. Concrete shall be tested 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 3 standard test drops in water.
  
- Q. Pigments: Conforming to ASTM C 979.
  
- R. Curing Materials:
  1. Apply Liquid Membrane Forming Curing Compound immediately after surface moisture has evaporated. Apply two full applications perpendicular to each other. Allow the first coat to become tacky prior to application of the second coat. 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" by Vexcon Chemicals Inc.
    - f. Day-Chem White Pigmented Cure (J-10-W) 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 (V.O.C.) compliant for both the states of New York and New Jersey. Certification of compliance shall be submitted 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. Polyethylene Film:
    - (1) White opaque, where curing surface is exposed to sun
    - (2) Clear, for other applications
  - b. 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.<sup>2</sup>, 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 Fibers
    - a. Provide 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 not be less than the minimum requirements of 2.02.T.1.b.1. and 2.02.T.1.b.2.
- (7) Fiber manufacturer or approved distributor: Provide the services of a qualified representative at the pre-concrete construction meeting and for the first two days of fibrous concrete placement production.

## 2.03 MIX PROPORTIONS

- A. Develop mixes in accordance with the latest editions of ACI 211, ACI 301, and ACI 318 to produce 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 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, admixtures that will be used at the proposed batch plant. In addition to fineness modulus of fine aggregate, the applicable properties listed in 1.05.A.1.a. shall also be shown. 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. When using fly ash or slag for Category IV applications, use a minimum of 30% fly ash or 40% slag substitution by total weight of cementitious material. 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. Water to cement ratio shall be computed 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 0.37 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° to 90° 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. Lightweight coarse aggregate shall be presoaked a minimum of 72 hours prior to mixing of concrete. The lightweight aggregate shall have 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 not be less than 7.6 cubic feet (absolute volume).

C. Architectural Concrete

1. A minimum of 35 days prior to construction of a mock-up, submit mix proportions and 2 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 Division Laboratory 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 mockup in accordance with ACI 303.1 Section 1.6 Quality Assurance shall be required for approval by the Engineer. For walls, a mockup shall include all details that will be encountered in a typical day's pour. The mockup 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. The approved mock-up shall be kept at the precast concrete production facility for the Engineer's representative to compare with the production units for acceptance or rejection. Acceptance or rejection shall be determined solely by the Engineer.
4. Mockups shall be constructed only with all of the actual constituents of the approved mix proportions. The Contractor shall 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, the Contractor will not be permitted to 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, the following shall be submitted 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 1500 Coulombs for mixes not containing a corrosion inhibitor and 2000 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 C1583): 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 A4 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	
	<u>LQL</u>	<u>UQL</u>
2" or above (# 467 and above)	3.5%	7.5%
1 ½" (# 57)	4.0%	8.0%
1" (# 67)	4.5%	8.5%
½" (# 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 specified 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 4580-86.
- B. Unless otherwise specified on the Contract Drawings, the above specified Quality Acceptance Limits shall be used for calculating 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 C1583, 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 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.

### 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 shall 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.
  - a. On an annual basis transit mix trucks must be inspected and approved by either the New Jersey or New York State Departments of Transportation.
  - b. 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.
  - c. Mixers which are found to be mechanically unsatisfactory shall be immediately repaired or withdrawn from use.
2. If truck mixers are used, 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 shall be available. 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, 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.
  - b. Water and cement shall be measured accurately to within 1% of the required amounts before being loaded into the mixer. Fine and coarse aggregate shall be measured accurately to within 2% of the required amounts before being loaded into the mixer.
3. The Engineer may permit one re-tempering of the concrete subject to the following:
- a. The addition of water to the concrete mix at the construction site shall not be permitted for mix proportions with a water to cement ratio of 0.40 or less. For all other mixes, water may be added, but the total amount of water shall not exceed the approved mix proportion water to cement ratio.
  - b. The redosage of high range water reducer shall conform to the Engineer-approved redosage chart and shall not exceed the recommended manufacturer's limitation, nor shall it retard the initial set of the concrete by more than 30 minutes.
  - c. Concrete that has partially hardened or has attained its initial set shall not be re-mixed or re-tempered, and will be rejected.
  - d. The Engineer reserves the right to reject concrete that has not been placed within 90 minutes from the time the cement had first contact with water or, if the concrete temperature reaches 92°F, as measured in accordance with ASTM C 1064.
  - e. When air content is below the lower quality limit specified in 2.04A.6.
4. 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 be readily adjustable to provide for 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. The Engineer may also perform testing of 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. Mixing shall be 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, concreting operations shall not continue until drier aggregates are obtained. The Engineer may view and copy all records for moisture content testing at any time.

### 3.03 PRE-PLACEMENT FIELD REQUIREMENTS

- A. During all concrete placements at the construction site, the Contractor shall be required to have an individual in a supervisory capacity present with a valid certification from one of the following programs:
  - 1. ACI Concrete Transportation Construction 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°F to 80°F or 68° F to 78° 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°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 such boxes from vibration or 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 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. 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. Placement shall not begin 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.

F. 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.

- G. 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°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°F for applications with a minimum dimension less than 12 inches; 40°F for applications with a minimum dimension between 12 and 36 inches; 30°F for applications with a minimum dimension between 36 and 72 inches; and 20°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.

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, such 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 have a length at least one foot greater 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.
4. Wet curing procedures may be stopped only when: the ambient temperature is expected to fall below 35°F within 24 hours, when placing concrete for slabs directly adjacent to the fog spraying system or soaker hoses or when concrete is to receive traffic.

- a. When the ambient temperature at the surface of placement is 35°F and falling, wet curing shall not be permitted; instead, apply a liquid membrane forming curing compound in accordance with 2.02.R. and 3.04.C.1.d.
  - 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.d.
  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. Choice of curing material and method shall be as approved by the Engineer.
    - b. Polyethylene film or burlap polyethylene sheet, if used, shall be lapped at edges and ends at least one foot and shall have all ends and edges taped to adjacent sheets or surfaces to completely seal areas to be cured. Secure in a manner that will not allow the film, the sheets, or the securing mechanism to be removed by wind forces, resulting in exposure of the fresh concrete and rapid drying.
    - c. Inspect sheet material before reuse. Repair all holes and tears with cemented patches, subject to approval by the Engineer.
    - d. Apply liquid membrane forming curing compound 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 of such occurrence.

- (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.

3.05 QUALITY ASSURANCE TESTING, SAMPLING, AND INSPECTIONS

- A. Quality Assurance testing during mixing and placing of concrete will be performed 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, cylinders will be made in accordance with ASTM C 31 when testing for compressive strength, as well as 4x8 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

<u>Daily Placement Quantity (Cubic Yards)</u>	<u>Number of Lots</u>	<u>Number of Sublots</u>
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 a given Class of concrete has one Work period's placement 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 samples will be obtained on a random basis, 4" x 8" cylinders will be used when the nominal maximum size of the coarse aggregate allows. Latex Modified Concrete samples shall be wet cured 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 2 test specimens at the compressive strength time requirement. The average of the two test specimen result values for each Sublot shall be considered the Sublot compressive strength value.
  2. Flexural Strength: From each Sublot sample, cast beams in accordance with ASTM C 31. 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 at the point of delivery during the time of placement in accordance with ASTM C 143 or ASTM C1611 when self consolidating concrete is used. For Latex Modified Concrete, slump tests shall be performed 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 days production indicate that the air content is outside the Quality Limits specified in 2.04A.6 by +1.0 or -0.50% the placement of the next load will be delayed until test results are obtained. If the air content for this load is outside the Quality Limits specified in 2.04A.6, it will be rejected. Subsequent loads will be tested until the air content is found to be within the specified limits of 2.04A.6.
  5. Unit Weight: The plastic unit weight of concrete (taken at the same frequency as specified in 3.05.B.4.) will be determined 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: Tested during the placement using a Microwave Drying Oven, in accordance with AASHTO T318. Drying times may be adjusted dependent on the mix constituents to provide 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 1½ inches, a sample of approximately 5000 grams will be obtained. This sample will be split. Two separate analyses will be performed. The weighted average of the two separate analyses will be considered the Sublot water content value. Likewise, the subplot water cement ratio will be computed as given above.

- a. When results for either two consecutive tests or three tests in one lot or days production indicate that the water content exceeds the limits given in 2.03A.4 by 0.10, the placement of the next load will be delayed until test results are obtained. If the water content for this load is greater than the Upper Limit given in 2.04 A 5, it will be rejected. Subsequent loads will be tested until the water content is found to be within the limit given in 2.04A.5.
7. Coulomb Test: To evaluate the permeability of the concrete the Upper Quality Limit, UQL, shall be 1500 Coulombs for mixes without a corrosion inhibitor and 2000 Coulombs for mixes containing a corrosion inhibitor, as tested 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 shall be evaluated at 90 days, using the same performance requirements stated above (1500 Coulombs for mixes without a corrosion inhibitor and 2000 Coulombs for mixes with a corrosion inhibitor). For Latex Modified Concrete applications, samples shall 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. Two-inch thick samples will be cut 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.
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 shall be evaluated as follows. Powder samples from 28 day concrete cylinders, prepared in accordance with ASTM C 31, shall be tested to assess both the acid soluble and water soluble chloride ion concentrations by weight of cementitious material from the concrete mix produced at the construction site. 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 shall be obtained from the inner three inches of the cylinder specimen, and shall 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 Division Laboratory 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 shall be cored for verification. The cores shall be measured in accordance with ASTM C 174. The average of three test result values for the Sublot shall be considered the Sublot test value.

11. Test Cores for Tremie Concrete:
  - a. 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 shall be obtained in accordance with ASTM C 42 and shall be drilled full depth (or thickness) through the pour horizontally or vertically as applicable.
  - b. If less than 95 percent recovery is obtained, it shall 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 for further investigation. The number and location of cores will be determined by the Engineer. All additional cores shall be taken at the sole expense of the Contractor.
  - d. All test core holes shall be filled by the Contractor by pressure grouting from the bottom upward, or from the inside out, as the case may be.
  - e. All voids, honeycombing, seams, or other defects shall be cleaned out and filled by pressure grouting with cement or sand-cement by the Contractor to the Engineer's satisfaction. Additional cores may be required to verify grouting, which shall be at the sole expense of the Contractor.
- 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. Such samples shall be taken 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. Any mix proportion constituents may be sampled by the Engineer 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 provide a planned schedule and Quality Control Plan for all production for the Work of the Contract.

- E. Precast Concrete: Arrange for the fabricator to provide the Engineer with a set of approved shop drawings for the Work of the Contract. Allow the Engineer to have access to the shop drawings at all times and to make copies of them at any time. 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.

**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., the Lot sample standard deviation,  $S_N$ , as defined in 4.01.D.4., for the specified number of Sublots,  $n$ , and 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 shall 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 G.2.
- \*\* 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 efficiencies found to exist as specified in 4.01.G. shall 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:	0.42	*	---	---	---	---	---

**Category III - Elevated Structural Overlays**

	I	I	I	P	I	---	---
LQL:	---	*	---	150 psi	***	---	---
UQL:	0.42	*	**	---	---	---	---

**Category IV - Structural (exposed to freeze-thaw and/or sulfates, in addition to chlorides or a marine environment)**

	I	I	P	---	I	---	---
LQL:	---	*	---	---	***	---	---
UQL:	0.42	*	**	---	---	---	---

**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
- \*\* - 1500 Coulomb counts for mixes without a corrosion inhibitor and 2000 Coulomb counts for mixes with a corrosion inhibitor
- \*\*\* - the proportion compressive strength at 28 days
- P - Used to Calculate Pay Factor per cubic yard. It denotes the concrete property that shall be used to calculate payment for a given concrete application. No incentive payments shall 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 & Unbonded Overlay (Category I) Final Pay Factor: The Pay Factor for Pavement Thickness shall 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 entering Table 4, "Percent of Lot Within Tolerance Limit (PWL) (Standard Deviation Method)" with  $Q_L$  and/or  $Q_U$  using 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 &amp; Bond Strength Pay Factor</u>
91 - 100	0.006 (PWL - 90)
80 - 90	0.0
55 - 79	0.00017PWL <sup>2</sup> - 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 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 C1152 and ASTM C114, 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 C1218 and ASTM C114. 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.
    - (3) If either or both of the requirements specified in 4.01.G.1.d.1. and 4.01.G.1.d.2. are not met, investigate the in-place compressive strength in accordance with ACI 318-99, 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.d.1. and 4.01.G.1.d.2., the concrete shall be considered deficient, and 4.01.G.1. shall 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 Section 4.01.G.1. If the concrete is accepted by the Engineer, seal cracks in accordance with Specification Section 03734, "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.
2. If the average air content for a Lot exceeds either the LQL or the UQL by more than 1% with the exception of those 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.

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

## DIVISION 3

### SECTION 03301

#### PORTLAND CEMENT CONCRETE, LONG FORM

#### SUBMITTALS

#### APPENDIX "A"

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.
- 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 a 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, 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.
    - c. Brand name and chemical composition of form oil or release agents, evaporation retardant and liquid membrane curing compounds. For Architectural Concrete, also include this information for forms, form liners, and pigments.
    - d. Certification of compatibility and five-year performance record for liquid membrane forming curing compound, when used under conditions specified in 3.04.C.1.d., 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°F to 90°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°F and 90°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.

D. Samples :

1. Concrete ingredients for trial batches 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, provide cement, fly ash, slag, and/or silica fume samples to check the Mill Certification at any time in accordance with 3.05.C of the Specification.
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, provide the methods of proportioning, mixing (including minimum time requirements), transferring and placing the concrete.
  - h. Curing Procedure Plan in accordance with 3.04, including the method and materials for curing.
  - i. Control Joint Location Plan.
  - j. 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 of the Specification.

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. of the Specification.
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.

**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"**

**SECTION 03602**  
**GROUT (NON-METALLIC)**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. This Section specifies requirements for non-metallic, non-shrink, cement-based grouting.

1.02 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements

1.03 REFERENCES

- A. ASTM International (ASTM)
1. C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars  
(Using 2-inches or 50-mm Cube Specimens)
  2. C191 – Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle
  3. C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
  4. C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

1.04 SUSTAINABLE DESIGN REQUIREMENTS

- A. Sustainable Design General Requirements
1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section 01352 and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the Work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.
- B. Sustainable Design Performance Criteria
1. The manufacturing location (final assembly) of the grout and mortar shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.

2. The origin of the raw materials from which the grout and mortar were manufactured shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
3. All field-applied interior adhesives, sealants, paints and coatings relating to Work of this Section shall meet the requirements of Section 01352.

## 1.05 QUALITY ASSURANCE

### A. Field Tests

1. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter as selected by the Engineer to insure continued compliance with these Specifications. The specimens will be made by the Engineer or its representative.
  - a. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at seven days, 28 days and any additional time period as appropriate.
2. The cost of all laboratory tests on grout will be borne by the Authority, but the Contractor shall assist the Engineer in obtaining specimens for testing. The Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens, at no additional cost to the Authority.
3. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Authority.

## 1.06 SUBMITTALS

- A. General: Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS.
- B. Submit a sample of the grout material to the Manager, Materials Engineering Division, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397, for approval.
- C. Submit manufacturer's instructions and methods for handling, storage, mixing and placing of the grout, for approval.
- D. Certified test results verifying the compressive strength and shrinkage and expansion requirements specified herein.
- E. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:

1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
  - a. Cost breakdowns for the materials included in the Contractor's Work. *Cost breakdowns shall include total cost plus itemized material costs.*
  - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
    - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
    - 2) The manufacturing location of the supplied product(s).
    - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
    - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this work.
    - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
3. Product cut sheets for materials that meet the SDMCF.
4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

#### 1.07 JOB CONDITIONS

- A. 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.

#### 1.08 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.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

#### **A. Non-Shrink Grout**

1. Non-shrink grout shall conform to ASTM C1107, Grade C. Non-shrink grout shall be, "Euco N-S:" by the Euclid Company, "Masterflow 928" by Master Builders, or "Sikagrout 212" by Sika Corporation.
2. Grout shall be pre-measured and pre-packed by the manufacturer, requiring only addition of potable water for mixing.
3. The minimum compressive strength at 28 days shall be 7000 psi unless noted otherwise on the Contract Drawings.

### **2.02 CURING MATERIALS**

- A. Curing materials shall be as recommended by the manufacturer for prepackaged grouts.

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. Areas to be grouted as shown on the Contract Drawings shall be cleaned of all foreign materials, to the satisfaction of the Engineer.
- B. All surface preparation, handling, placing, consolidation and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
- C. The Contractor, through the manufacturer of a non-shrink grout and epoxy grout, shall provide on-site technical assistance upon request, at no additional cost to the Authority.

### **3.02 CONSISTENCY**

- A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application.

### **3.03 MEASUREMENT OF INGREDIENTS**

- A. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

### 3.04 GROUT INSTALLATION

- A. Grout shall be placed quickly and continuously, shall completely fill the space to be grouted and be thoroughly compacted and free of air pockets. The grout may be poured in place, pressure grouted by gravity or pumped. The use of pneumatic pressure or dry-packed grouting requires approval of the Engineer. For grouting beneath base plates, grout shall be poured from one side only and thence flow across to the open side to avoid air-entrapment.
- B. Grout shall be consolidated by rodding, spading or vibrating to prevent formation of air pockets.

### 3.05 FIELD TESTS

- A. The Engineer may take and test samples of the grout being placed in accordance with ASTM C109, ASTM C191 and ASTM C827.
- 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**

**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 Specification for Masonry Structures.  
/TMS 602

American Society for Testing and Materials (ASTM)

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:

A. Product Data

*For each product indicated.*

B. 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.

C. Certifications

1. Compliance with ASTM C 270 for masonry mortar materials.
2. Compliance with ASTM C 91 and C 270 for premixed colored masonry cements, if any.

D. 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.

E. Design Mix

List products and mix proportions for mortar and source of aggregate (for information only).

END OF APPENDIX "A"

**SECTION 04070**  
**MASONRY GROUT**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. This Section specifies requirements for cementitious grout for use in unit masonry walls.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Provide masonry grout that develops the minimum compressive strengths at 28 days as indicated on the Contract Drawings.
- B. Determine net-area compressive strength ( $f_m$ ) of masonry assemblies from average net-area compressive strengths of masonry units, grouts, and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- C. Determine net-area compressive strength ( $f_m$ ) of masonry assemblies by testing masonry prisms according to ASTM C1314; refer to Section 04220 for requirements.

1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements
- B. Section 04061 - Masonry Mortar Unpigmented
- C. Section 04170 – Joint Reinforcement and Steel Reinforcing
- D. Section 04220 – Concrete Masonry Units

1.04 REFERENCES

- A. American Concrete Institute (ACI)/American Society of Civil Engineers (ASCE)/The Masonry Society (TMS)
1. ACI 530.1/ASCE 6/ TMS 602 Specification for Masonry Structures.
- B. ASTM International (ASTM)
1. C94 - Ready-Mixed Concrete.
  2. C143 - Test Method for Slump of Hydraulic Cement Concrete.

3. C150 - Specification for Portland Cement.
4. C207 - Specification for Hydrated Lime for Masonry Purposes.
5. C404 - Specification for Aggregates for Masonry Grout.
6. C476 - Specification for Grout for Masonry.
7. C1314 - Standard Test Method for Compressive Strength of Masonry Prisms

#### 1.05 SUSTAINABLE DESIGN REQUIREMENTS

##### A. Sustainable Design General Requirements:

1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section 01352 (Sustainability Requirements) and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.

##### B. Sustainable Design Performance Criteria:

1. The origin of the raw materials from which the grout is manufactured shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
2. The manufacturing location (final assembly) of the grout shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
3. The extraction location of the grout shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section

#### 1.06 QUALITY ASSURANCE

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

#### 1.07 SUBMITTALS

- A. General: Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 – GENERAL PROVISIONS.
- B. Product Data: For each product indicated.
- C. Certifications: Compliance with ASTM C 476 for masonry grout materials.
- D. Test Reports: Test results supporting compliance with performance requirements for grout (compressive strength), if shown on the Contract Drawings.

- E. 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.
- F. Design Mix: List products and mix proportions for grout and list source of aggregate (for information only).
- G. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
  - 1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's work. Cost breakdowns shall include total cost plus itemized material costs.
    - b. The manufacturing location of the supplied product(s).
    - c. The location (source) of the raw materials used to manufacture the supplied product(s).
  - 2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  - 3. Product cut sheets for materials that meet the SDMCF.
  - 4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
  - 5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

#### 1.08 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.

#### 1.09 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, or 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 apply 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.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Portland Cement: ASTM C150, Type I, or Type III for winter construction, natural color.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Grout Aggregate: ASTM C404.
- 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 C476, 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 C94. 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 C143.
- E. Perform hand mixing of small quantities of grout only if approved by the Engineer.

**3.02 ADJUSTMENTS**

- A. 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**

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

**END OF SECTION**

**SECTION 04170**  
**JOINT REINFORCEMENT AND STEEL REINFORCING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

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

**1.02 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. Not Used.

**1.03 RELATED SECTIONS**

- A. Section 01352 – Sustainable Design Requirements
- B. Section 04061 - Masonry Mortar - Unpigmented
- C. Section 04070 – Masonry Grout
- D. Section 04220 – Concrete Masonry Units

**1.04 DEFINITIONS**

- A. Joint Reinforcement
  - 1. Horizontal joint reinforcement fabricated, generally, in ladder-type configuration for placement in the horizontal mortar joints of masonry walls and partitions.
- B. Steel Reinforcing
  - 1. 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, where shown on the Contract Drawings.

**1.05 REFERENCES**

- A. American Concrete Institute (ACI)/American Society of Civil Engineers (ASCE)
  - 1. ACI 530.1/ASCE 6 - Specifications for Masonry Structures

## B. ASTM International (ASTM)

1. A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
2. A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware
3. A185 - Steel Welded Wire Reinforcement, Plain, for Concrete
4. A496 - Steel Wire, Deformed, for Concrete Reinforcement
5. A497 - Steel Welded Wire Reinforcement, Deformed, for Concrete
6. A615 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
7. A775 - Epoxy - Coated Steel Reinforcing Bars

## 1.06 SUSTAINABLE DESIGN REQUIREMENTS

## A. Sustainable Design General Requirements:

1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section 01352 (Sustainability Requirements) and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria. Where no additional articles are listed below refer to Specification Section 01352.

## B. Sustainable Design Performance Criteria:

1. Steel Reinforcing shall contain a minimum of 75 percent (by weight) recycled content, calculated by adding the post-consumer recycled content percentage to one-half of the post-industrial recycled content percentage. Certify the recycled content in accordance with the Sustainable Design Submittal Requirements of this section.
2. The post-industrial and/or post-consumer recycled content (by weight) of Joint Reinforcing shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
3. All field-applied adhesives, sealants, paints and coatings relating to work of this section shall meet the requirements of Section 01352 - Sustainability Requirements
4. The manufacturing location (final assembly) of the Steel Reinforcing shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
5. The origin of the raw materials from which the Steel Reinforcing was manufactured shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.

## 1.07 SUBMITTALS

- A. 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.
- B. 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.
- C. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
  - 1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's work. Cost breakdowns shall include total cost plus itemized material costs.
    - b. The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
    - c. The manufacturing location of the supplied product(s).
    - d. The location (source) of the raw materials used to manufacture the supplied product(s).
    - e. The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this work.
  - 2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  - 3. Product cut sheets for materials that meet the SDMCF. Cut sheets shall be submitted with the Contractor or sub-contractor's stamp, as confirmation that the submitted products are the products installed in the Project.
  - 4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
  - 5. The Sustainable Design submittal information shall be assembled into one package per Section or trade, and sent to the Engineer of review.

**1.08 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 or other causes.

**PART 2 - PRODUCTS****2.01 MANUFACTURERS**

- A. Subject to compliance with requirements of this Section, provide joint reinforcement products as shown on the Contract Drawings as manufactured by one of the following, or approved equal:
  - 1. AA Wire Products Co., Chicago, IL
  - 2. Cumberland Corp., Chattanooga, TN
  - 3. Dur-O-Wall Inc., Northbrook, IL

**2.02 MATERIALS**

- A. Joint Reinforcement
  - 1. Steel Wire: ASTM A82
  - 2. Finish: ASTM A153, Class B-2 (1.5 oz. per sq. ft. of wire surface)
- B. Horizontal or Vertical Steel Bar Reinforcing
  - 1. General: Provide reinforcing steel complying with requirements of ACI 530.1/ASCE 6 and this Section.
  - 2. Steel Reinforcing Bars: Material and grade as follows, as shown on the Contract Drawings:
    - a. Carbon steel complying with ASTM A615.
    - b. Epoxy-coated, billet steel complying with ASTM A615 and ASTM A775.
    - c. Grade 60, unless otherwise shown on the Contract Drawings.
  - 3. Provide one or more of the following, where shown on the Contract Drawings:
    - a. Deformed Reinforcing Wire: ASTM A496.
    - b. Plain Welded Wire Reinforcement: ASTM A185.
    - c. Deformed Welded Wire Reinforcement: ASTM A497.

## 2.03 FABRICATION

- A. Fabricate joint reinforcement 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: 0.0875-inch diameter (3/16-inch)
    - b. Cross rods: 0.1483-inch diameter (No. 9-gage)
  4. Units shall be fabricated with continuous perpendicular cross rods spaced not more than 16 inches o.c., placed in the same plane as longitudinal wires with one side rod for each composite wall wythe or face shell.
- B. 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. Install joint reinforcement in all masonry walls and partitions unless otherwise shown on the Contract Drawings.
- B. Install horizontal and/or vertical bar steel reinforcing where shown on the Contract Drawings.
- C. Horizontal Joint Reinforcement
1. Provide continuity at corners and intersections by use of prefabricated "L" and "T" sections. At returns, offsets, curves and other special conditions, cut and bend joint reinforcement to ensure continuity.
  2. Lap joint reinforcement at least 6 inches at splices and prefabricated sections.
  3. Space reinforcement as follows, unless otherwise shown on the Contract Drawings:
    - a. For single- and multi-wythe walls, 16 inches o.c. vertically;
    - b. For parapets, 8 inches o.c. vertically;
    - c. For masonry openings greater than 1 foot wide, place joint reinforcement 8 inches apart, immediately above lintel and below sill. Extend joint reinforcement at least 2 feet beyond opening jambs.
- D. Cut or interrupt horizontal joint reinforcement at control or expansion joints and terminate 2 inches back from such joints.

- E. Terminate horizontal joint reinforcement 2 inches back from jambs.

**END OF SECTION**

**SECTION 04220**  
**CONCRETE MASONRY UNITS**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. This Section specifies requirements for concrete masonry units and accessories.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Provide concrete masonry units that develop an installed compressive strength (fm) 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 the following:
1. Furnish certification from an independent testing laboratory confirming that all concrete masonry units with a nominal width of 8 inches or greater shall meet requirements of UL 618 for fire-ratings shown on the Contract Drawings, referencing full scale fire test reports in accordance with ASTM E119.
  2. All concrete masonry units with a nominal thickness of 4 inches or 6 inches shall conform to "National Bureau of Standards" and "National Research Council" full scale fire tests, for fire ratings shown on the Contract Drawings.

1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements
- B. Section 04061 - Masonry Mortar Unpigmented
- C. Section 04070 – Masonry Grout
- D. Section 04170 - Joint Reinforcement And Steel Reinforcing

1.04 REFERENCES

- A. American Concrete Institute (ACI)/American Society of Civil Engineers (ASCE)/The Masonry Society (TMS)
1. ACI 530/ASCE 5/TMS 402 Building Code Requirements for Masonry Structures

2. ACI 530.1/ASCE 6/TMS 602 Specifications for Masonry Structures
3. ACI 315 Details and Detailing of Concrete Reinforcement

B. ASTM International (ASTM)

1. A240 – Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
2. C90 – Specification for Load Bearing Concrete Masonry Units
3. C129 – Specification for Non-Load-Bearing Concrete Masonry Units
4. C140 – Test Methods of Sampling and Testing Concrete Masonry Units and Related Units.
5. C331 - Specification for Lightweight Aggregates for Concrete Masonry Units
6. C426 - Test Method for Linear Drying Shrinkage of Concrete Masonry Units
7. C578 – Specification for Rigid, Cellular Polystyrene Thermal Insulation.
8. C1093 - Practice for the Accreditation of Testing Agencies for Unit Masonry.
9. C1314 - Test Method for Compressive Strength of Masonry
10. D2240 - Test Method for Rubber Property-Durometer Hardness
11. E119 – Test Methods for Fire Tests of Building Construction and Materials

C. Underwriters Laboratories, Inc. (UL)

1. 618 – Concrete Masonry Units

## 1.05 SUSTAINABLE DESIGN REQUIREMENTS

A. Sustainable Design General Requirements:

1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section 01352 (Sustainability Requirements) and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.

B. Sustainable Design Performance Criteria:

1. Concrete products shall incorporate GGBF Slag as a replacement for up to 15 percent (by weight) of the portland cement. All design mixes are subject to review and approval by the Structural Engineer.
2. All field-applied adhesives, sealants, paints and coatings relating to work of this section shall meet the requirements of Section 01352.

3. The manufacturing location (final assembly) of the Masonry Units shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
4. The origin of the raw materials from which the Masonry Units were manufactured shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.

#### 1.06 QUALITY ASSURANCE

- A. Obtain masonry units from a single manufacturer for each type of unit required.
- B. Mock-Up
  1. Before masonry work commences, construct approximately 64 inches long by 48 inches high by full thickness panel of each type of concrete masonry unit for approval.
    - a. Include a sealant-filled joint at least 16 inches long in mockup.
    - b. Protect mock-ups from the elements with a weather-resistant membrane.
    - c. Approval of mock-ups is for color, texture, pattern, and blending of masonry units; relationship of mortar and sealant colors to masonry colors; tooling of joints; aesthetic qualities of workmanship.
      - 1) Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically approved by the Engineer in writing.
    - d. 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.
    - e. Where masonry is shown on the Contract Drawings to match existing, erect panels parallel to existing surface.
- C. Unit Masonry Standard: Comply with ACI 530.1/ASCE 6 "Specifications for Masonry Structures," except as otherwise indicated.
  1. Revise ACI 530.1/ASCE 6 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.
- D. The Authority will perform any required testing to inspect foundations for compliance with dimensional tolerances specified in referenced unit masonry standard.
- E. Inspecting Laboratory Qualifications: To qualify for employment in performing tests and inspection specified in this Section, an independent testing laboratory must demonstrate to Engineer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM C1093, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying the progress of the Work.
- F. Preconstruction Testing: 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:

1. Concrete Masonry Unit Tests: For each different type, class, and grade of unit shown on the Contract Drawings units will be tested for strength, absorption, density and moisture content per ASTM C140.
2. Prism Test: For each type of construction required, per ASTM C1314.

#### 1.07 SUBMITTALS

- A. General: Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS.
- B. Product Data: Manufacturer's product data for each type of concrete masonry unit and accessory including certifications that each complies with specified requirements.
- C. 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.
  1. Shop drawings detailing cutting and setting for stone trim, if any. Show sizes profiles, locations and material description.
- D. 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.
- E. Samples of accessories embedded in the masonry.
- F. Cold-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.
- G. Hot-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.
- H. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, telephone numbers, names of Architects and Owners, and other information specified.
- I. Certifications: Submit test results from a qualified testing lab, certifying the masonry complies with the requirements of this Specification.

J. . . Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:

1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
  - a. Cost breakdowns for the materials included in the Contractor's work. Cost breakdowns shall include total cost plus itemized material costs.
  - b. The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
  - c. The manufacturing location of the supplied product(s).
  - d. The location (source) of the raw materials used to manufacture the supplied product(s).
  - e. The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this work.
  - f. Provide concrete mix design to verify the percentage of recycled material included, by weight.
2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
3. Product cut sheets for materials that meet the SDMCF.
4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
5. The Sustainable Design submittal information shall be assembled into one package per Section or trade, and sent to the Engineer.

#### 1.08 ENVIRONMENTAL REQUIREMENTS

- A. Protection of Masonry: During 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 multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to constructed 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 any grout, mortar and 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, as well as similar products with painted and integral finishes from mortar droppings.
- D. Cold-Weather Construction: Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cold weather construction and the following:
  - 1. Do not lay masonry units that are wet or frozen.
  - 2. Remove masonry damaged by freezing conditions.
- E. Hot-Weather Construction: Comply with requirements of ACI 530.1/ASCE 6/TMS 602..
- F. Erect windbreaks or enclosures when wind is 15 mph or more.

#### 1.09 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. Materials shall not be dumped or stored on the ground. Store materials on a clean surface or platform, as required, and protect them from deterioration and the elements.
- C. During freezing weather, protect materials with tarpaulins or other suitable material.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Concrete Masonry Units (CMU)
  - 1. Provide Hollow or Solid Load-Bearing Units, conforming to ASTM C90 - Type I, or Non-Load-Bearing Units, conforming to ASTM C129 - Type I, where shown on the Contract Drawings.
  - 2. Aggregate: Provide lightweight aggregate - 100% expanded clay, shale, or slate produced by the rotary kiln process and conforming with ASTM C331. The blending of screenings or any other deleterious substances which will impair the fire rating or insulation value shall not be permitted.
  - 3. Weight: Density of oven-dry concrete shall be no greater than 90 lbs./cu.ft.

4. Exposed Faces
    - a. Color and texture shall be manufacturer's standard, unless otherwise shown on the Contract Drawings.
    - b. Pattern shall be plain face, unless otherwise shown on the Contract Drawings.
- B. Architectural Concrete Masonry Units (ACMU)
1. Provide Hollow or Solid Units, conforming to ASTM C90 - Type I (normal weight), where shown on the Contract Drawings.
  2. Subject to compliance with the requirements of this Section, provide "Marble Face Masonry Units MX36" by Anchor Concrete Products, Inc., Brick, NJ or approved equal.
  3. Units shall be manufactured with water repellent system and shall have manufacturer's standard treated acrylic face coating.
  4. Provide single face units (facing exterior) as shown on the Contract Drawings.
  5. Texture/Color: Marble face as selected by the Engineer from manufacture's catalog.
- C. Size: Provide nominal 16-inch by 8-inch face dimension, unless otherwise shown on the Contract Drawings.
- D. Special Shapes: Provide as required by the installation or as shown on the Contract Drawings.
- E. Linear Shrinkage: Shrinkage of concrete masonry units shall not exceed 0.065 percent, when tested in accordance with ASTM C426.

## 2.02 ACCESSORIES

- A. Ties and Anchoring Devices: Where shown on the Contract Drawings, provide products as listed below, or approved equals. Provide 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 of the Specifications and as shown on the Contract Drawings.
  2. Column Anchors
    - a. Hohmann and Barnard, Inc., Hauppauge, NY, No. 354; 1-1/2-inch x 3/16-inch galvanized steel.
    - b. Hohmann and Barnard, Inc. No. 356; galvanized steel
  3. Beam Anchors: Hohmann and Barnard, Inc. No. 357; 3/16-inch x 1-inch galvanized steel.
  4. Wall Anchors: Heckmann Building Products, Inc. Chicago, IL No. 340-A; 16-gauge corrugated galvanized steel, 1 1/2 inches wide x 6 inches long x 2 inches bend with 7/16-inch diameter hole.

5. Channel System Wall Anchor
    - a. Channel: Hohmann and Barnard, Inc. No. 360 or No. 360-C; 10-gauge galvanized steel, "Gripstay Channel."
    - b. Anchors: Hohmann and Barnard, Inc. No. 364 or No. 365; 3/16-inch x 1 1/4-inch stainless steel, "Gripstay Anchor"; length as shown on the Contract Drawings
  6. Lateral Support Anchors: Heckmann Building Products, Inc. No. 272 Z-Type, galvanized steel.
- B. Wire Mesh: Heckmann Building Products, Inc. No. 209 or approved equal; 16-gauge galvanized steel, 1/2-inch mesh; minimum 12 inches long; width as required to provide 5/8-inch mortar cover at edges.
  - C. Weepholes: Rectangular plastic tube, 1 1/2 inches x 3 1/2 inches x 3/8-inch outside width and spaced as shown on the Contract Drawings, manufactured by Hohmann and Barnard, Inc., or approved equal.
  - D. Premolded Neoprene Control Joints: Hohmann and Barnard, Inc. "Standard", or approved equal, in accordance with ASTM D2240.
  - E. Neoprene Joint Filler: Williams Products, Inc., Troy, MI Type 1400 open cell neoprene "Everplastic" gasket with pressure sensitive adhesive, or approved equal.
  - F. Insulation: Provide extruded polystyrene board Insulation where shown on the Contract Drawings.
    1. Rigid cellular polystyrene thermal insulation with closed cells and integral high-density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C 578, Type IV; in manufacturer's standard lengths and widths; thicknesses as shown on the Contract Drawings.
  - G. Sheet-Metal Flashing: Stainless steel sheet ASTM A240, soft annealed, Type 304, with No. 2D finish, except where harder temper is required for forming or performance.

### 2.03 SOURCE QUALITY CONTROL

- A. The Authority will engage a qualified independent testing agency to perform source quality-control testing indicated below:
  1. Payment for these services will be made the Authority.
  2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- B. Concrete Masonry Unit Test: For each type of unit furnished, per ASTM C 140.

**PART 3 - EXECUTION****3.01 PREPARATION**

- A. The substrate on which the wall is to be built shall have a clean, level surface free from laitance, other foreign materials, and frost or ice.
- B. Verify that the substrate elevation is such that the masonry bed joint shall not vary more than 1/4 inch in 10 feet.
- C. Clean projecting dowels and reinforcement steel 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. Comply with ACI 530.1/ASCE 6/TMS 602, ACI 530/ASCE 5/TMS 402 and other requirements indicated applicable to each type of installation included in Project.
- B. Erection Tolerances: Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
  - 1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, or 1/2 inch maximum.
  - 2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
  - 3. For conspicuous horizontal lines, such as lintels, sills, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
  - 4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed joint thickness of adjacent courses by more than 1/8 inch.
  - 5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed joint and head joints thicknesses by more than 1/8 inch.
  - 6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
- C. Concrete masonry units shall be of the type shown on the Contract Drawings and shall be dry, sound, clean, and free from dust, dirt, and cracks before laying.

- D. Lay units plumb, level, and true, with cells vertical and with joints not more than 3/8-inch thick.
1. Unless otherwise shown on the Contract Drawings, lay concrete masonry units with a running bond.
  2. Maintain uniform thickness of horizontal and vertical joints.
- E. Cut units accurately to fit penetrations for plumbing, ducts, electrical, fire protection and communication Work and patch holes neatly.
- F. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full size units without cutting where possible.
- G. Use proper special units to provide for doors, bond beams, lintels, pilasters, and corners with a minimum of unit cutting.
- H. Fully bed each concrete masonry unit in mortar with vertical joints completely filled and shove unit to a solid bearing.
- I. Unless otherwise shown on the Contract Drawings, point and tool joints for exposed concrete masonry units to a slightly concave surface 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.
1. Architectural Masonry Units shall be constructed with a "tuck" point mortar joint.
- J. 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 wire mesh, to prevent grout from dripping into voids below.
- K. Solidly grout longitudinal joints in two or more wythe masonry, except for cavity in cavity wall construction.
- L. Make provision during laying up of cavity walls to permit the removal of mortar droppings and other debris that may fall into cavity.
- M. 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 not be less than two-thirds of the wall thickness unless otherwise shown on the Contract Drawings.
- N. Installation of Miscellaneous Items

1. Install flashings and other sheet metal items to be incorporated in masonry, if any, as shown on the Contract Drawings, fully bedded in mortar above and below and overlapping a minimum of 3 inches at ends. At heads and sills, extend flashing 6 inches at ends turn up not less than 2 inches to form end dams.
2. Install anchor bolts, sleeves and other miscellaneous metal items to be incorporated into the masonry in accordance with the Contract Drawings and approved shop drawings submitted under other Sections of the Specifications. Solidly fill spaces between such items and masonry with mortar.

O. Reinforcing

1. If a substrate dowel does not line up with a vertical core, it shall not be sloped more than one inch horizontally per six 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. When reinforcing bars are to be spliced, lap reinforcing bars by 30 bar diameters at a minimum. Separate overlapping reinforcing bars by one bar diameter or wire together.

P. Horizontal Joint Reinforcement

1. Completely embed joint reinforcement in mortar or grout. Joints with wire reinforcement shall be at least twice the thickness of the wire. Lap wire reinforcement at least 6 inches at splices to contain at least one cross wire of each piece of wire reinforcement in the lapped distance.
2. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
3. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns.

Q. General Grouting

1. Reinforcing shall be in place before grouting begins.
2. Vibrate, rod or puddle grout in place.
3. Keep mortar droppings out of grout spaces.
4. Maintain vertical cell alignment to preserve a continuous unobstructed cell area not less than 2 inches by 3 inches.
5. Solidly fill with grout cells containing reinforcement, bolts or other anchor devices and where shown on Contract Drawings.
6. Solidly fill spaces at metal door frames and other built-in items with grout or mortar.

R. Control and Expansion Joints

1. Install control and expansion joints in unit masonry to provide an unbroken vertical separation through all single wythe masonry walls, at location indicated

in the Contract Drawings. Where locations are not shown, construct control joints throughout the unbroken length of walls at approximately 25 feet on center. Also place control joints at locations where masonry wall height changes more than 20 percent. Including above expansion, construction or control joints in the supporting structure and at vertical chases, recesses and other point of reduction in wall thickness.

2. Install control and expansion joints materials in unit masonry as masonry progress. Do not allow materials to span control and expansion joints without provisions to allow for in-plan wall or partition movement.
- S. 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.

### 3.03 FIELD QUALITY CONTROL

- A. The Authority will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
  1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
- B. Testing Agency: The Authority will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
  1. Payment for these services will be made the Authority.
  2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
  3. Testing Frequency: One set of tests for each 5,000 sq. ft. of wall area or portion thereof.
- C. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C140.
- D. Prism Test: For each type of construction provided, per ASTM C1314 at 7 days and at 28 days.

### 3.04 CLEANING AND PROTECTION

- A. Protect exposed masonry against staining from grouting or other sources and clean excess mortar off the surfaces as the Work progresses.
- B. At the 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.

1. Architectural Masonry Units: A mild detergent cleaning solution shall be used and rise thoroughly with clean water.
- C. If ordinary cleaning is not adequate, use special methods as approved by the Engineer.
- D. Protect sills, ledges, offsets, and other exposed horizontal surfaces from droppings of mortar.
- E. Provide temporary protection for doorjambs and corners during the Work. Remove when directed by the Engineer.

**END OF SECTION**

**SECTION 05120**  
**STRUCTURAL STEEL**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. The work covered by this Section shall include all labor, material, equipment, permits and services necessary for the fabrication and installation of structural steel and related work, complete and in accordance with the drawings and these specifications.
- B. For the purposes of this project, all structural steel is categorized as follows:
  - 1. Structural Steel Type 1, which is steel that is exposed to view in the public areas.
  - 2. Structural Steel Type 2, which is all other steel.
  - 3. Unless otherwise noted on the Contract Drawings, all structural steel shall be Type 2.

**1.02 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. Connection Design and Detailing
  - 1. Complete details shall be shown on the shop drawings. 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. 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 registered in New York State. Calculations and shop drawings shall also bear the signature and seal of a Professional Engineer licensed in the New York State in accordance with the paragraphs on Shop and Erection Drawings in the Submittals Section.
  - 3. In the case of conflict between the requirements of this Contract and the Codes and Standards contained in the AASHTO and AISC publications referenced in this Section, the requirements of this Contract shall govern.
  - 4. All contractor designed connections and details shall be in accordance with AISC. "Allowable Stress Design", (ASD) 9<sup>th</sup> Edition.
  - 5. Use types of shop and field connections as shown on the Contract Drawings or, in absence of such indication, use the most appropriate type.
  - 6. Design all connections to safely withstand the combined load effects where shears, axial forces, moments and/or torques are shown on the Contract Drawings.
  - 7. Typical connections shown on the drawings that are not completely designed are illustrative only and show only minimum requirements. They shall be completed by the Contractor's Engineer in accordance with the paragraphs under 1.07 Submittals.

8. Welded joints of heavy sections and plates (greater than 2 inches thick) shall be detailed in a manner to limit the amount of weld metal. Double bevels shall be used in lieu of single bevels where practical and allowed by AWS. Joints shall be detailed to allow for weld shrinkage. In cases of plates in more than one plane and where welding operations are not sequenced on the drawings, the welding shall start at the most restrained part of the weldment and proceed to the least restrained (see paragraph 1.07 B.1.d).

B. Tolerances

1. Unless otherwise indicated on the Contract Drawings, conform to the tolerances of Sections 6 and 7 of the AISC Code of Standard Practice for Steel Buildings and Bridges.
2. Elevator shafts used for temporary hoists shall conform to the detailed requirements of the hoist manufacturer.

C. Coordination With The Authority's Testing and Inspection Personnel:

1. The Contractor shall have sole responsibility for coordinating the work with the Authority to assure that all Quality Assurance/Quality Control procedures required by the Contract Documents are properly provided. The Contractor shall cooperate fully with the Authority in the performance of their work and shall provide the following:
  - a. Information as to time and place of starting shop fabrication and a field construction and erection schedule shall be submitted 15 days prior to the beginning of the work
  - b. Site File: At least one copy of each approved shop drawing shall be kept available in the Contractor's field office and the drawings not bearing evidence of approval and release for construction by the Engineer shall not be kept on the job. Provide drawings for the work to be performed in the shop or field one week prior to the start of work.
  - c. Cutting lists, order sheets, material bills and shipping bills.
  - d. Representative sample pieces requested by the Authority for testing, if necessary.
  - e. Full and ample means of assistance for testing and inspection of material.
  - f. Proper facilities, including scaffolding, temporary work platforms, etc., for inspection of the work in shop and field.
2. Refer to Article 3.04 C. for additional requirements.

1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements
- B. Section 03300 - Placement of Portland Cement Concrete
- C. Section 03602 – Grout (Non-Metallic)
- D. Section 05311 – Steel Deck
- E. Section 05507 - Miscellaneous Steel Embeds
- F. Section 09910 - Painting

#### 1.04 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO)
  - 1. HB-17 - Standard Specifications for Highway Bridges
- B. American Institute of Steel Construction (AISC)
  - 1. 303-05 - Code of Standard Practice for Steel Buildings and Bridges
  - 2. Specification for Structural Steel Buildings, Allowable Stress Design, 9<sup>th</sup> Edition
  - 3. Specification for Structural Buildings, 13<sup>th</sup> Edition (solely for the provisions referenced in Article 2.01.B.2)
- C. American Society for Non-destructive Testing (ASNT)
  - 1. SNT-TC-1A - Non-Destructive Testing
- D. American Welding Society (AWS)
  - 1. D1.1 - Structural Welding Code – Steel
  - 2. D1.5 - Bridge Welding Code
  - 3. QC1 - Standard for AWS Certification of Welding Inspectors
- E. Research Council on Structural Connections
  - 1. Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts
- F. Building Code of the City of New York, 2003
- G. US Department of Labor OSHA regulations.
- H. The Society for Protective Coatings (SSPC)
  - 1. Painting Manual-Volume 1-Good Painting Practice
  - 2. Painting Manual-Volume 2-Systems and Specifications

#### 1.05 SUSTAINABLE DESIGN REQUIREMENTS

- A. Sustainable Design General Requirements
  - 1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section 01352 and the articles below, are implemented to the fullest extent. Substitutions or other changes to the Work proposed by the Contractor shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.
- B. Sustainable Design Performance Criteria
  - 1. Structural steel shall contain a minimum of 40 percent (by weight) recycled content, calculated by adding the percentage of the post-consumer recycled content to one-half of

- the percentage of the post-industrial recycled content. Certify the recycled content in accordance with the Sustainable Design Submittal Requirements of this section.
2. The manufacturing location (final assembly) of the structural steel shall be documented in accordance with the Sustainable Design Submittal of this Section.
  3. The origin of the raw materials from which the structural steel was manufactured shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
  4. All field-applied adhesives, sealants, paints and coatings relating to Work of this Section shall meet the requirements of Section 01352.

#### 1.06 QUALITY ASSURANCE AND QUALITY CONTROL

- A. Quality assurance is testing and inspection undertaken by the Authority to evaluate the Contractor's performance. It is not a substitute for the testing and inspection which is required as part of the Contractor's quality control system as specified herein.
- B. Quality Control is testing and inspection performed by the Contractor to ensure that the Work conforms with the quality standards specified for the Work.
  1. See paragraph 1.08 A and 1.08 B for qualifications of the entities performing the Work.
  2. 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 for the type of work they are to perform.
  3. The Contractor shall maintain a Quality Control Program for both fabrication and erection of structural steel to ensure 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-1A Level II qualifications and an AWS Certified Welding Inspector (CWI).
  4. The fabricator's and erector's Quality Control Plans 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 being performed in accordance with the Contract Documents and the shop is being operated in accordance with the Quality Control Plan.
  5. For work where "Fracture Critical Members" (FCM) 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.
- C. Testing and Inspection Requirements: The Contractor shall perform the following shop and field inspections in addition to any other inspections specified herein:
  1. Shop inspection of steel alignment and straightness of members, camber, preparation for connections, dimensional checks, testing of shop bolts, witnessing of welding procedures, testing of cuts, weld access holes and copes of heavy sections as defined in this specification, examination and testing of completed welds, cutting of heavy sections,

milling of column ends, cleaning, painting and storage of material. All shop fabrication shall be inspected in the shop.

2. Welds shall be inspected and tested by the Contractor in accordance with AWS D1.1 (AWS D 1.5 for bridge and fracture critical members) and as follows:
  - a. All welds shall be visually inspected by an AWS Certified Welding Inspector (CWI).
  - b. All full penetration groove welds shall be non-destructively tested for 100 percent of the weld length by radiographic or ultrasonic methods and magnetic particle testing (MT) techniques, as approved by the Engineer, unless otherwise noted. Such testing should be performed no sooner than 48 hours after the welding has been completed.
  - c. 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 and fracture-critical members, test a minimum of 10 percent of the length of all partial penetration (by RT or UT and MT techniques) and fillet welds (by MT techniques) in accordance with AWS D1.5. The acceptance/rejection criteria for partial penetration welds tested by RT or UT shall be based on the appropriate table of the code using the effective weld throat as the weld thickness category. 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 percent, without additional compensation.
  - d. For welded T or corner joints in plates or rolled sections with members exceeding 2 inches in thickness, careful attention shall be paid to the heat affected zone of the base metal where the weld shrinkage stresses are in the through thickness direction. At these joint locations, the heat affected zone of the adjacent base metal shall be tested ultrasonically for discontinuities that may result in lamellar tearing.
  - e. For plate members 4 inches and greater, perform a straight beam ultrasonic survey of the last 6 inches at the end of members/plates at weld locations to ensure member/plate is free of laminations and gross segregation prior to welding.
- D. 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 percent 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 Work.
- E. 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 Fabricator shall supply the Authority with the mill order, and the Authority will identify where coupons for testing are to be provided. The Contractor shall also provide a desk and adequate office workspace for the Authority shop inspector. Access to the use of telephones, fax machines, a high speed internet connection and copy machines shall be provided at all times.
- F. 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 and tested by the Authority for wedge tensile and Rockwell hardness requirements in accordance with the appropriate 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 this Section, the containers shall be so labeled in a manner approved by the Engineer.
4. Bolts in bridge and fracture critical members 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 and AASHTO Section 11.5.6.4.2).
5. Shop and field bolting shall be inspected and tested in accordance with the referenced standards.

G. Remedial Work:

1. The Contractor shall indicate to the Authority where remedial work must be performed and will maintain a current list of work not in compliance with the Contract Documents. This list along with proposed corrective action shall be given in writing to the Engineer for review on a weekly basis.

H. Certification: When all work has been approved by the Contractor's Quality Control personnel, the Contractor shall certify in a letter to the Engineer and owner that the installation is in accordance with the design and specification requirements (including applicable codes).

I. Pre-Steel Erection Conference:

1. At least 60 days prior to the commencing of steel erection the Contractor shall hold a meeting to review the detailed requirements for the steel erection. The Contractor shall notify responsible representatives of every party who is concerned with the steel erection to attend the conference, including but not limited to the following:
  - a. Engineer
  - b. General Contractor
  - c. Steel Fabricator
  - d. Steel Erector
  - e. Erector's surveyor
  - f. Concrete Contractor
  - g. Intumescent Paint Applicator
  - h. MEP Contractors
  - i. All testing and inspection agencies
2. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed by him to all parties concerned within five days of the meeting. The minutes shall include a detailed outline of the erection procedure including a schedule of

milestone dates for erection staging surveying and sign-offs which will represent the agreements reached by all parties involved. It shall also include the surveying program and schedule submission for approval.

J. Mock-Ups

1. The Contractor shall prepare steel mock-ups, as indicated on the Contract Documents, to demonstrate the proposed fabrication procedure and verify the inspectability of each weld within the assembly.
2. Each mock-up shall comprise a complete fabrication of the specified detail as shown on the plans, but with member lengths that need not extend beyond the joint more than 1'-6".
3. For each mock-up, the Contractor shall prepare a written fabrication and welding sequence and a preliminary mock-up made of wood, plastic, dense Styrofoam or other material approved by the Engineer. The preliminary mock-up shall be sufficiently large to demonstrate the assembly sequence, but need not exceed one-half scale. These shall be submitted for review by the Engineer, and approval shall be given before the full-scale mock-up is fabricated in steel. The Engineer shall witness all fit-up and welding for each steel mock-up.
4. The completed steel mock-up shall be examined visually and by UT or RT and by Magnetic Particle (MT) using the nondestructive examination procedures that are proposed for production. Mock-up assemblies shall then be sectioned as directed by the Engineer to produce three macroetch samples per weld type that shall be evaluated per AWS D1.5. Approval of the fabrication and erection procedure and the nondestructive examination procedures shall be contingent on satisfactory results from the mock-up examination and destructive tests. Satisfactory mock-ups shall be defined as satisfactory when, either before or after repair as permitted herein, the mock-ups are free of defects as defined herein and all relevant section of AWS D1.5 and demonstrate a procedure that will meet the requirements of this Specification as determined by the Engineer. Minor weld repairs will be allowed except for the following circumstances:
  - a. A crack, as defined by AWS D1.5, is found visually or by MT.
  - b. Defects, as defined by AWS D1.5 that are found by UT or RT occur in greater than 5 percent of the cumulative length of any weld.
  - c. Distortion is caused that, in the opinion of the Engineer, cannot be repaired within the specifications and good engineering practice.
  - d. The mock-up, in the opinion of the Engineer, fails to demonstrate a procedure that will meet the specifications or fails to demonstrate a procedure that is repeatable in actual production.
  - e. Repair to the welds may not be made after macroetching. Cracks, lack fusion, and lack of penetration, as defined in AWS D1.5, that are found during macroetch examination will result in a unsatisfactory mockup.
5. Should the Engineer deem the mock-up unsatisfactory, the Contractor shall revise and resubmit the Fabrication/Erection Procedure to correct the deficiency identified by the first mock-up. A new mock-up, or partial mock-up, as determined by the Engineer, will be required after approval of the revised Fabrication/Erection Procedure.
6. Mock-ups shall not be part of the permanent structure and shall become the property of the Contractor.

1.07 SUBMITTALS

- A. All submittals shall be in the English language using Imperial units.
- B. Submit the following information related to welding:
  - 1. Written shop and field welding procedures including, but not necessarily limited to, the following:
    - a. All AWS D1.1 pre-qualified joints.
    - b. Qualification procedures for all joints not pre-qualified by Section 3 of AWS D1.1.
    - c. Written welding procedures for all weldments involving fracture-critical members in accordance with the Fracture Control Plan (see paragraph 1.06.B.5).
    - d. Written welding procedures developed by a welding consultant for all weldments involving heavy members (plates or elements with thickness 2 inches or greater) or a high degree of restraint (junctions of several members, multiple stiffeners, etc.), showing welded positions, sequence of assembly, preheat, interpass and postheat requirements and any other information required to provide a satisfactory connection.
  - 2. Welder qualifications
  - 3. Inspection and test results from fabrication shop and from field within five calendar days of inspections and tests
- C. Mill Reports: Furnish three certified copies of all mill reports for approval, covering the chemical and physical properties of all steel, nuts, bolts, washers and anchor rods used in this contract. Reports shall include results of Charpy V-notch tests, where required. Prior to commencing the erection of steel, the Contractor shall deliver certificates to the Authority. Such certificates shall be obtained from the mills producing the steel and shall certify in a cover letter submitted with the certificates, that the steel meets the minimum requirements as to physical properties, inspection, marking and tests for structural steel as defined by the current edition of the relevant ASTM Specification.
- D. Quality Control Program: Submit a Copy of the fabrication shop's Quality Control Program as outlined in this Section. The program, at a minimum, shall include the following:
  - 1. Contractor qualifications: See paragraphs 1.08A and 1.08B.
  - 2. 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.
  - 3. 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 for bridge members and Fracture Critical Material, as required by AWS D1.5.
  - 4. 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.
  - 5. 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.

6. 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.
  7. A brief statement that explains the amount of steel, in tons, to be fabricated by each shop performing the work and the location it is intended for.
  8. Copy of the Fracture Control Plan as per this Section, if applicable.
  9. Name and location of shop that will perform painting work along with the shop's Quality Control Plan in accordance with Section 09910.
  10. Notification, in writing, 15 days prior to commencing fabrication of structural steel.
  11. Notification, in writing, 15 days prior to commencing with surface preparation and painting.
  12. Notification, in writing, 15 days prior to commencing field welding operations.
- E. Preconstruction Survey: Where interface with existing construction occurs, the existing construction shall be surveyed and such survey submitted before related shop drawings are prepared. Before steel erection commences, a complete survey for position and alignment at all points where the concrete foundation will support steel elements, including, but not limited to, embedded plates, anchor rods and base plates. Include plan location positions in the same vertical and horizontal datum as the Contract Documents.
- F. Shop and Erection Drawings: Submit shop and erection drawings, job standards and calculations as follows:
1. At least two weeks prior to submission of job standards and shop drawings, the Contractor shall submit for approval a job standard and shop drawing weekly submission schedule. This schedule shall include a list in order of date to be submitted and the format of all drawings scheduled to be submitted each week, including, but not limited to, the number of job standards, erection drawings and piece drawings. Once shop-drawings submissions have commenced any modification or addition to this schedule must be submitted for approval at least two weeks before the modification or addition is proposed to take place.
  2. The Contractor is responsible to design all connections not completely detailed on the Contract Drawings based on the forces shown and using the criteria outlined in paragraph 1.07F.7. The design of these connections shall be prepared under the supervision of a Professional Engineer registered in the State of New York and retained by the Contractor.
  3. The shop and erection drawings shall contain all dimensional and geometric information, grade of steel, shop surface treatments and shop connections. The shop drawings shall clearly distinguish between shop and field welds and bolts and shall clearly identify pre-tensioned and slip-critical high strength bolted connections.
  4. Materials shall not be fabricated or delivered to the site before the shop drawings have been approved and returned to the Contractor.
  5. Shop drawings shall include layouts and details showing the type of steel for each member, sizes of members, connections, cuts, copes, holes, bolts and welds in structural steel. Surface treatments (cleaning, shop paint, etc.) and provisions for the connection of other work shall be indicated on the shop drawings.

6. All welds shall be indicated by standard welding symbols as shown in the AWS "Structural Welding Code". Drawings shall include, but not necessarily be limited to the following:
  - a. Size, length and type of each weld.
  - b. Type of electrodes to be used.
  - c. All weld access, blow and stress-relief holes.
  - d. Locations of fracture critical welds.
  - e. Indicate grinding, finish and profile of all welds for Structural Steel Type 1.
7. The Contractor shall submit job standards for all typical beam, girder, column splices, moment connections and wind bracing details prior to submitting detail drawings. Job standards shall include calculations, when applicable, for details not specifically shown on the Contract Drawings. The job standards shall meet the following criteria:
  - a. Typed, or by using a spreadsheet, or by computer program or by other method approved by the Engineer.
  - b. Provide sketches for each calculation, with all pertinent dimensions relating to the calculations (including pitch, gauge, edge distance, unbraced lengths, etc.) clearly shown. Geometry must be shown accurately and to scale. Provide enough sketches to clearly document the full range of geometric conditions applicable to each job standard proposed.
  - c. For repetitive connections, provide a standard calculation and a spreadsheet or table for each specific location, showing how the standard calculation applies.
  - d. Provide drawings showing the overall locations of the connections that are keyed/referenced to each connection calculation.
  - e. Number each calculation in a logical and orderly numbering system. Once submitted for review calculations shall not be renumbered. Resubmitted calculations shall be indicated by using the same number with an "R" suffix. All changes must be clouded.
  - f. All forces shown on the drawings are assumed reversible and must be checked for both directions unless specifically indicated otherwise.
  - g. All AISC code requirements apply, provide calculations for each check, "OK by inspection" is not permitted.
8. The erection drawings shall include the following information:
  - a. Exact locations of base and bearing plates and/or bolts and other embedded items.
  - b. All field connections, not specifically shown on shop drawings, including the size, type and number of bolts.
  - c. Size, type and length of all field welds.
  - d. Location and preparation methods for areas to receive field-applied primer.
9. Shop and erection drawings shall be submitted in complete packages so that individual parts and the assembled unit may be reviewed together. This Section and the applicable drawings used in the development of the shop and erection drawings shall be referenced on each shop and erection drawing to facilitate checking. Index sheets that show related piece marks to the sheet numbers on which they are located shall be furnished with all beam, girder and column details at the same time the details are submitted for review, unless the marks are self indexing.
10. Drawing Review: The review and approval of connection design and the review and approval of shop and erection drawings by the Engineer of Record shall be for

conformance with the design concept of the work and with the information given in the contract documents only and will not in any way relieve the Contractor from:

- a. The responsibility for all required detailing.
  - b. The responsibility for the proper fitting of construction work in strict conformance with the contract requirements.
  - c. The necessity of furnishing material and workmanship required by contract drawings and specifications which may not be indicated on the shop and erection drawings.
11. Changes to Submittals: All changes to submittals, shop drawings, job standards and erection drawings must be identified by clouding.
    - a. Automatic Rejection: Failure to submit calculations, failure to specifically indicate modifications, departure from contract documents or revisions to previously submitted job standards, shop drawings, or erection drawings and submittals shall automatically be considered cause for rejection of the modification or revision whether or not the drawing has been approved by the Engineer.
  12. The review and approval of shop and erection drawings shall not be construed as permitting any departure from the Contract Documents. Requests for substitutions or changes must be submitted in writing by the Contractor and approved in writing by the Engineer.
  13. Clearly identify each member as Structural Steel Type 1 or 2.
  14. Welding procedures including fracture control plan and sequence of construction plan shall be submitted by the Contractor and approved by the Engineer prior to submission of shop and erection drawings.
  15. Provide at a minimum a 3-1/2 inches by 3-1/2 inches blank area on each shop and erection drawing for application of the Engineer's drawing review stamp.
- G. Loads Imposed: The structure as shown on the contract documents is designed to withstand the superimposed loads when all members, such as bracing members, beams and metal deck, are installed and fully connected. The Contractor shall be responsible for the analysis of all components for stresses that may be superimposed to all members due to fabrication, shipping, handling, temporary conditions, construction loads, etc. The analysis of such, which shall be performed by a Professional Structural Engineer registered in the State of New York and retained by the Contractor, shall be submitted to the Engineer for review and approval.
- H. Provide a detailed sequence of construction plan as indicated on Contract Drawings.
- I. If Load Indicating Washers (Direct Tension Indicators) are used, submit installation procedures, including a diagram of the proper bolt fit up prior to the start of work. Provide sample installations on site for verification and testing.
- J. When indicated on Contract Drawings, submit intermediate field surveys to confirm that specified erection tolerances are being met. Surveys shall be performed by a licensed surveyor retained by the Contractor.
- K. Submit test results for slip coefficient of paint when applied to faying surfaces of bolted connections.

- L. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's work. Cost breakdowns shall include total cost plus itemized material costs
    - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
      - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
      - 2) The manufacturing location of the supplied product(s).
      - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
      - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
      - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
  2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  3. Product cut sheets for materials that meet the SDMCF.
  4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
  5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.
- M. Structural Steel Type 1 Samples:
1. Finished painted samples:
    - a. Two samples of 12 inch by 12 inch by 1/2 inch thick steel plate with full penetration groove weld full length of plate. Weld shall be ground in accordance with 2.02 F.2 and plate shall be properly prepared and finish painted in accordance with the requirements of this specification.
  2. Repaired painted samples (to be prepared in the presence of the Engineer):
    - a. Two samples of 12 inch by 12 inch by 1/2 inch thick steel plate with full penetration groove weld full length of plate. Plate shall be intentionally damaged with two gouges at least 2 inches long by 1/4 inch in depth and repaired. Plate shall be straightened and the welds shall be ground smooth. Plate shall be properly prepared and finish painted in accordance with the requirements of this specification.

1.08 QUALIFICATIONS

- A. The entity performing the Work of this Section shall have a minimum of five 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.
- B. Fabricator Certification
  - 1. For the purposes of this work, the fabrication shop shall be certified under the AISC certification program as Category STD (Standard for Steel Building Structures).
  - 2. For members designated on the Contract Documents as bridge members, the fabrication shop shall be certified under the AISC certification program as Category CBR (Major Steel Bridge).
  - 3. For members designated on the Contract Documents as FCM's, the fabrication shop shall have a fracture critical endorsement of the AISC if a firm in the U.S.
  - 4. For fabricators located outside of the U.S. without AISC certifications, fabricator shall be certified under a certification program with requirements deemed equivalent to the applicable AISC Category, as determined and approved by the Authority.
  - 5. If the prime fabricator subcontracts any portion of the work, the subcontractor is subject to the same requirements as the prime fabricator.
- C. Welding Consultant
  - 1. The Fabricator shall employ a welding consultant responsible for the review or writing of all shop and field welding procedures (See 1.07.B.1.d). The welding consultant shall possess as a minimum a Bachelor of Science Degree in Metallurgical Engineering and demonstrate a minimum of 10 years experience in the welding of heavy steel sections: bridge and fracture critical members. Submit resume for review and approval.
- D. Field Welders: All welders shall be certified in the City of New York using AWS procedures and the following:
  - 1. The Contractor shall provide the Engineer with certifications for each welder. The certification for each welding operator shall state name, name and title of person conducting the certifying examination, bend of the specimens, weld position, test results and date of examination within a six-month period previous to starting on this project.
- E. Procedure Qualification
  - 1. For each weld type, the minimum plate size for welds in plates greater than 2 inches thick (t) is 10 inches by 20 inches by t for each of the two plates to be welded together.
  - 2. Three macro-examinations shall be performed on each sample such that one is taken near the end of the weld and one near the centerline. Additionally, three hardness traverses shall be performed: one near the top surface, one through the mid-plane, and one near the bottom surface.
  - 3. Two sets of Charpy V-notch impact (CVN) toughness tests shall be performed on each weld qualification sample. CVN specimens shall be taken from the weld and heat-affected zone (HAZ) near the end and centerline of the weld qualification sample. These CVN specimens shall exhibit at minimum toughness level of 30 ft-lb at 40 degrees F for HAZs and 20 ft-lb at 0 degrees F for weld metal.

4. The qualification test plates shall be adequately constrained so as to simulate the extent of constraint that will occur in the actual welded connections.
5. Preheat and interpass temperatures shall be maintained as specified herein.

#### 1.09 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 jobsite 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 jobsite. 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.

#### 1.10 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. Provide weep holes and clean outs as required to keep steel free from water. Adequate shoring and protection shall be provided to prevent distortion and other damage. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. Use special care in handling to prevent local or global distortion of Structural Steel Type 1 members and to prevent damage to any shop applied coatings.
- C. Any damages, including damages to coatings, shall be repaired by the Contractor at no cost to the Authority.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

##### A. Structural Steel

1. 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.
2. All structural steel shapes and plates identified as bridge or fracture critical members shall meet the following Charpy V-notch impact requirements when tested in accordance with ASTM A673:
  - a. ASTM A709 steel shall meet the requirements of Zone 2 for fracture critical tension components.

- b. All other fracture critical steel shall have a minimum Charpy V-notch value of 30 ft-lb at 40 degrees F tested at frequency level "P."
3. All other structural steel shapes and plates shall meet the following Charpy V-notch impact requirements when tested in accordance with ASTM A673:
  - a. Test not required for steel plates and structural steel shapes with elements up to 2" in thickness.
  - b. All 50 grade steel plates and structural steel shapes with elements 2" and greater shall have a minimum Charpy V-notch value of 30 ft-lb at 40 degrees F.
  - c. All grade 70 and grade 100 steel plates and structural steel shapes with elements 2 inches and greater shall meet the requirements of Zone 2 for non-fracture critical tension components.
  - d. The Charpy V-notch-impact testing frequency shall be "H".
- B. High Strength Bolts
  1. 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 A325 or A490 Bolts."
  2. When bolt requirements cannot be provided by ASTM A325 or A490 bolts because of requirements for lengths exceeding 12 diameters or diameters exceeding 1 ½ inch, bolts or threaded rods conforming to ASTM A354 Grade BC, A354 Grade BD, or A449 are to be permitted to be used in accordance with the provisions for threaded rods in Table J3.2 of the "Specification for Structural Buildings, March 9, 2005," published by the American Institute of Steel Construction, Inc. The number of bolts and bolt diameter shall be as shown on the Contract Drawings.
- C. Anchor Bolts
  1. Anchor bolts shall conform to ASTM type shown on the Contract Drawings and shall be the regular hexagon-bolt type.
- D. Welding Electrodes:
  1. Comply with AWS D1.1 (D1.5 for bridge and fracture critical members).
  2. All weld metal for 50 grade steel shall have a minimum Charpy V-notch impact value of 20ft.-lb at 0 degrees F, unless otherwise noted.
  3. All weld metal for 70 grade steel and higher shall have a minimum Charpy V-notch impact value of 20 ft-lb at minus 20 degrees F, unless otherwise noted.
  4. Provide the lowest possible hydrogen content filler material (electrode) for all weld types, including fillet welds.
- E. Grout: In accordance with Section 03602.
- F. Primer: In accordance with Section 09910.

## 2.02 FABRICATION

- A. Cleaning and Preparation of Steel Surfaces shall be in accordance with Section 09910.

- B. Fabrication shall not begin without approvals for the following:
1. Shop Drawings
  2. Quality Control Plan including Fracture Control Plan for FCM's
  3. Welding Procedure Specifications
  4. Procedure Qualification Records (if applicable)
  5. Welder Qualifications
  6. Mill Test Reports
  7. Metal Pre-heating and post-heating requirements
  8. Quality Control personnel, including an AWS Certified Welding Inspector (CWI) and non-destructive testing personnel that meet ASNT SNT-TC-1A Level II qualifications.
- C. 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.
- D. 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. Fabricate within tolerances specified in Section 6 of AISC Code of Standard Practice or as shown on the Contract Documents.
- E. Properly mark and match-mark materials for field assembly. Fabricate for a delivery sequence, which will expedite erection and minimize field handling of materials.
- F. Employ the following additional fabrication techniques for Structural Steel Type 1:
1. At field joint locations the member shall be shop-fabricated as a single unit, with a precision-cut joint or it shall be pre-assembled into a single unit to confirm the connection fit-up prior to shipping.
  2. Welds Ground Flush:
    - a. For exposed members, all groove welds to within 20 feet of adjacent top of slab to be ground to "flush surfaces" as specified in AWS D1.1 with the exception that the weld surface shall be within 1/16 inch of surrounding plate surface.
    - b. For groove welds of exposed members located greater than 20 feet above adjacent floor slab, welds shall be ground to flush surface to be no more than 1/8 inch from the surrounding plate surface.
  3. Mill Mark Removal: Fabricator shall deliver steel with no mill marks (stenciled, stamped, raised etc), If necessary, mill marks shall be omitted by cutting of mill material to appropriate lengths.
- G. Refer to Article 3.02 for additional requirements.

2.03 SHOP PAINTING-

- A. Unless otherwise shown on the Contract Drawings, shop paint all structural steel, except the following:
  - 1. 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.
  - 2. Surfaces which are to be welded.
- B. For high strength bolted surfaces with slip critical connections, paint with an approved slip critical zinc rich prime coating only.
- 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.
- E. Notify the Authority Materials Engineering Division 15 days prior to starting painting work 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
  - 1. 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 Rods and Embed Plates
  - 1. The Contractor shall ascertain by accurate survey the location, alignment and elevation of the anchor rods and plates 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 ASSEMBLY

- A. Workmanship: The Authority's inspector may require any welder be requalified if, in the opinion of the Authority's inspector, the workmanship of the welder has created a reasonable

doubt as to the proficiency of the welder in accordance with AWS D1.1 and D1.5 for bridge or fracture critical members. If a welder is required to be requalified, preparation of test samples and subsequent tests shall be conducted at the sole expense of the Contractor and shall be witnessed by the Authority's inspector. Should the welder fail the recertification test, the welder shall be permanently removed from performing work on the project using that welding process. Welder qualifications shall be performed in accordance with AWS requirements.

- B. Holes: Comply with referenced standards and specifications and the following:
1. Holes shall not be enlarged by burning. Burning or drifting misaligned holes will not be permitted. Holes that must be enlarged shall be reamed. Drift pins will be allowed only to bring together the several parts for connection.
  2. Holes shall be provided in members to permit connections to the work of other trades or contracts only where specifically indicated on the Contract Drawings, or when approved by the Engineer.
- C. Cutting: Comply with referenced standards and specifications and the following:
1. The use of manual gas-cutting to correct misalignment shall only be permitted where approved by the Engineer.
  2. All thermally cut surfaces shall be ground to a bright metal finish and if the surface is to be subsequently welded, shall be inspected by magnetic particle testing (MT).
  3. The thermally cut surfaces of weld access holes for plates 1 inch thick and greater shall be ground to a bright metal finish and then inspected by magnetic particle testing (MT).
- D. Bolting: Comply with referenced standards and specifications and the following:
1. Bolts shall be driven accurately into the holes without damaging the threads. Bolt heads shall be protected from damage during driving. Bolt heads and nuts shall rest squarely against the metal. Where bolts are to be used on beveled surfaces having slopes greater than 1 in 20 with a plane normal to the bolt axis, beveled washers shall be provided to give full bearing under the head or nut. Bolt threads for unfinished bolts or any bolts which are shown as "snug tight" shall be deformed to prevent the nuts from backing off.
  2. Anchor rods and base plates shall be labeled and shipped in sets indicating sizes and locations of columns. Delivery of anchor rods shall be made in ample time prior to the start of related concrete work. Rigid steel templates shall be furnished, together with instructions for setting of anchor rods. Provide 3-inch by 3-inch by 5/16-inch minimum plate washers between top of base plate and bottom of anchor rod nuts.
- E. Welding: Comply with referenced standards and specifications and the following:
1. The surface to be welded and the filler material to be used shall be subject to inspection before welding is performed.
  2. The heat, input, length of weld, weld sequence and cooling process shall be controlled to prevent distortions. For weldments whose configuration could restrain contraction during cooling of the weldment, extreme precautions should be taken. Sequence of welding operations shall conform to the approved shop and erection drawings.
  3. Each welder shall mark their identification symbol on their work.
  4. Where rolled shape elements or plates exceeding 2 inches in thickness are to be welded the following additional preheat requirements shall apply:

- a. The Contractor shall demonstrate that the preheat can be maintained without relying on the heat from the arc. This shall be demonstrated prior to the start of production welding. For field welding, the Contractor shall provide a shelter to protect each joint from inclement weather {rain, snow, etc.}, from start until completion of the joint
  - b. The preheat shall be maintained throughout the thickness of the material for a distance equal to the material thickness or 3 inches, whichever is greater, on both sides of the joint at a minimum. Where different thicknesses of steel are being joined, the greater thickness shall govern. Preheat shall be measured on the face opposite the side of the heat application. Preheat shall be applied uniformly in a manner that does not harm the surface of the material nor cause surface temperatures to exceed 1100 degrees F.
5. Welding of fracture critical members shall conform to AWS D1.5, Section 12 except as modified herein.
6. Pre-Heat Requirements
- a. All welds in FCM and bridge plates and shapes less than 1-1/2 inch in thickness shall have a minimum preheat and interpass temperature of 200 degrees F.
  - b. Welds in plates with a thickness of 1-1/2 inch or greater (including non-FCMs) shall have a minimum preheat and interpass temperature of 300 degrees F.
  - c. For FCMs, where the preheat temperatures of Tables 12.3 to 12.5 of AWS D1.5 exceed the temperatures given herein, the temperature in the table shall govern.
7. Post-Heat Requirements
- a. For FCM plates and shapes with thickness of 3 inches or greater, the incorporation of hydrogen diffusion post heat treatment per Section 12.15 of AWS D1.5 is required. Post weld heat treatment of 450 degrees F to 600 degrees F for 1 hour per inch of thickness is required.
8. All weld bevel surfaces shall be ground to bright metal finish.
9. Low hydrogen welding practices shall be utilized for all weld types including fillet welds.
10. Removal of Backing Bars
- a. For fracture critical members that are not designated as bridge members, the backing bar in CJP welds, transverse to the direction of the stress, shall be removed after completion of welding, and the root shall be ground and inspected by MT unless it is otherwise indicated on the Contract Drawings that the backing bar may remain. At these locations where it is identified on the Contract Drawings that the backing bar may remain in place, the root pass shall be cleaned, and inspected by MT prior to continuing with the weld. All defects and flaws shall be removed and repaired prior to proceeding with the remainder of the weld.
  - b. For fracture critical members that are also designated as bridge members, the backing bar in CJP welds, transverse to the direction of stress, shall be removed after completion of welding and the root shall be ground and inspected by MT. All defects in the root weld shall be repaired and rewelded per AWS requirements (including post heat requirements as applicable). AWS pre-heat requirements for repair of the root weld is not required
11. Where access permits, all CJP welds shall be made from both sides of the joint.

12. The root pass of all groove welds of FCMs and of members with thickness 4 inches and greater, shall be back-gouged on the back side of the weld (unless where the backed bar is permitted to remain) and inspected by MT prior to depositing any additional weld metal.
  13. Weld passes shall be sequenced to minimize residual stresses.
  14. Each weld pass shall be thoroughly cleaned prior to depositing the next pass.
  15. Groove welds in fracture critical members shall be ground flush with the parent base metal.
  16. Tack welds shall be subject to the same requirements as the primary weld unless the tack welds are consumed by the SAW welding process.
- F. Bearing Surfaces: Comply with referenced standards and specifications and the following:
1. Protect milled and sawn bearing surfaces with an approved rust-inhibiting coating which is to be removed immediately prior to erection.
- G. Temporary Attachments
1. Temporary attachments to FCMs must be pre-approved by the Engineer in writing, and shall be shown on the shop drawings.
  2. When run-off tabs are utilized in CJP welds and subsequently removed by thermal cutting, the flame cut surfaces shall be ground to a bright metal finish and inspected using MT.
  3. All temporary attachments on fracture critical members shall be removed, ground flush to a bright metal finish, and inspected by MT. Attachments to non-fracture critical members may only be left in place with prior written approval of the Engineer.
  4. Removal of temporary attachments to FCMs shall be subject to the weld removal requirements of AWS D1.5, articles 12.13.2 and 12.13.3.

### 3.03 ERECTION

- A. Workmanship: 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 tolerances specified in Section 7 of the AISC Code of Standard Practice or as 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.
- B. Procedure: Erection shall match the approved sequence of construction plan. Where deviations to this plan are required, submit revisions for review and approval at least 30 days prior to anticipated change.
- C. 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.

- D. Errors: Immediately report to the Engineer any errors in shop fabrication, deformations resulting from handling and transportation and improper erection that affect the assembly and fitting of parts. Prepare details for corrective work and obtain approval of the method of correction. Approved corrections shall be made expeditiously at the sole expense of the Contractor.
- E. Column Base Plates: Column base plates shall be supported and aligned on steel shims or leveling nuts. After the supported members have been plumbed and properly positioned the anchor nuts shall be tightened, in preparation for grouting. Wedges and shims shall be cut off flush with edges of plates and shall be left in place. The use of leveling plates will not be permitted unless specifically indicated on the Contract Drawings. All base plates greater than 20 inches in any dimension shall be set on steel angle seats or shim packs.
- F. Grouting: Refer to Section 03602. Base plates shall be grouted immediately after the first tier of columns is plumbed. Steel erection shall not proceed above the first tier until base plates are grouted.
- G. Bolting and Welding of Structural Steel: See Article 3.02.
- H. Bearing Surface: Clean bearing surfaces and surfaces that will be in permanent contact before the members are assembled.
- I. Field Splices: Fastening of splices of compression members shall be done after cleaning of the surfaces and the abutting surfaces have been brought completely into contact. Any remaining gaps shall be filled with steel shims driven into place and cut flush. Tack weld shims to each other and to members. Splices will be permitted only where indicated on the Contract Drawings or the approved shop drawings. Bevel weld splices shall use runoff tabs, which shall be cut off and ground smooth after weld completion.
- J. Driftpins: Driftpins may be used only to bring together the several parts and shall not be used in such a manner as to distort or elongate the hole. Poor matching of holes shall be corrected by drilling to the next larger size and the use of larger size bolts. Plug welding and redrilling will not be permitted, unless approved by the Engineer.
- K. Hammering: Hammering which may injure or distort the members will not be permitted.
- L. The use of cutting torches in the field shall not be permitted without the specific approval of the Engineer for each application.
- M. Employ the following additional erection techniques for Structural Steel Type 1:
  - 1. Erect pre-painted finish pieces using padded slings or other methods such that they are not damaged. Provide padding as required to protect while rigging and aligning member's frames.
  - 2. Weld tabs for temporary bracing and safety cabling only at points concealed from view in the completed structure. Where weld tabs on exposed surfaces are approved by the Engineer they shall be removed and ground to a smooth profile with adjacent surfaces.

3. Do not locate weld access holes in exposed portions of Type 1 structural steel without the written approval of the Engineer.
- N. Additional Material and Labor: If the Contractor furnishes additional material and labor for the purpose of erection or if the erection method requires that material be added to certain members, the required modifications shall be at the sole expense of the Contractor.
- O. 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.
- P. Miscellaneous:
1. Where headed steel studs are called for to be welded to tops of beams, these beams are designed to act compositely with the concrete floor slab
  2. Provide temporary planking and working platforms as necessary to effectively complete Work.

#### 3.04 FIELD TESTS

- A. The Contractor shall perform field tests and inspections as required by Article 1.06, the approved Contractor's Quality Control Plan and the Sequence of Construction Plan. Tests and inspections of the following items shall be performed in accordance with the Codes and Standards referenced in 1.04: connections; proper tensioning of bolts; levels, plumbness and alignment of framing; and field painting.
- B. The Authority will perform all quality assurance testing and the Contractor shall perform all quality control inspections for field bolting and welds in accordance with this Section. The Contractor shall supply all equipment and personnel necessary to allow safe access for said testing and inspection, at no additional cost to the Authority.
- C. Scheduling:
1. Every 2 weeks, the contractor shall submit an updated schedule for the following 6 weeks, indicating all testing and inspections required during that period.
  2. Every week, the contractor shall submit an updated schedule for the following 2 weeks, indicating anticipated shift hours that will require the Contractor's inspector to be present during that period.
  3. The contractor shall submit written notification, by email to those individuals identified by the Engineer, a minimum of 24 hours in advance of all Contractor inspections and testing, indicating, location and start/finish times of said inspections and testing.

**END OF SECTION**

**SECTION 05311**  
**STEEL DECK**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section specifies requirements for steel floor, roof and form deck.

**1.02 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. Comply with applicable provisions of the following specifications:

1. American Iron and Steel Institute (AISI)
2. American Welding Society (AWSI)
3. Steel Deck Institute (SDI)

**1.03 RELATED SECTIONS**

- A. Section 01352 – Sustainable Design Requirements

**1.04 REFERENCES**

- A. American Iron and Steel Institute (AISI)
1. North American Specification for the Design of Cold-Formed Steel Structural Members
- B. American Welding Society (AWS)
1. D1.1 - Structural Welding Code - Steel
  2. D1.3 - Structural Welding Code - Sheet Steel
- C. ASTM International (ASTM)
1. A36 - Standard Specification for Carbon Structural Steel
  2. A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished
  3. A653 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  4. A780 – Standard Practice for Repair of Damaged and Coated Areas of Hot Dip Galvanized Coatings
  5. A1008 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
- D. Steel Deck Institute (SDI)

1. Design Manual for Composite Decks, Form Decks and Roof Decks - Publication No.31.
  2. Diaphragm Design Manual Third Edition - Publication No. DDM03.
- E. Factory Mutual (FM) Global
1. 1-28 Wind Loads to Roof Systems and Roof Deck Securement Data Sheet

#### 1.05 SUSTAINABLE DESIGN REQUIREMENTS

- A. Sustainable Design General Requirements
1. The Authority requires the Contractor to implement practices and procedures to meet the Contract's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Section 01352 and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the Work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.
- B. Sustainable Design Performance Criteria
1. Metal decking shall contain a minimum of 25 percent (by weight) recycled content, calculated by adding the post-consumer recycled content percentage to one-half of the post-industrial recycled content percentage. Certify the recycled content in accordance with the Sustainable Design Submittal Requirements of this Section.
  2. The manufacturing location (final assembly) of the metal decking shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
  3. The origin of the raw materials from which the metal decking was manufactured shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
  4. All field-applied adhesives, sealants, paints and coatings relating to Work of this Section shall meet the requirements of Section 01352.

#### 1.06 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 Code requirements 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. 31. See Section C1.0 of the design manual 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. 31. See Section C1.0 of the design manual for composite steel floor deck, also Sections RD1.0 for steel roof deck and NC1.0 for non-composite steel floor deck (form deck). Refer to RD1.0 or C1.0 (if applicable) for the specifications pertaining to 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.

#### 1.07 SUBMITTALS

- A. All submittals shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 – GENERAL PROVISIONS.
- B. Shop Drawings
  - 1. 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.
  - 2. Layout of electrical distribution ducts and trenches in cellular metal floor.
- C. Catalog Cuts, Materials Certification and Test Results
  - 1. Submit the following information related to welding:
    - a. Certification that welders to be employed in the Work have satisfactorily passed AWS qualification tests.
    - b. Written field welding procedures.
  - 2. 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.
  - 3. Test data, calculations or design charts for self tapping screws prepared by the screw manufacturer.
- D. Samples
  - 1. Submit samples of the metal decking of sufficient size to show the materials, finishes, construction, connections and workmanship involved in fabrication of the decking.
- E. Construction procedures and Quality Assurance Documents
  - 1. Submit manufacturers recommended installation instructions.
- F. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:

1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
  - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.
  - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
    - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
    - 2) The manufacturing location of the supplied product(s).
    - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
    - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
    - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
3. Product cut sheets for materials that meet the SDMCF.
4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

#### 1.08 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.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. The following materials shall conform to the types shown on the Contract Drawings. The types are indicated by the ASTM International (ASTM) Specifications Designation for each.
1. Steel for Painted Deck Units: ASTM A1008.
    - a. For composite floor deck use SS Grades 33 and 40. For non-composite floor deck and for roof deck, use SS Grades 33, 40 or 80.
  2. Steel for Galvanized Metal Deck Units: ASTM A653 SQ Grade 33.
  3. Steel for Galvanized Steel Form Deck: ASTM A653 Structural Quality (SQ) Grade 40 or 50.
  4. Miscellaneous Steel Shapes: ASTM A36.

### 2.02 ACCESSORIES

- A. Shear Connectors, if any
1. Headed stud type, ASTM A108, Grade 1015 or 1020, cold-finished carbon steel, AWS D1.1 Type B.
- B. Sheet Metal Accessories
1. Commercial quality, ASTM A653, galvanized (coating designation G90).
- C. T-toggles when their use is permitted by the Engineer.

### 2.03 FABRICATION

- A. General
1. 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 of floor deck by acting compositely with the concrete shall be limited to 1/360 of the span. The deflection of roof deck under design live load shall not exceed 1/240 of the span.
  2. Metal Joint Cover Plates, if any
    - a. Fabricate metal joint cover plates of no 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.
  3. Metal Closure Strips, if any
    - a. Fabricate metal closure strips, for cell raceways and openings between decking and other construction, of no less than 0.045-inch, minimum (18-gauge) 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.

4. Roof Sump Pans
  - a. Fabricate from single piece of 0.071-inch, minimum (14-gauge) 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 no less than 3 inches wide. Recess pans no 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.
5. Tolerances
  - a. Fabrication tolerances for deck shall be in accordance with the provisions of SDI Publication No. 31.

B. Composite Metal Deck

1. Fabricate deck units with integral embossing or raised pattern to furnish mechanical bond with concrete slabs.

2.04 SHOP PAINTING

A. Galvanizing: ASTM A653, G60 (Z 180) minimum.

B. Galvanizing Repair Paint

1. High zinc dust paint complying with ASTM A780 and containing a minimum of 92 percent zinc in the dry film
2. Field applied repair paint shall comply with the VOC limits of Section 01352. The maximum allowable VOC content for zinc-rich paints is 100 grams/liter.

C. Coating for Exposed Galvanized Deck Surfaces

1. 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

1. 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 and Form Deck Units

1. Fasten floor and form deck units to steel supporting members by no less than 3/4-inch diameter fusion welds spaced no more than 12 inches on center with a minimum of two 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 on center for fastening end closures.

C. Fastening Roof Deck Units

1. Fasten roof deck units to steel supporting members by no less than 5/8-inch diameter fusion welds spaced not more than 12 inches on center 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

1. Where shown on the Contract Drawings, an Engineer-approved self tapping screw fastener may be used in lieu of fusion welds specified above. Only one type of fastening method shall be used for the steel deck fastening.

E. Welding

1. Comply with AWS Code 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. 31 shall be considered minimum requirements.

F. Cutting and Fitting

1. Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.

G. Reinforcement at Openings

1. 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
1. 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
1. Place over openings provided in roof decking, and weld to top decking surface. Space welds no more than 12 inches on center, with at least one weld at each corner. Cut opening in roof sump bottom to accommodate drain size shown.
- J. Shear Connectors, if any
1. 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
1. 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
1. 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 weight of steel deck and wet concrete weight as determined by design slab thickness 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  $3/4$  inch, whichever is less. Calculated deflection shall be relative to supporting members.
- 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**  
**INSTRUCTIONS TO SPECIFIER**

- A. The specifier shall review all items listed in 1.07 "Submittals". Remove items that are not applicable to this project and add to 1.07 "Submittals" under the proper headings, any submittal items that are intended to be shown on the contract drawings. Review the final 1.07 "Submittals" with the Principal/Senior Engineer in charge.
- B. Ensure that the Contract Drawings show:
1. Type, size and finish of deck units.
  2. Shear connectors, if any. (2.02 A)
  3. Shop prime paint and surface preparation, or galvanizing, if any.
  4. Welds where heavier than standard.
  5. For decks with diaphragm action and for deck at roof edges, show the increased number and/or size of attachments at supports and side laps.
  6. If screw fasteners are to be used as an alternative to fusion welds, specify fasteners and all spacings on drawings.

**END OF INSTRUCTIONS**

**SECTION 05400**  
**COLD-FORMED METAL FRAMING AND SHEATHING SYSTEM**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. This Section specifies requirements for cold-formed metal framing systems.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Design Criteria: Items requiring design computations shall be designed by the Contractor to comply with AISI North American Specification for the Design of Cold-Formed Steel Structural Members, Standard for Cold-Formed Steel Framing – General Provisions, and with applicable building codes.

1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements
- B. Section 09250 – Gypsum Drywall.

1.04 REFERENCES

- A. American Iron and Steel Institute (AISI)
1. North American Specification for the Design of Cold-Formed Steel Structural Members.
  2. Standard for Cold-Formed Steel Framing – General Provisions.
- B. ASTM International (ASTM)
1. A123 - Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
  2. A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  3. A780 - Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
  4. C954 - 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.

5. C955 - Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.
6. C1007 - Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
7. C1177 - Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
8. C1513 - Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
9. E96 – Test Methods for Water Vapor Transmission of Materials
10. E119 - Test Methods for Fire Tests of Building Construction and Materials.
11. E283 - Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

C. American Welding Society, Inc. (AWS)

1. D1.1 - Structural Welding Code – Steel.
2. D1.3 - Structural Welding Code – Sheet Steel.

D. The Society for Protective Coatings (SSPC)

1. Paint 20 - Paint Specification No. 20 – Zinc Rich Primers (Type I, Inorganic, and Type II, Organic).

## 1.05 SUSTAINABILITY DESIGN REQUIREMENTS

A. Sustainable Design General Requirements

1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section 01352 and the articles below, are implemented to the fullest extent. Substitutions or other changes to the Work proposed by the Contractor shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.

B. SUSTAINABLE DESIGN PERFORMANCE CRITERIA

1. Gypsum board products shall contain a minimum of 5 percent (by weight) recycled content, calculated by adding the post-consumer recycled content percentage to one-half of the post-industrial recycled content percentage. Certify the recycled content in accordance with the Sustainable Design Submittal Requirements below.
2. The manufacturing location (final assembly) of the gypsum board and steel framing shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.

3. Steel framing and support members (studs and runners, wall and ceiling furring, ceiling framing) shall contain a minimum of 25 percent (by weight) recycled content, calculated by adding the post-consumer recycled content percentage to one-half of the post-industrial recycled content percentage. Certify the recycled content in accordance with the Sustainable Design Submittal Requirements below.
4. The manufacturing location (final assembly) of gypsum board and steel framing shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
5. The origin of the raw materials from which the gypsum board and steel framing were manufactured shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
6. All field-applied adhesives, sealants, paints and coatings relating to Work of this Section shall meet the requirements of Section 01352.

#### 1.06 QUALITY ASSURANCE

- A. Fire Resistance Rating: Where assemblies with fire resistance ratings are shown on the Contract Drawings, provide materials and installations which are identical to those of applicable assemblies tested in accordance with ASTM E 119 by an approved test agency.
- B. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated without delaying the Work, as documented in accordance with ASTM E699.
- C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project site is located and is experienced in providing engineering services of the type required for Work of this Contract.
- D. Welding Standards: Comply with applicable provisions of AWS D1.1 and AWS D1.3.
  1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and if pertinent, has undergone recertification.
- E. Single Source Responsibility: Obtain cold-formed metal framing and gypsum board products, each from a single manufacturer, or from manufacturers recommended by the prime manufacturer of each product.

#### 1.07 SUBMITTALS

- A. General: Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL REQUIREMENTS.

- B. **Product Data:** Manufacturer's product information and installation instructions for each item of steel framing system, accessories and gypsum sheathing.
- C. **Shop Drawings:** For special components and installations not fully dimensioned or detailed in the manufacturer's product data.
1. Include placing drawings for framing members showing size and thickness designations, number, type, location and spacing. Indicate welds, type and location of mechanical fasteners, anchorage, connections, supplemental strapping, bracing, bridging, reinforcing, splices, accessories and details required for complete installation.
- D. **Certifications**
1. Mill certificates signed by manufacturer of cold-formed metal framing certifying that their products comply with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation and galvanized coating thickness.
  2. In lieu of mill certificates, submit test reports from a qualified independent testing agency evidencing compliance with requirements.
- E. **Construction and Installation Procedures:** For prefabricated (panelized) framing installations, submit construction sequencing plan.
- F. **Design Calculations:** Submit calculations for loads and stresses of metal framing or trusses, sealed by a professional engineer registered in the state where the Work is to be erected.
1. Submit structural calculations for metal framing, signed and sealed by a Professional Engineer licensed and registered in New York State, indicating compliance with these Design and Performance Requirements.
- G. **Qualifications**
1. **Testing Agency:** Submit qualifications of testing agency.
  2. **Professional Engineer:** Demonstrate capabilities and experience. Include list of completed projects with project names, addressees, names of architects and owners.
  3. **Welder:** Evidence of current AWS certification.
- H. **Sustainable Design Submittal Requirements:** The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.

- b. The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).\*
  - c. The manufacturing location of the supplied product(s).\*
  - d. The location (source) of the raw materials used to manufacture the supplied product(s).\*
  - e. The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.\*
  - f. Include total cost for all wood products and itemized costs for all FSC-certified wood products.\*
- \* If applicable- requirements are defined per the Sustainable Design Performance Criteria, of this Section.
- 2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  - 3. Product cut sheets for materials that meet the SDMCF.
  - 4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
  - 5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver metal framing materials to construction site in the manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Protect metal framing from corrosion, deformation and other damage. Store off ground in a dry ventilated space or protect with suitable waterproof coverings.
- B. Deliver exterior sheathing materials in the manufacturer's original packaging, legibly identified. Store flat and level, off ground and under cover, with provision for air circulation. Handle to prevent breakage and damage to board edges.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Subject to compliance with requirements of this Section, furnish and install cold-formed metal framing by one of the following, or approved equal:
  - 1. Clark Steel Framing Systems, Middletown, OH
  - 2. Deitrich Metal Framing, Inc., div. of Worthington Industries Co., Pittsburgh, PA

3. Marino\WARE, South Plainfield, NJ
4. Super Stud Building Products Inc., Astoria, NY

B. Subject to requirements of this Section, furnish and install gypsum sheathing by one of the following, or approved equal:

1. G-P Gypsum Corp., Atlanta, GA
2. BPB America Inc., Tampa, FL

## 2.02 MATERIALS

### A. Metal Framing Materials and Finish

1. Minimum base-metal steel thickness of 0.0538 inch (16 gage) and heavier components: Structural quality steel sheet with a minimum yield point of 40,000 psi or greater in conformance with structural design, complying with ASTM A653.
2. Minimum base-metal steel thickness of 0.0428 inch thick (18 gage) and lighter components: Commercial quality steel sheet with a minimum yield point of 33,000 psi, complying with ASTM A653.
3. Studs
  - a. Manufacturer's standard C-shape or punched channel steel studs of type, size, shape and thickness shown on the Contract Drawings with 1.675 inch flange width on C-shape and 1.365 inch flange width on punched channel, unless otherwise shown.
4. Track
  - a. Same thickness as corresponding steel studs, sized to match, solid web. Track style, size and thickness for joists shall be as recommended by the joist manufacturer.
5. Joists
  - a. Manufacturer's standard C-shape sections of size and thickness as shown on the Contract Drawings.
6. Mark components to identify manufacturer, thickness and yield strength.
7. Finish: Galvanized finish on system components, including stud, track, joist, bridging and framing accessories, complying with ASTM A653 for minimum G60 coating.

### B. Framing Accessories

1. Furnish bracing, blocking, bridging, clips and gusset plates as shown on the Contract Drawings or as required by design using manufacturer's standard shapes. Hot-dip galvanize per ASTM A123.
2. Fastenings: Furnish type or combination of types per approved framing design and connection details.

- a. Manufacturer's standard self-drilling self-tapping screws: ASTM C1513. Where installed underneath sheathing, provide low-profile type fastener head.
- b. Anchor bolts, nuts and washers: Hot-dipped galvanized.
- 3. Anchorage devices: Drilled expansion bolts.
- 4. Galvanizing Repair Paint
- 5. SSPC-Paint 20, with dry film containing minimum of 94 percent zinc dust by weight.
  - a. "Cold Galvanizing Compound", manufactured by Z.R.C. Worldwide, Quincy, MA, or approved equal.

### C. Exterior Sheathing System

- 1. Gypsum Board Sheathing: Type and thickness as shown on the Contract Drawings:
  - a. Glass Mat Gypsum Board: ASTM C1177, 1/2 inch thick, square edge, water resistant treated core, eligible for 6 month in-place manufacturer warranty against damage due to weather exposure.
  - b. Where fire rated Work is shown on the Contract Drawings: ASTM C1177, Type X, 5/8 inch thick glass-mat faced, fire resistant sheathing.
- 2. Gypsum or other board product for interior walls and partitions shall be as specified in Section 09250.
- 3. Sheathing Fasteners
  - a. ASTM C954, steel drill screws, Type S-12 fluted tip, minimum 1-1/4 inches long, with organic-polymer coating or other corrosion-protective coating.
- 4. Sheathing Joint Treatment
  - a. Sheathing tape or sealant as recommended by the sheathing manufacturer, specifically designed and manufactured to seal joints in gypsum sheathing against water and air infiltration. Tape shall be formulated with an adhesive that permanently bonds to gypsum sheathing substrates.
- 5. Air Barrier
  - a. 17 mills thick self-adhering membrane consisting of a micro porous film laminate, backed with a specially applied adhesive, which allows water vapor to permeate through while acting as a barrier to air and bulk water. The air barrier shall have an air leakage rate of 0.012 CFM/square feet at 10.5 psi pressure when tested in accordance with ASTM E283 and water vapor permeance of 37 Perms when tested in accordance with ASTM E96. Air barrier shall be equal to Blueskin Breather as manufactured by Henry Company. Provide primer and edge seal materials recommended by air-barrier manufacturer.
- 6. Vapor Retarder
  - a. Reinforced polyethylene vapor retarder with manufacturer recommended joint tape and fasteners where shown on the Contract Drawings, or vapor retarder type as otherwise shown.

## 2.03 FABRICATION

### A. General

1. Studs, track, bracing and bridging shall be manufactured per ASTM C 955.
2. System components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion in any member.

### B. Fastenings

1. Attach similar components by welding. Attach dissimilar components by welding, bolting or screw fasteners, as recommended by the manufacturer.

### C. Wire tying of framing components and splicing of axially loaded studs is not permitted.

### D. Fabrication Tolerances

### E. Fabricate assemblies to a maximum allowable tolerance variation from plumb, level and true to line of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Maximum out-of-square tolerance of 1/8 inch.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- #### A.
- Examine supporting substrates and abutting structural framing for compliance with requirements, including installation tolerances and other conditions affecting performance of cold-formed metal framing. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- #### A.
- Coordinate framing installation with sprayed-on fireproofing application, if any, to avoid disturbing or damaging fireproofing material.

### 3.03 INSTALLATION

#### A. General

1. Fastening type, size, spacing and penetration shall be as detailed per design on approved Shop Drawings.
2. As framing Work progresses, fill voids that will become inaccessible, with insulation, sound attenuation or other materials shown on the Contract Drawings.

B. Steel Studs

1. Place and secure steel studs in accordance with ASTM C1007.
2. Do not start placement of steel studs until supporting Work is in place and secure. Install temporary bridging, connections and anchors as required to ensure lateral stability during construction.
3. Set studs plumb, spaced 16 inches o.c., unless otherwise shown on the Contract Drawings, without splices between connection points.
4. Install horizontal stiffeners in stud system, spaced not more than 48 inches o.c. vertically, or as otherwise shown on the Contract Drawings. Weld at each intersection.

C. Runner Tracks

- D. Install continuous tracks sized to match studs. Align tracks accurately to layout at base and tops of studs. Securely anchor tracks to supporting structure as recommended by stud manufacturer for type of construction involved, except do not exceed 24 inches o.c. spacing for nail or power-driven fasteners, nor 16 inches o.c. for other types of attachment.

1. Ensure complete, uniform and level bearing support for the bottom track at each stud location. If not provided, install full size load-bearing, high-density plastic shims below bottom track at stud locations as needed, or set bottom track in nonmetallic, nonshrink grout.
2. At intersecting or abutting track joints, securely anchor abutting pieces of track to a common structural element or splice pieces of track together.
3. Fasten track at corners and ends.
4. Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges.

E. Openings

1. Framed wall openings shall include a header and either multiple or heavier studs at each side of the openings, designed in accordance with AISI requirements and manufacturer's recommendations.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding. Space jack studs same as full-height wall studs. Secure stud system to wall opening frame as shown on the Contract Drawings.
3. Frame floor openings that are larger than the joist spacing.

## F. Joints

1. Frame both sides of expansion and control joints, where required for wall system, with a separate stud. Do not bridge joints with components of stud system.

## G. Joists

1. Install continuous rim track sized to match joists.
2. Install joists plumb, fastened to both flanges of track, complete with bracing and reinforcing as shown on approved Shop Drawings. Ensure minimum 1-1/2 inch end bearing.
3. Reinforce ends with end clips, steel hangers, steel angle clips, steel stud section or as otherwise recommended by joist manufacturer.
4. Where required, reinforce joists at interior supports with single short length of joist section located directly over interior support, snap-on shoe, 30 percent side-piece lapped reinforcement or other method recommended by joist manufacturer.
5. Secure joists to interior support systems to prevent lateral movement of bottom flange of joist.

## H. Exterior Sheathing System: Apply gypsum board sheathing where shown on the Contract Drawings, in accordance with ASTM C1280 and the following:

1. Screw sheathing to metal framing with screws placed 3/8 inch from board edges and ends. Space fasteners 8 inches o.c. or tighter as recommended by sheathing manufacturer, or as required for fire resistance rated application. Fasteners shall be flush with sheathing face, not countersunk.
2. Do not bridge control or expansion joints with sheathing.
3. Seal sheathing joints with sheathing tape or sealant per sheathing manufacturer's instructions, except where sheathing is overlaid with an air barrier, vapor retarder or a full layer of insulation.
4. Protection of Sheathing
  - a. Instead of sheathing tape or sealant and where shown on the Contract Drawings or required by code, apply felt to sheathing with corrosion resistant staples spaced as recommended by the sheathing manufacturer. Lap felt 2 inches horizontally, shingle fashion, and 8 inches at end laps. Install felts smooth, without bulges, free of buckling, but not stretched tight.
  - b. For slanted wall applications, if any: After sheathing is in place, apply felt to slanted walls with corrosion resistant staples spaced as recommended by the sheathing manufacturer, installed per 3.03 G.4.a.
  - c. Temporary protection for exposed wall ends: Apply felt as above at wall ends and other locations as required to temporarily protect cavity from water infiltration.

## I. Air Barrier

1. Apply air barrier as specified in the manufacturer's latest published technical data sheet. Provide mechanical attachment of air barrier at all framed openings such as windows, doors, equipment openings, etc.

3.04 ADJUSTING

- A. Field Painting: Touch-up protective coatings damaged during welding, handling and installation. Comply with ASTM A780 and use galvanizing repair paint for galvanized surfaces.

**END OF SECTION**

**SECTION 05506**  
**MISCELLANEOUS STEEL**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section specifies requirements for the miscellaneous steel and iron fabrications and assemblies:
1. Loose steel lintels
  2. Ladders and safety cages
  3. Floor plates and slab edge angles
  4. Nosings and treads
  5. Temporary steel supports
  6. Structural steel door frames
  7. Steel weld plates and angles for casting into concrete
  8. Miscellaneous steel framing and supports including, but not limited to:
    - a. Toilet partitions
    - b. Countertops
    - c. Stone lavatory counters and tops
    - d. Fire extinguisher and hose cabinets
    - e. Overhead door and shutter assemblies
    - f. Mechanical and electrical equipment

**1.02 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. Ladders: When installed, if any, shall comply with the following minimum requirements for structural performance, unless otherwise shown on the Contract Drawings:
1. Treads and Platforms: Capable of withstanding a uniform load of 100 lbs. per sq. ft. and a concentrated load of 300 lbs., so located as to produce maximum stress conditions.
  2. Handrails and Toprails: Capable of withstanding the following loads applied as indicated below:
    - a. Uniform load of 50 lbs. per linear ft. applied simultaneously in both vertical and horizontal directions.
    - b. Concentrated load of 200 lbs. applied at any point in any direction when tested per ASTM E935.
    - c. Uniform and concentrated loads above need not be assumed to act concurrently.
  3. Guards: Intermediate rail balusters and panel fillers capable of withstanding a horizontal uniform load of 50 lbs. per sq. ft. of gross area of guard, including

open areas of which they are part, of fabrication required or as shown on the Contract Drawings.

- B. Materials must have B.S.A. or M.E.A. approval for use in New York City.

### 1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements
- B. Section 09910 - Painting

### 1.04 REFERENCES

- A. American National Standards Institute (ANSI)
  - 1. A14.3 - Safety Requirements for Fixed Ladders
- B. American Society of Mechanical Engineers (ASME)
  - 1. B18.2.1 - Square and Hex Bolts and Screws, Inch Series
  - 2. B18.6.1 - Wood Screws (Inch Series)
  - 3. B18.6.3 - Machine Screws and Machine Screw Nuts
  - 4. B18.21.1 - Lock Washers (Inch Series)
  - 5. B18.22.1 - Plain Washers
- C. ASTM International (ASTM)
  - 1. A27 - Specification for Steel Castings, Carbon, for General Application.
  - 2. A36 - Specification for Carbon Structural Steel.
  - 3. A47 - Specification for Ferritic Malleable Iron Castings.
  - 4. A48 - Specification for Gray Iron Castings.
  - 5. A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - 6. A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 7. A153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 8. A276 - Specification for Stainless Steel Bars and Shapes
  - 9. A307 - Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - 10. A500 - Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

11. A501 - Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
  12. A563 - Specification for Carbon and Alloy Steel Nuts.
  13. A666 - Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bars
  14. A780 - Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
  15. A786 - Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
  16. A1011 - Specification for Sheet, Steel and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
  17. B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
  18. C1028 - Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
  19. C1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
  20. D1187 - Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
  21. E488 - Test Method for Strength of Anchors in Concrete and Masonry Elements.
  22. E935 - Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
  23. F568M - Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners.
  24. F593 - Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
  25. F594 - Specification for Stainless Steel Nuts.
- D. American Welding Society, Inc. (AWS)
1. D1.1 - Structural Welding Code – Steel
  2. D1.3 - Structural Welding Code – Sheet Steel
- E. Code of Federal Regulations (CFR)
1. 29 CFR Part 1910, Subpart D - Fixed Ladders
- F. Occupational Safety and Health Administration (OSHA)
- G. The Society for Protective Coatings (SSPC)
1. Paint 20 - Paint Specification No. 20 – Zinc Rich Primers (Type I, Inorganic, and Type II, Organic)
  2. PA 1 - Shop, Field and Maintenance Painting of Steel

3. SP 3 - Surface Preparation Specification No. 3 – Power Tool Cleaning
4. SP 6 - Surface Preparation Specification No. 6 – Commercial Blast Cleaning

H. Metal Framing Manufacturers Association (MFMA)

1. MFMA-3 – Metal Framing Standards Publication

## 1.05 SUSTAINABLE DESIGN REQUIREMENTS

A. Sustainable Design General Requirements

1. The Authority requires the Contractor to implement practices and procedures to meet the Contract's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Section 01352 and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the Work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.

B. Sustainable Design Performance Criteria:

1. Miscellaneous Steel (lintels, angles, floorplates and framing) shall contain a minimum of 25 percent (by weight) recycled content, calculated by adding the post-consumer recycled content percentage to one-half of the post-industrial recycled content percentage. Certify the recycled content in accordance with the Sustainable Design Submittal Requirements of this section.
2. All field-applied adhesives, sealants, paints and coatings relating to Work of this Section shall meet the requirements of Section 01352.
3. The manufacturing location (final assembly) of the Miscellaneous Steel (lintels, angles, floorplates and framings) shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
4. The origin of the raw materials from which the Miscellaneous Steel (lintels, angles, floorplates and framing) were manufactured shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.

## 1.06 QUALITY ASSURANCE

- A. Calculations: Provide structural calculations for ladders, and other miscellaneous metals required to meet specific structural performances. Calculations shall be signed and sealed by a Professional Engineer licensed in New York State, 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. Welding Standards: Comply with applicable provisions of AWS D1.1 and AWS D1.3.
  - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and if pertinent, has undergone recertification.
- D. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabricating. Show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

#### 1.07 SUBMITTALS

- A. General: Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS.
- B. Product Data: Manufacturer's technical information, specifications, anchor details and installation instructions for miscellaneous steel products used, including grout and paint products.
- C. Shop Drawings: For fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Furnish templates for anchor and bolt installation under other Sections if required.
- D. Samples: Representative samples of materials, color, texture or design of finished products for nosings, treads and thresholds, if any.
- E. Design Calculations: Submit design calculations signed and sealed by a professional engineer licensed and registered in New York State, showing compliance with Design and Performance Requirements loading criteria.
- F. Qualifications
  - 1. Professional Engineer: Include experience qualifications.
  - 2. Fabricator: Experience, in-service performance and capability qualifications.
  - 3. Welder: Evidence of current AWS certification.
- G. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
  - 1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.

- b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
  - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
  - 2) The manufacturing location of the supplied product(s).
  - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
  - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
  - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
- 2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
- 3. Product cut sheets for materials that meet the SDMCF.
- 4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
- 5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

#### 1.08 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
- B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
  - 1. Provide allowance for trimming and fitting at site.

#### 1.09 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. 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 Project site in time for installation.

- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. Ferrous Metals

1. Metal Surfaces: For fabrication of Work exposed to view, use materials that are smooth and free of surface blemishes including pitting, roughness, seam marks, roller marks and rolled trade names.
2. Steel Plates, Shapes and Bars: ASTM A36.
3. Rolled Steel Floor Plates: ASTM A786 rolled from plate complying with ASTM A36 or ASTM A283, Grade C or D.
  - a. Abrasive-Surface: Steel plate with abrasive granules rolled into surface.
  - b. Coefficient of Friction: Provide C.O.F. of 0.6 or higher when tested in accordance with ASTM C1028.
4. Steel Tubing: ASTM A500, cold-formed; or ASTM A501, hot-rolled; for exterior installations, steel tubing shall be hot-dip galvanized coated per ASTM A53.
5. Steel Pipe: ASTM A53; 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.
6. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.
  - a. Size of Channels: 1-5/8 by 1-5/8 inches, unless otherwise indicated on the Contract Drawings.
  - b. Material: Galvanized steel complying with ASTM A653, structural steel, Grade 33, with G90 coating; 0.079-inch nominal thickness.
  - c.
7. Brackets, Flanges and Fittings: Cast or formed metal of the same type material and finish as supported construction.
8. Gray Iron Castings: ASTM A48, Class 30.
9. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47 Grade 32510, or cast steel, ASTM A27. Furnish bolts, washers and shims as required, hot-dip galvanized per ASTM A153.

#### B. Fasteners

1. General: Zinc-Plated: ASTM B633, 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 A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563, and where indicated, flat washers.
3. Machine Screws: ASME B18.6.3.
4. Lag Bolts: ASME B18.2.1.
5. Wood Screws: Flat head, carbon steel, ASME B18.6.1.
6. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.
7. Plain Washers: Round, carbon steel, ASME B18.22.1.
8. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E488, conducted by a qualified independent testing agency.
  - a. Interior Locations: Carbon steel components zinc-plated complying with ASTM B633, Class Fe/Zn 8.
  - b. Exterior Locations: Alloy Group 1 stainless steel bolts complying with ASTM F593 and nuts complying with ASTM F594.

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 Section 09910.
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 D1187.

D. Grout: Pre-mixed, factory-packaged, nonshrink type, complying with ASTM C1107, as manufactured by one of the following, or approved equal, for specified application:

1. Non-Metallic
  - a. "Five Star Grout," Five Star Products, Inc., Fairfield, CT
  - b. "Masterflow 713 Plus," BASF Building Systems, Shakopee, MN
  - c. "NS Grout," Euclid Chemical Co., Cleveland, OH
2. Metallic
  - a. "Embeco 636 Plus," BASF Building Systems, Shakopee, MN
  - b. "Five Star Metallic Grout," Five Star Products, Inc., Fairfield, CT
  - c. "NS Metallic Grout," Euclid Chemical Co., Cleveland, OH
3. Use metallic grout in concealed locations where not exposed to moisture. Use non-metallic, nonstaining, grout in exposed, wet and exterior locations, unless otherwise shown on the Contract Drawings.

- E. Stainless Steel: Provide austenitic stainless steel in form indicated complying with the following requirements:
1. Strip, Plate and Flat Bar: ASTM A666, Type 304
  2. Bars and Shapes: ASTM A276, Type 304

## 2.02 FABRICATION

- A. General: Fabricate items to sizes, shapes, profiles and dimensions required for application shown on the Contract Drawings or approved Shop Drawings, using proven details of fabrication and support. Use materials of type and thickness shown on the Contract Drawings or specified in this Section for various components of Work or, if not shown, as required to produce strength and durability in finished product for intended use.
1. Shop Assembly: Preassemble items in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly match mark units for reassembly and coordinated installation.
  2. Form exposed Work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of 1/32 inch, unless otherwise shown. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
  3. Weld corners and seams continuously, complying with AWS D1.1 and D1.3 recommendations as applicable. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.
  4. Form exposed connections with hairline joints flush and smooth, using concealed fasteners wherever possible. Exposed fasteners, where used, shall be of type as shown on the Contract Drawings or, if not shown, Phillips flathead (countersunk) screws or bolts.
  5. Fabricate joints that will be exposed to weather in a manner to exclude water, or with weep holes where water may accumulate.
  6. Cut, drill and tap units to receive anchorage, hardware and similar items.
  7. Furnish anchorage of type shown on the Contract Drawings, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use and for design loads. Furnish steel washers, except where heads and nuts bear on wood structural connections, furnish malleable-iron washers.
  8. Galvanizing: Zinc coating by the hot-dip process for items shown on the Contract Drawings or specified in this Section to be galvanized. Coating thickness shall be as specified in the referenced standards.
    - a. Rolled, pressed and forged iron and steel shapes, castings, plates, bars and strip 1/8 inch thick and heavier and assembled fabrications: ASTM A123.
    - b. Iron and steel hardware: ASTM A153.

**B. Steel Ladders**

1. Fabricate ladders for locations shown on the Contract Drawings, with dimensions, spacings, details and anchorages as shown. Comply with requirements of ANSI A14.3 or OSHA 29 CFR 1910, whichever is more stringent.
  - a. Side rails shall be 1/2 inch by 2-1/2 inches continuous structural steel flat bar with eased edges, spaced 18 inches apart, unless otherwise shown.
  - b. Bar rungs shall be 3/4 inch diameter solid structural steel, spaced 12 inches on center.
  - c. Ladders for Platform Level elevator pits shall be stainless steel, type 304; glass bead blasted finish.
2. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
3. Top surface of each rung shall be non-slip; either coat the rung with aluminum oxide (corundum) granules set in epoxy resin adhesive or use a type of manufactured rung that is filled with aluminum oxide grout.
4. Support each ladder at top and bottom and at intermediate points spaced not more than 5 feet on center. Use welded or bolted steel brackets, designed for adequate support and anchorage and to hold ladder clear of the wall surface with a minimum 7-inch clearance from wall to centerline of rungs.
  - a. At elevator pits a clear distance of not less than 4-1/2-inche from centerline of the rug to the wall surface or nearest permanent object in back of the ladder shall be provided.
5. Extend rails 42 inches above top rung and return rails to wall or structure, unless other secure handholds are furnished. If the adjacent structure does not extend above the top rung, gooseneck the extended rails back to the structure for secure ladder access.
6. Galvanize ladders, brackets and fasteners.
  - a. Brackets and fasteners for Platform Level elevator pits shall be stainless steel Type 304; glass bead blasted finish.
7. Ship's Ladders, if any: Fabricate of open type construction with structural steel channel or steel plate stringers, pipe handrails and open steel grating treads, unless otherwise shown on the Contract Drawings. Furnish brackets and fittings necessary for installation.

**C. Safety Cages**

1. General
  - a. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
  - b. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet on center. Provide secondary intermediate hoops spaced not more than 48 inches on center between primary hoops.
  - c. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners, unless otherwise indicated.
  - d. Primary Hoops: 1/4-by-4-inch flat steel bar hoops.
  - e. Secondary Intermediate Hoops: 1/4-by-2-inch flat steel bar hoops.

- f. Vertical Bars: 3/16-by-1-1/2-inch flat steel bars secured to each hoop.
- g. Galvanize ladder safety cages; including fasteners.

D. Steel Weld Plates And Angles

- 1. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no less than two integrally welded steel strap anchors for embedding in concrete.

E. Structural-Steel Door Frames

- 1. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches on center. Reinforce frames and drill and tap as necessary to accept finish hardware.
- 2. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.
- 3. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.
- 4. Galvanize structural steel door frames.

F. Loose Bearing and Leveling Plates: For steel items bearing on masonry or concrete construction, flat, free from warps or twists and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required.

- 1. Galvanize after fabrication.

G. Loose Steel Lintels

- 1. Fabricate from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- 2. Weld adjoining members together to form a single unit where shown on the Contract Drawings.
- 3. Size loose steel lintels for equal bearing of 1 inch per foot of clear span, but not less than 8 inches bearing at each side of openings, unless otherwise shown on the Contract Drawings.
- 4. Galvanize loose steel lintels located in exterior walls.

H. Miscellaneous Framing and Supports

- 1. Furnish miscellaneous steel framing and supports not part of structural steel framework, as required by the Contract Drawings to complete the Work.
- 2. Fabricate miscellaneous units as shown on the Contract Drawings or, if not shown, of required dimensions to receive adjacent other Work to be retained by framing. Fabricate from structural steel shapes, plates and bars of welded

construction using mitered joints for field connection, except as otherwise shown on the Contract Drawings.

3. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed. Space anchors 24 inches on center and furnish minimum anchor units of 1-1/4 inch by 1/4 inch by 8 inch steel straps, except as otherwise shown on the Contract Drawings.

I. Fabricate support for suspended toilet partitions as follows:

1. Beams: Continuous steel shapes of size required to limit deflection to L/360 between hangers, but use no less than C8 by 11.5 channels or another shape with equivalent structural properties.
2. Hangers: Steel rods, 1/2 inch minimum diameter, spaced not more than 36 inches on center. Thread rods to receive anchor and stop nuts. Fit hangers with wedge-shaped washers for full bearing on sloping flanges of support beam.
3. Braces and Angles: Steel angles of size required for rigid support of beam and for secure anchorage.
4. Posts: Provide steel post assemblies to receive wall anchorages as indicated.
5. Galvanize miscellaneous framing and supports at exterior locations and where shown on the Contract Drawings.

J. Miscellaneous Steel Trim

1. Fabricate units from structural steel shapes, plates and bars, with continuously welded joints and smooth exposed edges, unless otherwise shown on the Contract Drawings. Miter corners and use concealed field splices wherever possible. Furnish cutouts, fittings and anchorages as required for coordination of assembly and installation with other Work.
2. Galvanize miscellaneous steel trim at exterior locations. Galvanize miscellaneous steel trim at interior locations where shown on the Contract Drawings.

K. Extruded Nosings

1. Fabricate of material, color, sizes and configurations shown on the Contract Drawings. If not shown, fabricate cast-iron units with an integral abrasive finish. Lengths shall be as required to accurately fit each opening or conditions.
  - a. Integral abrasive filler shall consist of aluminum oxide (corundum), silicon carbide or a combination of both, in an epoxy resin binder.
  - b. Solid abrasive type units without ribs.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - a. American Safety Tread Co., Inc., Helena, AL
  - b. Balco Inc., Wichita, KS
  - c. Safe-T-Metal Co., Inc., Mineola, NY

- d. Wooster Products Inc., Wooster, OH
3. Drill for mechanical anchors with countersunk holes located no more than 4 inches from ends and no more than 12 inches on center, evenly spaced between ends, unless otherwise shown on the Contract Drawings. Use closer spacing if recommended by the manufacturer.

L. Cast Nosings

1. Fabricate units of material, color, sizes and configurations shown on the Contract Drawings. If not shown, furnish cast-iron units with an integral abrasive finish. Lengths shall be as required to accurately fit each opening or conditions.
  - a. Cast units with an integral abrasive grit consisting of aluminum oxide (corundum), silicon carbide or a combination of both.
  - b. Plain surface texture, except where fluted or cross-hatched surfaces are shown on the Contract Drawings.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - a. American Safety Tread Co., Inc., Helena, AL
  - b. Balco Inc., Wichita, KS
  - c. Safe-T-Metal Co., Inc., Mineola, NY
  - d. Wooster Products Inc., Wooster, OH
3. Furnish anchors for embedding units in concrete, either integral or applied to units, as standard with the manufacturer.
4. Drill for mechanical anchors with countersunk holes located no more than 4 inches from ends and no more than 12 inches on center, evenly spaced between ends, unless otherwise shown on the Contract Drawings. Use closer spacing if recommended by the manufacturer.

M. Metal Floor Plates

1. Fabricate from rolled-steel floor plate of 3/16 inch thickness.
  - a. Abrasive-Surface: Manufacturer's standard abrasive granules rolled into surface of steel plate where shown on the Contract Drawings. Coefficient of friction (COF) shall be 0.6 or higher when tested according to ASTM C1028.
2. Provide steel angle supports as indicated.
3. Include steel angle stiffeners, and fixed and removable sections as indicated.
4. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

- N. Wheel Guards: Fabricate from 3/4 inch thick, hollow-core, gray-iron castings of size and shape shown on the Contract Drawings. Fabricate with holes for countersunk anchor bolts and grouting.

- O. Safety Post: Provide type 304 stainless steel telescoping safety post permanently mounted to the top two rungs of fixed ladder where shown on the Contract Drawings.

Post shall have telescoping tubular section that locks automatically when fully extended. Upward and downward movement shall be controlled by stainless steel spring balancing mechanism. Unit shall be completely assembled with fasteners for securing to the ladder rungs in accordance with manufacturer's instructions.

1. Provide LadderUP® safety post Model LU-3 as manufactured by The Bilco Company or approved equal.

## 2.03 SHOP PAINTING

- A. Surface Preparation: Prepare ferrous metal surfaces to comply with requirements for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications as follows:
  1. Exterior: SSPC-SP 6
  2. Interior: SSPC-SP 3
- B. Apply shop primer to surfaces of metal fabrications, except those that are galvanized or shown on the Contract Drawings to be embedded in concrete or masonry, in compliance with requirements of SSPC-PA 1 for shop painting.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- 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 Project site in time for installation.

### 3.02 INSTALLATION

- A. Furnish and install anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction, including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.
- B. Cutting Fitting and Placement: Perform cutting, drilling and fitting required for installation of metal fabrications. Set Work accurately in location, alignment and elevation plus level, true and free of rack, measured from established lines and levels. Furnish and install temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

- C. Fit exposed connections accurately together to form tight hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint coat. Do not weld, cut or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.
- D. Field Welding: Comply with AWS D1.1 and D1.3 for procedures of manual shielded metal-arc welding, appearance and quality of welds made and methods used in correcting welding Work.
- E. Setting Loose Plates
1. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of bearing plates or surfaces.
  2. Set loose leveling and bearing plates on wedges or other adjustable devices. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
- F. Miscellaneous Framing and Supports: Install framing and supports in compliance with requirements of items being supported, including manufacturer's written instructions and requirements.
1. Anchor miscellaneous framing and supports securely to and rigidly brace from overhead building structure.
- G. Nosings
1. Install with anchorage system indicated complying with manufacturer's recommendations.
  2. Apply black bituminous coating to concealed bottoms, sides and edges of cast-iron units set into concrete.
- H. Wheel Guards: Anchor wheel guard assemblies to concrete and masonry construction complying with manufacturer's instructions. Fill cores solidly with concrete.

### 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 A780.

**END OF SECTION**

**SECTION 05507**  
**MISCELLANEOUS STEEL EMBEDS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section specifies requirements for miscellaneous steel embeds as indicated on the Contract Drawings.
  - 1. Miscellaneous steel embeds include standard and custom embedment items required to install other construction materials, systems and assemblies.
- B. For the requirements of embedded plates for major structural elements refer to Section 05120.

**1.02 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. Provide miscellaneous steel embed assemblies as required to meet structural performance criteria designed, fabricated and installed to comply with the New York City Building Code requirements. Fabrications required to meet such criteria shall be reviewed and designed by a licensed Professional Engineer authorized to practice in New York.
  - 1. Assemblies shall be designed, fabricated and installed to withstand both live and dead loads, including moment and other such forces/loads transferred to the foundations and supporting concrete assemblies through the miscellaneous steel embed assemblies. Assemblies shall be designed with a safety factor of 1.5, unless otherwise recommended by the Engineer and acceptable to the Architect.
  - 2. Refer to the Contract Drawings for additional requirements.
- B. Concrete Inserts
  - 1. The inserts must meet the requirements of Underwriters Laboratory Inc. The UL Mark on the product will be accepted as evidence of compliance.
  - 2. Materials and applications of fire protection piping system inserts shall be FM approved.

**1.03 RELATED SECTIONS**

- A. Section 01352 - Sustainable Design Requirements
- B. Section 03602 - Grout (Non-Metallic)
- C. Section 05120 - Structural Steel
- D. Section 09910 - Painting

## 1.04 REFERENCES

## A. ASTM International (ASTM)

1. A36 – Standard Specification for Carbon Structural Steel
2. A123 – Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
3. A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
4. A780 – Standard Practice for Repair of Damaged and Coated Areas of Hot Dip Galvanized Coatings
5. A1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
6. C1107 – Standard Specification for Packaged Dry Hydraulic – Cement Grout (Non shrink)

## B. American Welding Society (AWS)

1. D1.1 – Structural Welding Code – Steel
2. D1.3 – Structural Welding Code – Sheet Steel

## C. National Association of Architectural Metal Manufacturers (NAAMM)

1. AMP 500 - Metal Finishes Manual

## D. Underwriters Laboratories Inc. (UL)

1. Underwriters Laboratories Listed

## E. Factory Mutual (FM)

1. Factory Mutual Approved

## 1.05 SUSTAINABLE DESIGN REQUIREMENTS

- A. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section 01352 and the articles below, are implemented to the fullest extent. Substitutions or other changes to the Work proposed by the Contractor shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.
- B. Sustainable Design Performance Criteria
  1. All field-applied adhesives, sealants, paints and coatings relating to Work of this Section shall meet the requirements of Section 01352.

## 1.06 QUALITY ASSURANCE AND QUALITY CONTROL

- A. Quality assurance is testing and inspection undertaken by the Authority to evaluate the Contractor's performance. It is not a substitute for the testing and inspection which is required as part of the Contractor's quality control system as specified herein.
- B. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to those required for this Project.
- C. Welding: Qualify welding processes and operators in accordance with AWS D1.1 and D1.3.
- D. Quality Control Program: The Contractor shall maintain a Quality Control Program for both fabrication and erection of miscellaneous steel embeds to ensure that all installations conform to the requirements of the Contract Documents. The Contractor shall employ non-destructive testing personnel that meet ASNT SNT-TC-1A Level II qualifications and an AWS Certified Welding Inspector (CWI).
- E. Professional Engineer Qualifications: A professional engineer who is licensed and registered in the State of New York and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of miscellaneous steel embeds that are similar to those indicated for this Project in material, design and extent.
- F. Testing and Inspection Requirements
  - 1. The Contractor shall perform the following inspections and tests of all welds in accordance with AWS D1.1 and AWS D1.3:
    - a. All welds shall be visually inspected by an AWS Certified Welding Inspector (CWI).
    - b. All full penetration welds shall be non-destructively tested for 100% of the weld length by radiographic or ultrasonic methods, as approved by the Engineer.
    - c. Areas of suspected defects found by visual inspections in partial penetrations or fillet welds shall be non-destructively tested by magnetic particle or dye penetrant methods, as approved by the Engineer.
  - 2. 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 percent 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.

## 1.07 SUBMITTALS

- A. General: Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS.

- B. Product Data: Submit product data for products used in miscellaneous metal fabrications, including paint products.
- C. Qualifications, Certifications and Quality Control
1. Welding Procedures.
  2. Welder Certifications.
  3. Inspection Certifications.
  4. Inspection and Test Reports.
  5. Mill Reports.
  6. Shop Fabrication Schedule.
  7. Notification, in Writing, 15 Days Prior to Commencing Fabrication.
  8. Notification, in Writing, 15 Days Prior to Commencing with Painting or Galvanizing.
  9. Notification, in Writing, 15 Days Prior to Commencing with Field Welding.
- D. Shop Drawings: Submit shop drawings for fabrication and erection of all miscellaneous steel embeds. Include plans, elevations and details of sections and connections. Show anchorage and accessory items.
1. Where fabrications are indicated to comply with design loadings, include structural computations, material properties, and other information needed for structural analysis.
  2. Structural data (including design calculations) shall be signed and sealed by a qualified professional engineer, licensed and registered in the State of New York, who is responsible for their preparation.
- E. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.
    - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
      - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
      - 2) The manufacturing location of the supplied product(s).
      - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
      - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
      - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.

2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
3. Product cut sheets for materials that meet the SDMCF.
4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Metal Surfaces, General: For exposed metal fabrications, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes.
  1. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher leveled sheet.
- B. Steel Plates, Shapes and Bars: ASTM A36.
- C. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

### 2.02 MISCELLANEOUS ACCESSORIES

- A. Non Shrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107, Grade C and recommended by manufacturer for interior and exterior use.
  1. Refer to Section 03602 for additional requirements.
- B. Galvanizing Repair Paint: High zinc dust paint complying with ASTM A780 and containing a minimum of 92 percent zinc in the dry film. Field applied repair paint shall comply with the VOC limits of Section 01352. The maximum allowable VOC content for zinc-rich paints is 100 grams/liter.

## 2.03 FABRICATION, GENERAL

- A. Form metal fabrications of size, thickness and shapes indicated but not less than needed to comply with performance requirements. Work to dimensions on shop drawings, using proven details of fabrication and support. Use type of materials indicated.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges slightly.
- C. Remove sharp edges on exposed surfaces.
- D. Shear and punch metals cleanly and accurately. Remove burrs. Remove sharp or rough areas on exposed traffic surfaces.
- E. Ease exposed edges to a radius of approximately 1/32 inch. Form bent-metal corners to smallest radius possible without impairing work.
- F. Weld corners and seams continuously to comply with AWS recommendations and the following:
  - 1. Minimize distortion and develop strength of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
- G. Provide for anchorage of type indicated. Fabricate and space anchoring devices to provide adequate support for intended use.
- H. Shop-fabricate and preassemble metal fabrications to the greatest extent possible. Use connections that maintain structural value of joined pieces.

## 2.04 BASE AND ANCHORING PLATES

- A. General: Provide base and anchoring plates for embedment into cast-in-place concrete; for the support/attachment of other materials, assemblies and construction as indicated on the Contract Drawings. Assemblies shall be fabricated from steel plates, shapes and bars with fully welded joints and seams. Assemblies shall be fabricated with integrally welded embedments and reinforcement cradles as indicated on the approved Shop Drawings.
  - 1. Assemblies shall be fabricated flat and free from warps, twists and other distortions, and of the required thickness and bearing area.
  - 2. Shop cut, tap, tool and drill plate assemblies to receive fasteners as indicated on the Drawings. Hot-dip galvanize assemblies after fabrication.

## 2.05 HANGERS, INSERTS AND PIPE SUPPORTS

- A. Concrete inserts shall be UL listed. In addition, concrete inserts indicated to support fire protection systems shall be FM approved.
  
- B. Concrete Inserts
  - 1. Embedded Channel Type Inserts shall be Unistrut P3200 series embedded inserts, or approved equal, with a minimum of 2000 lbs allowable point load capacity. Channel section shall conform to ASTM A1011 SSGR 33. Channel inserts shall be hot dipped galvanized conforming to ASTM A123 or ASTM A153, with dimensions so as to avoid interference with the placement of the structural reinforcement. Length of inserts shall be as indicated on the contract drawings. Embedded channel type inserts shall be installed with closure strips, end caps, and nailer tabs, and shall be installed in accordance with the manufacturers written instructions.
  - 2. Metal Deck Inserts shall be type BBMD3762 Blue Banger Hanger inserts, or an approved equal, with a minimum of 2500 lbs allowable tension load capacity based on a 3000 psi concrete strength. Metal deck inserts shall not be installed in low flute of metal deck. Metal deck inserts shall be installed in accordance with the manufacturers written instructions.
  - 3. Cast In Place Anchor Rods shall be as shown on the contract drawings. Cast in anchor rods shall be securely fastened in place to the formwork, so as to ensure that they are not dislodged during the casting operation. Contractor may substitute an acceptable pre-manufactured anchor of equal design strength to that shown on the drawings. Substitutions shall ensure that the installation is UL and FM listed if applicable for fire protection system. In addition, manufactures written technical data shall demonstrate that the allowable tension load capacity is achieved based on a factor of safety of 4.0 over the ultimate capacity. In addition, the substituted anchor must be capable of receiving the same diameter hanger rod as that shown.
  
- C. Support hangers from approved concrete inserts where concrete slabs exist. Use inserts with space for nuts of sizes 3/4-inch and smaller. Set all inserts in forms in ample time to allow the concrete work to be performed on schedule.
  - 1. The rods on all hangers shall be of adequate size to support the loads which they carry with a safety factor of 1.5.
  - 2. Do not hang piping from ductwork, piping, conduits, etc. In such cases where approved inserts have not been installed and other/alternative means of support must be used, obtain specific approval of the proposed installation method from the Engineer, prior to proceeding. Hangers shall not be fastened by means of vertical expansion bolts, except as otherwise permitted by the engineer.

## 2.06 FINISHES, GENERAL

- A. Comply with NAAMM AMP 500 for recommendations relative to application and designations of finishes.
  
- B. Finish metal fabrications after assembly.

- C. Galvanizing: For galvanized items, apply zinc-coating by the hot-dip process in compliance with the following requirements:
  - 1. ASTM A123 for galvanizing iron and steel shapes, plates, bars and strip 0.0299 inches thick, and heavier.

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

- A. Coordinate and furnish anchorages, setting drawings, diagrams and directions for installation of assemblies that are to be embedded in concrete. Coordinate delivery of such items.

#### **3.02 INSTALLATION, GENERAL**

- A. Embedded Channel Type Inserts
  - 1. Secure inserts in place in accordance with the manufacturers written instructions.
  - 2. After concrete is poured and forms removed, remove closure strips.
- B. Placement: Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.
- D. Fit exposed connections accurately to form hairline joints. Weld connections that cannot be shop welded. Do not weld, cut or abrade units which have been hot-dip galvanized after fabrication.
- E. Field Welding: Comply with AWS Code for welding, appearance and quality of welds made, methods used in correcting welding work and as required for shop welding.

#### **3.03 ADJUSTING AND CLEANING**

- A. Immediately after erection, clean field welds, bolted connections and abraded areas of shop paint in accordance with Section 09910, and paint exposed areas with same material as used for shop painting.
- B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

**END OF SECTION**

**SECTION 05810**  
**PREFABRICATED EXPANSION JOINT ASSEMBLIES**

1.01 SUMMARY

- A. This Section specifies requirements for interior and exterior prefabricated expansion joint assemblies, including seismic type, fire barriers and moisture barriers.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. General: Expansion joint assemblies shall permit unrestrained movement of joint without disengagement of cover. Expansion joint assemblies shall also, where shown on the Contract Drawings and as required to suit project requirements, maintain fire-resistance ratings, maintain integrity of smoke barrier, prevent air infiltration, prevent moisture and water penetration, serve as finished architectural joint closures and remain in place upon exposure to seismic activity.
- B. Loading Characteristics: Joints shall withstand loading as established by product types shown, without damage or permanent deformation to the expansion joint assembly.
- C. Fire Performance Characteristics: Where indicated on the Contract Drawings, expansion joint assemblies shall incorporate fire barriers identical to those of assemblies whose fire resistance has been determined per ANSI/UL2079 or ASTM E1966, including hose stream test at full-rated period, by a nationally recognized testing and inspection organization.
1. Fire Rating: Not less than the rating of adjacent construction.

1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements

1.04 REFERENCES

- A. American Architectural Manufacturers Association (AAMA)
1. 611 - Specification for Anodized Architectural Aluminum.
  2. 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. American National Standards Institute (ANSI)/Underwriters Laboratories Inc. (UL)
1. 2079 - Tests for Fire Resistance of Building Joint Systems.

- C. ASTM International (ASTM)
  - 1. A36 - Specification for Carbon Structural Steel
  - 2. A666 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - 3. B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 4. B221 - Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - 5. D2000 - Standard Classification System for Rubber Products in Automotive Applications
  - 6. E1399 - Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.
  - 7. E1966 - Test Method for Fire-Resistive Joint Systems
- D. Society of Automotive Engineers (SAE)
- E. Unified Numbering System for Metals and Alloys (UNS)
- F. National Association of Architectural Metal Manufacturers (NAAMM)
  - 1. Metal Finishes Manual for Architectural and Metal Products.

#### 1.05 SUSTAINABLE DESIGN REQUIREMENTS

- A. Sustainable Design General Requirements:
  - 1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section 01352 and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the Work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.
- B. Sustainable Design Performance Criteria:
  - 1. All field-applied adhesives, sealants, paints and coatings relating to Work of this Section shall meet the requirements of Section 01352.

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Arrange for expansion joint assemblies specified in this Section to be furnished by a manufacturer with minimum five years experience in the fabrication of expansion joint assemblies involving quantities and complexities equal to or greater than those required by this Contract.

- B. **Installer Qualifications:** Arrange for expansion joint assemblies specified in this Section to be installed by an entity with minimum five years experience in the installation of assemblies involving quantities and complexities at least equal to those required by this Contract.
- C. **Single Source Responsibility:** Obtain expansion joint assemblies furnished and installed under this Section from a single manufacturer.

#### 1.07 SUBMITTALS

- A. **General:** Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS.
- B. **Product Data:** Manufacturer's product data, material and finish descriptions, installation instructions and general recommendations for each type of expansion joint assembly shown on the Contract Drawings.
- C. **Shop Drawings:** Show full extent of expansion joint assemblies; include large scale details of each type indicating profiles, splice joints between sections, joinery with other joint types including intersections, corner joints and tees, special end conditions, anchorages, fasteners, block-out locations and requirements, and relationship to adjoining Work and finishes.
  - 1. Include isometric drawings, if required to fully describe assemblies, depicting the continuity of their route and their intersections.
- D. **Samples**
  - 1. **Preformed Seals:** 6 inch long samples of each type of flexible seal material to be used in the Work. Include manufacturer's standard color charts showing full range of colors and textures available for each type of flexible seal material for selection by the Engineer.
  - 2. **For Verification:** Full-size units 6 inches long of each type of joint system to be used in the Work, including all system components and showing finish, color, texture, patterns and full range of variations expected for these characteristics.
- E. **Certifications**
  - 1. **Fire Performance:** Where fire-rated expansion joint assemblies are shown, submit test data to indicate conformance with 1.02 C and 2.02 F.
- F. **Qualifications:** Submit proof of manufacturer and installer experience qualifications.
- G. **Sustainable Design Submittal Requirements:** The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:

1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
  - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.
  - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
    - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
    - 2) The manufacturing location of the supplied product(s).
    - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
    - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
    - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
3. Product cut sheets for materials that meet the SDMCF.
4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

#### 1.08 COORDINATION

- A. Ensure that prefabricated expansion joint assemblies furnished and installed under this Section are compatible with expansion joint assemblies specified in other Sections.

#### 1.09 DELIVERY, STORAGE, AND HANDLING

- A. Handle expansion joint assemblies in manner to protect surfaces and to prevent distortion and other types of damage. Store under cover and off ground. Protect from weather and construction activities until installed and accepted.

#### 1.10 WARRANTY

- A. Submit written warranty executed by the Contractor, installer and the manufacturer, agreeing to provide materials and labor to repair or replace expansion joint assemblies

that fail in materials or workmanship within five years after date of issuance of the Certificate of Final Completion. This warranty shall not limit other rights the Authority may have under the Contract.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Subject to compliance with the requirements of this Section, furnish and install products of one of the following, or approved equal:
  - 1. Architectural Art Mfg., Inc., Wichita, KS
  - 2. Balco Inc., Wichita, KS
  - 3. Conspec Systems, Inc. (C/S Group), Cranford, NJ
  - 4. MM Systems Corp., Pendergrass, GA
  - 5. Watson Bowman Acme Corp. (subsidiary of Degussa Corp.), Amherst, NY
- B. Basis of Design: Provide expansion joint assemblies "C/S Parking Deck Series - Model ZB-400" as manufactured by Conspec Systems, Inc, or equivalent acceptable to the Engineer.

### 2.02 MATERIALS

- A. Aluminum: ASTM B 221, alloy 6063-T5 for extrusions; ASTM B 209, alloy 6061-T6 for sheet and plate; mill finish, unless otherwise shown on the Contract Drawings.
  - 1. Protect aluminum surfaces in contact with cementitious materials with zinc chromate primer or chromate conversion coating
- B. Stainless Steel: ASTM A 666, Type 304 for plates, sheet, and strip; No. 2B finish, unless otherwise shown on the Contract Drawings.
- C. Steel: ASTM A36, for plates, sheet, and strip, unless otherwise shown on the Contract Drawings.
- D. Elastomeric: Provide the manufacturer's standard, steel reinforced, premolded elastomeric anchor block material designed to capture extruded preformed seals and provide suitable anchoring flanges.
- E. Preformed Seals: Multicellular extruded elastomeric profiles, designed with continuous, longitudinal, internal baffles for use as primary and secondary seals complying with ASTM D2000. Formed to fit with anchored flanges, in color shown on the Contract Drawings or, if not shown, as selected by Engineer from manufacturer's standard colors.

## F. Fire Barriers

1. Manufacturer's standard fire barrier materials for use with fire-resistant expansion joint assemblies, resisting passage of flame and hot gases through the joint without material degradation or fatigue when tested after cycling per ASTM E 1399; tested in maximum joint width condition with a field splice as a component of the expansion joint assembly per performance requirements of 1.02 C.
2. Include manufacturer's standard fire caulks, sealants and hardware for the required hourly fire rating. Fire barrier materials shall be asbestos-free.

G. Moisture/Water Barriers: Manufacturer's standard flexible elastomeric material for use as an inner expansion joint seal: minimum 45 mils thick EPDM or minimum 30 mils thick PVC.

## 2.03 ACCESSORIES

A. Manufacturer's standard stainless steel anchors, fasteners, set screws, spacers, flexible vapor seal, filler materials, gutters, drain tubes, adhesives, sealants, grout, bedding materials, and other accessories compatible with material in contact, and as shown on the Contract Drawings for complete installations.

## 2.04 FABRICATION

- A. General: Expansion joint assemblies shall be of design, basic profile, materials and operation shown on the Contract Drawings. Furnish units equal to those shown on the Contract Drawings, as required to suit joint size, to accommodate variations in adjacent surfaces and to absorb structural movement.
- B. Furnish units in longest available lengths to minimize number of end joints, with hairline mitered corners where joint changes directions or abuts other materials. Include closure materials, transition pieces, tee-joints, corners, curbs, cross-connections, centering bars, pantograph mechanisms, gaskets, splice covers and other accessories as required for continuous joint assemblies.
- C. Protection caps shall be stainless steel, as shown on the Contract Drawings, with surface design options as shown on the Contract Drawings. Fasten protection caps to anchor member per manufacturer's instructions, lapping each side of joint opening, permitting free movement of joint and maintaining close contact with adjacent finished surfaces.
- D. Include manufacturer's continuous standard flexible moisture seals under covers at locations shown on the Contract Drawings.
- E. Horizontal Joint Assemblies: Furnish continuous steel reinforced elastomeric seating members of profile shown on the Contract Drawings with raised floor rim and concealed bolt and stainless steel anchors for embedment in concrete. Assemblies shall be of the

design shown on the Contract Drawings and to receive abrasive-resistant filler materials, if any, for space between raised rim of seating member and edge of joint assembly. Depth and configuration shall suit type of construction and ensure that top surface of exposed extrusions, filler material and cover plate fits flush with adjoining finish floor surface.

1. Assemblies shall be capable of resisting moisture penetration and air infiltration, as shown on the Contract Drawings.
- F. Interior Joint Assemblies: Assemblies for floor-to-floor , floor-to-wall, wall-to-wall and joints in ceilings and soffits shall be as shown on the Contract Drawings.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Verify dimensions and conditions in field for Work fabricated to fit project conditions.

#### 3.02 PREPARATION

- A. Prepare substrates according to expansion joint assembly manufacturer's instructions, including cutting, cleaning, priming, repair and surfacing.
- B. Coordinate with Work of related trades, such as for installation of items embedded in concrete or masonry.
- C. Furnish templates as required to related trades for location of embedded support and anchorage items.
- D. Repair and grout block-outs as required with manufacturer's recommended material, to provide a level support beneath side frames of floor covers and to correct oversize block-outs. Do not use shims.
- E. Fastening to In-Place Construction: Furnish and install anchorage devices and fasteners as required for securing expansion joint assemblies to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Metal fasteners shall be of the type and size required to suit type of construction shown on the Contract Drawings and to ensure secure attachment of expansion joint assemblies.

#### 3.03 INSTALLATION

- A. Comply with manufacturer's written instructions for handling and installation of expansion joint assemblies, unless more stringent requirements are indicated.

- B. Terminate exposed ends of expansion joint assemblies with factory-fabricated termination pieces to maintain watertight integrity.
- C. Cutting Fitting and Placement: Perform cutting, drilling, patching and fitting required for installation of expansion joint assemblies. Install expansion joint assemblies in true alignment and proper relationship to adjoining finished surfaces measured from established lines and levels. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling. Set floor assemblies, with countersunk fasteners, at elevations to be flush with adjacent finished floor materials. Locate assemblies where shown on the Contract Drawings, in continuous contact with adjacent surfaces. Attach in place securely with required accessories.
- D. Joinery and Continuity: Maintain continuity of expansion joint assemblies with end joints held to a minimum. Cut and fit ends to produce hairline joints and to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials, if any, to seating member with adhesive or pressure-sensitive tape as recommended by the manufacturer.
- E. Anchorage: Anchor extrusions to adjacent substrates, continuously, at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches on center. Set anchorage extrusions in continuous bed of sealant per manufacturer's recommendations; prevent slippage of vertical seal anchorages. Sealant type shall be compatible with sealants of adjacent construction.
- F. Preformed Seals: Install seals with minimum number of end joints; straight sections shall be in continuous lengths. Vulcanize or heat-weld field splice joints watertight, using manufacturer's recommended procedures. Apply manufacturer's approved adhesive, epoxy or lubricant-adhesive to both frame interfaces before installing preformed seal material. Seal transitions and end joints according to manufacturer's instructions.
- G. Seismic Seals: Install interior seal in continuous lengths. Install outer seal in standard lengths and vulcanize or heat-weld field splice joints watertight, using manufacturer's recommended procedures. Seal transitions and end joints according to manufacturer's instructions.
- H. Fire Barriers: Install fire barriers, including transitions and end joints, in accordance with manufacturer's recommended procedures so that fire-resistant construction is continuous and uninterrupted.
- I. Moisture/Water Barriers: Install water barriers and where shown on the Contract Drawings, in accordance with manufacturer's recommended procedures. Include drainage system where shown.

3.04 CLEANING

- A. Remove strippable protective material after Work in adjacent areas is complete. When protective material is removed, clean exposed metal surfaces in accordance with manufacturer's instructions.

3.05 PROTECTION

- A. Protect the installation from damage by other Work. Remove and store protective cap plates and exposed seals as required to protect from damage from construction traffic. Install temporary protection over joints, and reinstall covers and seals prior to Substantial Completion.

**END OF SECTION**

**SECTION 06100**  
**ROUGH CARPENTRY**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. This Section specifies requirements for the following rough carpentry items:
1. Wood grounds, nailers, blocking and sleepers
  2. Subflooring and underlayment
  3. Plywood backing panels
  4. Riser construction for access flooring transitions, as indicated

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Not Applicable

1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements

1.04 REFERENCES

- A. American Wood-Preservers' Association (AWPA)
1. C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Process
  2. C27 - Plywood - Fire-Retardant Treatment by Pressure Process
- B. ASME International (ASME)
1. B18.2.1 - Square and Hex Bolts and Screws (Inch Series)
  2. B18.6.1 - Wood Screws (Inch Series)
- C. ASTM International (ASTM)
1. A153 - Specification for Zinc-Coating (Hot-Dip) of Iron and Steel Hardware
  2. A307 - Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
  3. A563 - Specification for Carbon and Alloy Steel Nuts

4. A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  5. B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel
  6. D5664 - Test Method for Evaluating the Effects of Fire-Retardant Treatments and Elevated Temperatures on Strength Properties of Fire-Retardant Treated Lumber
  7. E488 - Test Methods for Strength of Anchors in Concrete and Masonry Elements
  8. F1667: Specification for Driven Fasteners: Nails, Spikes, and Staples
- D. Forest Stewardship Council (FSC)
1. FSC-STD-01-001 (April 2004) - FSC Principles and Criteria for Forest Stewardship
  2. For FSC-certified wood products, refer to the Forest Stewardship Council - United States, 1155 30th Street, NW Suite 300, Washington, D.C
- E. U.S. Department of Commerce, National Institute of Standards and Technology (DOC)
1. PS1 - U.S. Product Standard for Construction and Industrial Plywood
  2. PS20 - American Softwood Lumber Standard
- F. West Coast Lumber Inspection Bureau (WCLIB)
1. Standard No. 17-1996: Grading Rules for West Coast Lumber
- G. Western Wood Products Association (WWPA)
1. Western Lumber Grading Rules
- H. National Evaluation Service, Inc. (NES)
1. NER-272 - Power-Driven Staples and Nails for Use in All Types of Building Construction

## 1.05 SUSTAINABLE DESIGN REQUIREMENTS

- A. Sustainable Design General Requirements
1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Section 01352 and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the Work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.
- B. Sustainable Design Performance Criteria:

1. All field-applied adhesives, sealants, paints and coatings relating to Work of this Section shall meet the requirements of Section 01352.
2. The manufacturing location (final assembly) of the rough carpentry wood shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
3. All composite wood, engineered wood, or agrifiber products used for rough carpentry (e.g., plywood, particleboard, medium density fiberboard) shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and methyl diisocyanate (MDI). Certification of these products shall be in accordance with the Submittal Requirements of this Section.
4. Fifty percent (by cost) wood-based materials used on this Project, whether permanently-installed or temporary, shall be certified in accordance with the Forest Stewardship Council (FSC) guidelines.
  - a. Applicable products include, but are not limited to, structural framing and general dimensional framing, flooring, finishes, furnishings, miscellaneous blocking, fire rated plywood back panels used for equipment mounting, architectural panels, plywood, and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers.
  - b. Certified wood material suppliers may be researched through the following websites: [www.rainforest-alliance.org/greenbuilding](http://www.rainforest-alliance.org/greenbuilding), [www.smartwood.org](http://www.smartwood.org), <http://www.certifiedwoodsearch.org/searchproducts.aspx>, [http://www.fscus.org/certified\\_companies/](http://www.fscus.org/certified_companies/).
  - c. Any FSC-certified wood products deemed unavailable must be reported by the Contractor to the Engineer.
  - d. Wood products previously purchased and used on prior projects, which are reused on this Project, are exempt from the FSC certification requirement. Appropriate documentation certifying reused wood products must be submitted.
  - e. Documentation of all FSC-certified wood products shall be in accordance with the Sustainable Design Submittal Requirements herein. Wood products submitted without acceptable documentation will be rejected.

#### 1.06 QUALITY ASSURANCE

- A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with "FSC Principles and Criteria for Forest Stewardship":
  1. Dimension lumber and miscellaneous lumber.

## 1.07 SUBMITTALS

- A. General: Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS.
- B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  2. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
  3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
  4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
  5. Include proof of approval for use in New York City.
- C. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.
    - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
      - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
      - 2) The manufacturing location of the supplied product(s).
      - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
      - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
      - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
  2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  3. Product cut sheets for materials that meet the SDMCF.

4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
5. Documentation for all FSC-certified wood products. Provide copies of vendor invoices for each certified wood product, itemizing product costs and FSC chain-of-custody certification tracking numbers.
6. Documentation that all plywood, composite wood and agrifiber products installed within the Project's weatherseal do not contain added urea-formaldehyde resins.
7. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

#### 1.08 DELIVERY, STORAGE AND HANDLING

- A. Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack materials above ground level on uniformly spaced supports to prevent deformation. Provide for air circulation within, around stacks and under temporary coverings including polyethylene and similar covering types.
  1. Lumber and plywood pressure-treated with waterborne chemicals: Place a spacer between each course to provide for air circulation.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Lumber
  1. Lumber Standards
    - a. Lumber shall comply with DOC PS20 and with applicable grading rules of inspection agencies certified by the American Lumber Standards Committee's (ALSC) Board of Review.
  2. Grade Stamps
    - a. Lumber shall be factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at the time of surfacing and producing mill.
    - b. Exposed lumber shall have grade stamp applied to ends or back of each piece. Grade stamp may be omitted if a certificate of grade compliance from the inspection agency is submitted.
  3. Sizing

- a. Sizes of lumber specified herein and on the Contract Drawings are nominal, except patterned sizes shall be as shown by detail dimensions on the Contract Drawings. Actual dressed sizes are as specified in DOC PS20, for moisture content specified for each use.
- 4. Surfacing: S4S (surfaced four sides) dressed lumber, unless otherwise shown on the Contract Drawings.
- 5. Moisture Content: Seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes less than 5 inches in nominal thickness.
- 6. Miscellaneous Lumber: Furnish wood for support or attachment of other Work including bucks, nailers, blocking, furring, grounds, stripping, sleepers and similar members. Lumber shall be of sizes and worked into shapes as shown on the Contract Drawings, and as follows:
  - a. Moisture Content: 19 percent maximum for lumber items not specified to receive treatment.
  - b. Grade: Standard grade light framing size lumber of any species or board size lumber as required for application as shown on the Contract Drawings, No. 3 Common or Standard grade boards per WCLIB or WWPA rules or No. 3 grade boards per SPIB rules.

#### B. Construction Panels

- 1. Plywood Panel Standards: Comply with DOC PS1 for plywood panels and, for products not manufactured under DOC PS1 provisions, comply with APA Form No. E445S.
- 2. Trademark: Each construction panel shall be factory-marked with APA trademark evidencing compliance with grade requirements.
- 3. Concealed APA Performance-Rated Panels: APA Performance-Rated panels complying with requirements shown on the Contract Drawings for grade designation, span rating, exposure durability classification, edge detail (where applicable), and thickness, for the following applications:
  - a. Combination Subfloor-Underlayment: Fire-retardant treated, APA rated plywood Sturd-I-Floor (APA trademark).
    - 1) Exposure Durability Classification: Exterior.
    - 2) Thickness: As shown on the Contract Drawings.
    - 3) Span Rating: As required to suit joist spacing shown on the Contract Drawings.
    - 4) Edge Detail: Tongue and groove, unless otherwise shown on the Contract Drawings.
- 4. Plywood Backing Panels: Telephone or Electrical Equipment Backing Panels: Painted, fire-retardant treated, APA A-C with exterior glue, in thickness shown on the Contract Drawings, or if not otherwise shown, not less than 3/4 inch.

#### C. Fasteners and Anchorages: Size, type, material and finish as shown on the Contract Drawings. Furnish metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

- 1. Wood Screws: ASME B18.6.1
- 2. Bolts: ASTM A307, Grade A; with ASTM A563 hex nuts and flat washers.

3. Lag Bolts: ASME B18.2.1
  4. Nails and Staples: ASTM F1667
  5. Where rough carpentry is in direct contact with preservative treated wood, exposed to weather, in ground contact, or in area of high relative humidity, such as interior humidified spaces, kitchens, laundries and showers, furnish fasteners and anchorages of AISI Type 304 stainless steel, or with a hot-dip zinc coating per ASTM A153.
- D. Fire-Retardant Treatment by Pressure Process Lumber or plywood shall be fire-retardant treated wood, unless specifically noted otherwise on the Contract Drawings, with pressure impregnated with fire-retardant chemicals to comply with AWWA C20 and AWWA C27, respectively. Each treated item shall be identified with classification marking of Underwriters Laboratories, Inc., U.S. Testing, or Timber Products Inspection, indicating surface burn characteristics and New York City BSA or MEA approval number.
1. Flame spread rating: 0-25, per ASTM E84 when tested for a 30 minute period; flame front shall not progress more than 10-1/2 feet beyond the centerline of the test burner at any time during the test.
  2. Use treatment that does not promote corrosion of metal fasteners and anchors.
  3. Use AWWA treatment Type A High Temperature (HT) at interior applications, and AWWA Exterior type for exterior or interior applications.
  4. Treatment type shall have been tested for strength retention after exposure to elevated temperatures; ASTM D5664 for lumber, ASTM D5516 for plywood.
  5. Treatment chemicals shall be free of halogens, sulfates, ammonium sulfate and formaldehyde.
  6. Lumber and plywood shall be kiln-dried after treatment to a maximum moisture content of 19 percent and 15 percent, respectively. After drying, discard damaged or defective pieces as determined by the Engineer.
  7. Treatment type shall permit end cuts and drilled holes; do not rip saw or plane surfaces of fire-retardant treated lumber.

## 2.02 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated on the Contract Drawings and lumber for support or attachment of other construction, including the following:
1. Blocking
  2. Nailers
  3. Cants
  4. Furring
  5. Grounds
  6. Sleepers

- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.
  - 1. Hem-fir (north); NLGA.
  - 2. Mixed southern pine; SPIB.
  - 3. Spruce-pine-fir; NLGA.
  - 4. Hem-fir; WCLIB, or WWPA.
- C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- E. For furring strips for installing plywood, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.03 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing and inspecting agency.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

## 2.04 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Alpine Engineered Products, Inc.
  2. Cleveland Steel Specialty Co.
  3. Harlen Metal Products, Inc.
  4. KC Metals Products, Inc.
  5. Simpson Strong-Tie Co., Inc.
  6. Southeastern Metals Manufacturing Co., Inc.
  7. USP Structural Connectors
  
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
  
- C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653, G60 coating designation.
  
- D. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.

## 2.05 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
  1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## PART 3 - EXECUTION

### 3.01 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
  
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

- C. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- D. Do not splice structural members between supports, unless otherwise indicated.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches on center.
- F. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Building Code of the City of New York.
- H. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.
  - 1. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.

### 3.02 WOOD SLEEPER, BLOCKING AND NAILER INSTALLATION

- A. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

**END OF SECTION**

## DIVISION 7

### SECTION 07115

#### RUBBERIZED ASPHALT SHEET WATERPROOFING

#### PART 1. GENERAL

##### 1.01 SUMMARY

- A. This Section specifies requirements for the following, where shown on the Contract Drawings:
1. Rubberized asphalt sheet membrane waterproofing system.
  2. Prefabricated drainage composite.
  3. Protection board.

##### 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 836	Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
ASTM D 146	Sampling and Testing Felted and Woven Fabrics Saturated with Bituminous Substances for Use in Waterproofing and Roofing.
ASTM D 412	Tests for Rubber Properties in Tension.
ASTM D 570	Test Method for Water Absorption of Plastics.
ASTM D 746	Test Method for Brittleness Temperature for Plastics and Elastomers by Impact.
ASTM D 1000	Method of Testing Pressure-Sensitive Adhesive Coated Tapes Used for Electric Insulation.
ASTM D 1621	Test Method for Compressive Properties of Rigid Cellular Plastics.
ASTM D 1777	Method for Measuring Thickness of Textile Fabric.
ASTM D 3767	Practice for Rubber-Measurements of Dimensions.
ASTM D 4491	Test Methods for Water Permeability of Geotextiles by Permittivity.
ASTM D 4632	Breaking Load and Elongation of Geotextiles (Grab Method).
ASTM D 4751	Test Method for Determining the Apparent Opening Size of a Geotextile.
ASTM E 96	Tests for Water Vapor Transmission of Materials in Sheet Form.
ASTM E 154	Testing Materials for Use as Vapor Barriers Under Concrete Slabs and as Ground Cover in Crawl Spaces.
	<u>Corps of Engineers</u>
CW-02215	Civil Works Construction Guide Specification for Plastic Filter Fabric.

General Services Administration, Public Building Service

GSA-PBS-07115 Guide Specification for Elastomeric Waterproofing.

1.03 ENVIRONMENTAL REQUIREMENTS

- A. Proceed with waterproofing only when existing and forecasted weather conditions permit Work to be performed in accordance with manufacturer's recommendations.
- B. Apply drainage composite when there is no present or anticipated precipitation and temperatures are 25 degrees F and above.
- C. Cover drainage composite promptly to avoid damage.

1.04 QUALITY ASSURANCE

A. Manufacturer

Sheet membrane waterproofing systems shall be manufactured and marketed by a firm with a minimum of 5 years experience in the production and sales of self-adhesive sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years. Sheet membrane and drainage composite shall be produced by the same manufacturer.

- B. Entity performing installation Work of this Section shall be a firm with not less than 5 years experience installing sheet waterproofing and which is approved by the manufacturer of sheet membrane material and shall have worked on at least 3 projects involving complexities equal to those required for the Work of this Section.
- C. Obtain sheet membrane and drainage composite, if any, from a single manufacturer. Provide accessory materials only as recommended by membrane sheet manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's printed instructions. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the construction site and dispose of in accordance with applicable regulations.
  - 1. Do not double-stack pallets of membrane on the construction site. Provide cover on top and all sides, allowing for adequate ventilation.
  - 2. Protect primer, mastic and adhesive from moisture and potential source of ignition.
  - 3. Store protection board flat and off the ground. Provide cover on top and all sides.
- B. Sequence deliveries to avoid delays, but minimize onsite storage.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

## 1.07 WARRANTY

- A. The Contractor shall execute and submit a written warranty agreeing to repair or replace sheet membrane waterproofing or drainage composite, if any, that fails in materials or workmanship within specified warranty period. This warranty shall include any labor for excavation operations and removal and replacement of materials necessary to the waterproofing system repair, including the paving system and all component elements, as shown on the Contract Drawings.
- B. Arrange for the manufacturer to execute and submit a written warranty agreeing to furnish membrane waterproofing, drainage composite, if any, and accessory materials required to repair waterproofing failures occurring within warranty period.
- C. Warranties shall be in effect for a five (5) year period, beginning at the date of issuance of the Certificate of Final Completion.
- D. These warranties shall not deprive the Authority of other rights it may have under the provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.
- E. Natural disasters or structural failure of the substrate are not covered by these warranties.

## PART 2. PRODUCTS

### 2.01 MANUFACTURERS

Subject to compliance with the requirements of this Section, provide products of one of the following manufacturers, or approved equal:

- A. Sheet Membrane
  - 1. Bituthene 3000 Low Temperature; W. R. Grace Co., Cambridge, MA
  - 2. Miradri 861; Mirafi Inc., Charlotte, NC
  - 3. Polyguard 650; Polyguard Products, Inc., Ennis, TX
- B. Drainage Composite
  - 1. Hydroduct HSF; W. R. Grace Co., Cambridge, MA
  - 2. Miradrain 9000; Mirafi Inc., Charlotte, NC
  - 3. Polyguard Drainage Board; Polyguard Products, Inc., Ennis, TX

### 2.02 MATERIALS

- A. Sheet Membrane Waterproofing System

A self-adhesive, cold-applied composite sheet consisting of a thickness of 56 mils of rubberized asphalt and 4 mils of cross-laminated, high density polyethylene film. Provide rubberized asphalt membrane covered with release paper that is removed during installation. No special adhesive or heat shall be required to form laps.

B. Sheet Membrane Waterproofing Physical Characteristics

<u>Property</u>	<u>Thickness</u>	<u>Test Method</u>
Thickness, unless otherwise shown on the Contract Drawings.	60 mils	ASTM D 1000, ASTM D 1777, or ASTM D 3767 Method A
Pliability, 180± bend over 1" mandrel	Unaffected at -20±F	ASTM D 146

The following ASTM D 746 test may be referenced in lieu of the ASTM D 146 test referenced above:

<u>Property</u>	<u>Thickness</u>	<u>Test Method</u>
Brittleness Temperature	-25±F	ASTM D 746
Tensile Strength, membrane	250 psi (minimum)	ASTM D 412 Die C Modified
Elongation, ultimate failure of rubberized asphalt	300% (minimum)	ASTM D 412 modified
Crack Cycling 100 cycles	Unaffected at -15±F	ASTM C 836 Modified
Puncture Resistance, membrane	40 lb. (minimum)	ASTM E 154
Resistance to Hydrostatic Head	150 ft. of water	
Exposure to Fungi in Soil, 16 weeks	No effect	GSA-PBS 07115
Permeance	0.05 grains/sq. ft./hr./in. Hg	ASTM D 96 Method B
Water Absorption	0.15% (maximum) weight gain after 48 hours of immersion at 70±F	ASTM D 570

C. Prefabricated Drainage Composite

Drainage composite shall be designed to promote positive drainage while serving as a protection course.

D. Drainage composite shall consist of a 3/8 inch dimpled high impact polymeric drainage core and a woven filter fabric adhered to the core. Drainage composite shall conform to the following physical properties:

<u>Property</u>	<u>Test Method</u>	<u>Typical Value</u>
<u>Drain Core</u>		
Thickness (in.)	ASTM D 1777	0.38
Compression Strength (psf)	ASTM D 1621	18,000
<u>Filter Fabric</u>		
Equivalent Opening Size (U.S. Standard)	COE CW 02215 or ASTM D 4751	70-100
Flow (gpm/ft. width at 3600 psf)	ASTM D 4491	20
Grab Strength (lb.)	ASTM D 4632	250 cross direction

E. Protection Board

1. Asphaltic Hardboard

A premolded semi-rigid protection board consisting of bitumen, mineral core and reinforcement.

2. Protection Course: Manufactured by W. R. Meadows, Inc., Elgin, IL, or approved equal. Protection board shall be 1/4-inch thick, unless otherwise shown on the Contract Drawings.

2.03 ACCESSORIES

A. Mastic

Type recommended by sheet waterproofing manufacturer for waterproof sealing of seams in membrane, and for waterproof sealing of joints between membrane and flashings, adjoining surfaces and projections through membrane.

B. Primer

Type recommended by sheet waterproofing manufacturer for applications shown on the Contract Drawings.

**PART 3. EXECUTION**

3.01 EXAMINATION

- A. Inspect concrete substrate to ensure that surfaces are free of voids, spalled areas, sharp protrusions, loose aggregate and form release agents.
- B. Do not proceed with waterproofing Work until construction that is attached to or passes through surfaces to be waterproofed is complete and substrate surface defects have been repaired to the satisfaction of the Engineer.
- C. Ensure that concrete surfaces are thoroughly dry and concrete has been cured for a minimum of 10 days prior to application of waterproofing membrane, unless manufacturer's recommendations for required application require a longer curing period, in which case such longer curing period shall be observed.

3.02 PREPARATION

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, and loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of sheet membrane waterproofing.
- B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

### 3.03 INSTALLATION

- A. Comply with manufacturer's printed instructions for handling and installation of waterproofing materials.
- B. Schedule installation to minimize period of exposure of waterproofing materials.
- C. Apply primer to concrete substrate at the rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of primer. Reprime surfaces not covered by waterproofing membrane on the day of primer application.
- D. Apply membrane, in the thickness in accordance with the details shown on the Contract Drawings, at inside corners, pipe penetrations and other protrusions shown on the Contract Drawings. Thicknesses shown are minimum thicknesses, if not shown, provide in thicknesses recommended by the sheet waterproofing manufacturer for the applications shown.
- E. Apply membrane to extent shown on the Contract Drawings and roll in place. On vertical surfaces, apply from low points to high points. Overlap joints a minimum of 4 inches, unless otherwise shown on the Contract Drawings.
- F. Seal seams, projections through membrane and terminations.
- G. Inspect membrane prior to covering for the presence of fishmouths, wrinkles, buckles, pockets, blisters, or other defects, including improperly sealed seams, projections or terminations which would impair watertightness. Repair all defects immediately and to the satisfaction of the Engineer.
- H. At surfaces to be in contact with backfill, install protection board with glass mat side of board facing away from the waterproofing membrane. At horizontal surfaces, provide protection course shown on Contract Drawings.
- I. In lieu of or in addition to protection course, where shown on the Contract Drawings, install prefabricated drainage composite.
- J. Provide protection board on horizontal surfaces over drainage composite, where shown on the Contract Drawings.
- K. Drainage Composite (Horizontal Surfaces)

Adhere Drainage Composite to the substrate with strips of approved adhesive applied at approximately 10 foot intervals. More adhesive may be required in high wind. Panels shall be butted tightly. Overlap fabric onto the previous panel. Adhere overlapped filter fabric with Bitustik or Bituthene Mastic if necessary. At corners, cut the core and cover the core with filter fabric or tape. Waterproofed decks will require a temporary protection course if the Drainage Composite is not placed promptly.

L. Drainage Composite (Vertical Surfaces)

1. Apply rolls of the Drainage Composite starting at the base of the wall. Peel the fabric back approximately 12 inches from the lower edge.

Adhere drainage composite to walls with strips of adhesive. Strips shall be placed near the top and bottom of each sheet. Press drainage composite firmly to the adhesive. Additional drainage composite rolls shall be butted tightly to the adjacent roll. Overlapping fabric may be adhered with spots of adhesive mastic. Drainage composite shall be applied to a point approximately 6 inches below the grade line. At the top termination, tuck the excess fabric below the grade line. At the top termination, tuck the excess fabric behind the drain core and adhere it to the wall with mastic. On the inside corners, cut the drain core film backing, but do not cut the filter fabric. On outside corners, cut the drainage composite and cover cut ends of drain core with fabric or tape. Adhere to overlapping fabric on corners. Prior to backfilling, repair any damaged drainage composite with the filter fabric and/or drain core material.

2. Backfilling shall be completed promptly following installation of the drainage composite. As a guideline, do not leave the drainage composite exposed for more than one week. Use care to follow accepted practices for backfilling and compaction. Backfill shall normally be added and compacted in 6 to 12 inch lifts.

3.04 FIELD TESTS

On horizontal surfaces, test for leaks with 2 inches depth of water maintained for 24 hours. Repair all leaks revealed by examination of substructure and repeat test until no leakage is observed before installation of protection course. Replace insulation and/or other Work damaged by water leaks.

3.05 PROTECTION

- A. After completion of the Work of this Section remove masking materials, if any, and stains from exposed surfaces caused by waterproofing installation.
- B. Protect completed membrane during installation of Work over membrane and throughout remainder of the Work. Do not allow traffic of any type on unprotected membrane.

END OF SECTION

## SECTION 07115

### RUBBERIZED ASPHALT SHEET WATERPROOFING

#### 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

1. Product data, installation instructions and recommendations for all waterproofing materials, including storing and handling instructions. Include data substantiating that materials comply with requirements of this Section.
2. One copy of U.S. Department of Labor, Material Safety Data Sheets (MSDS) for all hazardous or toxic materials utilized during Work of this Section.

B. Samples

Three 12 inch by 12 inch samples of sheet waterproofing materials, drainage composite and protection board.

C. Certifications

Evidence of sheet membrane manufacturer's approval of installer.

D. Qualifications

Qualification data for manufacturer, if other than one of those specified, as required by 1.04 to demonstrate its capabilities and experience. Include list of completed projects with project names, addresses, names of architects and owners, and other information specified.

END OF APPENDIX "A"

**SECTION 07116**  
**SELF-ADHERED SHEET MEMBRANE WATERPROOFING**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. This Section specifies requirements for self-adhered sheet membrane waterproofing systems for the following locations:
1. A multi-ply rubberized asphalt waterproofing systems of cast-in-place concrete slabs, and other below grade conditions/structures, as indicated on Drawings.
  2. Drainage composite panels (protection board) and waterproofing accessories.
  3. Provide substrate preparation including, but not limited to the application of suitable membrane primer/conditioner materials, and termination accessories as required to install (and interface) membrane with other substrates and waterproofing membranes/materials.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. General: Provide a complete waterproofing system (WP-2) that prevents the passage of liquid water under hydrostatic pressure, and complies with requirements as demonstrated by testing performed by an independent testing agency of manufacturer's current self-adhered rubberized asphalt membranes.

1.03 RELATED SECTIONS

- A. Section 01352 - Sustainable Design Requirements
- B. Section 04220 – Concrete Masonry Units
- C. Section 07175 – HDPE Waterproofing
- D. Section 07207 – Extruded Foam Insulation

1.04 REFERENCES

- A. ASTM International (ASTM)
1. C578 - Specification for Rigid, Cellular Polystyrene Thermal Insulation
  2. C836 - Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
  3. D146 - Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing

4. D412 - Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers – Tension
5. D570 - Test Method for Water Absorption of Plastics
6. D746 - Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
7. D1621 - Test Method for Compressive Properties of Rigid Cellular Plastics
8. D1777 - Test Method for Thickness of Textile Materials
9. D3762 - Test Method for Adhesive-Bonded Surface Durability of Aluminum (Wedge Test)
10. D3767 - Standard Practice for Rubber-Measurement of Dimensions
11. D4258 - Practice for Surface Cleaning Concrete for Coating
12. D4263 - Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
13. D4491 - Test Methods for Water Permeability of Geotextiles by Permittivity
14. D4632 - Test Method for Grab Breaking Load and Elongation of Geotextiles
15. D4751 - Test Method for Determining Apparent Opening Size of a Geotextile
16. E96 - Test Methods for Water Vapor Transmission of Materials
17. E154 - Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover

## 1.05 SUSTAINABLE DESIGN REQUIREMENTS

### A. Sustainable Design General Requirements

1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Section 01352 and the articles below, are implemented to the fullest extent. Substitutions or other changes to the Work proposed by the Contractor shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.

### B. Sustainable Design Performance Criteria

1. The post-industrial and/or post-consumer recycled content (by weight) of the insulation and waterproofing membrane shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
2. The manufacturing location (final assembly) of the waterproofing membrane and insulation shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
3. Insulation products that must be expanded or extruded (e.g. extruded polystyrene - EPS), shall avoid blowing agents containing chlorine-based gas used for manufacture or installation.

## 1.06 QUALITY ASSURANCE

- A. **Manufacturer:** Self-adhered sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 10 years experience in the production and sales of membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
- B. **Installer Qualifications:** A firm which has specialized in this type of waterproofing, and which is certified by the manufacturer of primary waterproofing materials.
  - 1. Installer and the on-site "crew chief" shall have no less than five years of successful experience in the installation of the exact waterproofing systems specified for this Project. The qualified installer shall also have completed three projects in the past five years similar in size and scope.
- C. **Source Quality Control:** Obtain primary self-adhered sheet membrane waterproofing materials from a single manufacturer with no less than 10 years of successful experience in sheet waterproofing work and having qualified field personnel.
  - 1. Provide secondary materials as manufactured by the primary materials manufacturer; where secondary materials are not produced by the primary materials manufacturer, provide products recommended by the primary materials manufacturer.
- D. Potential subcontractors/installers of self-adhered sheet membrane waterproofing shall attend a mandatory pre-installation meeting to review specific Project details, and each typical and atypical substrate condition prior to submitting their proposals.
- E. **Preinstallation Meeting:** Conduct a pre-installation meeting at the Project site.
  - 1. Before installing the self-adhered sheet membrane waterproofing systems (WP2), meet at the site with the Engineer and other concerned entities whose work is directly related to or penetrating the self-adhered sheet membrane waterproofing.
  - 2. Review requirements for self-adhered sheet membrane waterproofing, including surface preparation, substrate condition and pretreatment, minimum curing period, weather conditions, special details (including penetrations, flashing, terminations horizontal-and vertical-seams and laps, interface with adjacent waterproofing materials/systems, and similar conditions), installation procedures, inspection and testing procedures, drainage interface, protection and repairs.
  - 3. Notify the Engineer and other concerned entities at least seven days before conference.

## 1.07 SUBMITTALS

- A. **General:** Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS.
- B. **Product Data:** Submit manufacturer's product data including manufacturer's printed instructions for evaluating, preparing and treating waterproofing substrates, technical

data, specifications and tested physical and performance properties for each waterproofing material required.

1. Include data substantiating compliance with requirements.
- C. Samples: Submit 6 inch by 12 inch samples of each self-adhered sheet membrane waterproofing, combination drainage/protection boards and auxiliary materials as requested by the Engineer.
1. Include full size samples of the manufacturer's standard self-adhered sheet membrane waterproofing termination, as well as a typical detail of the self-adhered sheet membrane (WP-2)-to-HDPE membrane (WP-1, specified in Section 07175) condition.
- D. Shop Drawings: Provide shop drawings showing locations and extent of self-adhered sheet membrane waterproofing; include sheet layout drawings, flashing profiles and terminations, reglets, accessories, taped splice, seam and lap details, substrate preparation (including details for substrate joints and cracks), penetrations, waterstops and similar conditions.
1. Provide general sheet layout drawings at 1/4-inch scale; details, flashing and similar special conditions shall be prepared at full scale.
  2. Clearly identify/indicate the composite drainage panels (protection boards), insulations and other work not specified herein, but required for coordination purposes and the overall system success.
- E. Installer Certificates: Provide installer certificates signed by primary material manufacturer certifying that Installers and on-site "crew chief" comply with requirements under this Section .
- F. Manufacturer Certificates: Provide a written affidavit signed by the self-adhered sheet membrane manufacturer stating that the waterproofing system (WP-2) specified herein is completely compatible to the substrates, and other interfacing waterproof membranes (WP-1, specified in Section 07175) and substrates indicated; and as specified in other sections.
- G. Product Test Reports: Submit product test reports from a qualified independent testing agency evidencing compliance of waterproofing with requirements and other physical properties reported by manufacturer based on comprehensive testing of products according to current standard test methods within previous five years.
- H. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.
    - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:

- 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
  - 2) The manufacturing location of the supplied product(s).
  - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
  - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
  - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  3. Product cut sheets for materials that meet the SDMCF.
  4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
  5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

#### 1.08 DEFINITIONS

- A. General: Self-adhered sheet membrane waterproofing systems (WP-2) shall include all primary and secondary materials required to complete the indicated work, and as recommended by the manufacturer. Materials and accessories not specifically indicated or specified but are recommended by, or required by the primary materials manufacturer to complete the "systems" shall be included as part of the specified self-adhered sheet membrane waterproofing system.

#### 1.09 JOB CONDITIONS

- A. General: Proceed with Work of this Section only after substrate construction and penetrating work have been completed. Apply self-adhered sheet membrane waterproofing within range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply self-adhered sheet membrane waterproofing to a damp or wet substrate.
  1. Do not apply sheet waterproofing in snow, rain, fog or mist.
- B. Ventilation: Provide ventilation to remove fumes during application and cure of self-adhered sheet membrane waterproofing system components in enclosed spaces, and maintain ventilation until such components have thoroughly cured and fumes have dissipated.

- C. Weather: Proceed with self-adhered sheet membrane waterproofing and associated work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations and warranty requirements.

#### 1.10 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer and installer agrees to repair or replace components of the self-adhered sheet membrane waterproofing systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Water penetrating the building or structure resulting from substrate cracking of up to 1/8-inch.
    - b. Deteriorated or displaced waterproofing materials.
  - 2. Warranty Period: Five years after date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide self-adhered sheet membrane waterproofing systems/products as manufactured by W.R. Grace & Company, or an approved equal.
  - 1. Selected Systems: Provide self-adhered sheet membrane waterproofing systems (WP-2) "Bituthene 3000LT" as manufactured by W. R. Grace & Co.

#### 2.02 MATERIALS

- A. Sheet Membrane Waterproofing System
  - 1. A self-adhesive, cold-applied composite sheet consisting of a thickness of 56 mils of rubberized asphalt and 4 mils of cross-laminated, high density polyethylene film. Provide rubberized asphalt membrane covered with release paper that is removed during installation. No special adhesive or heat shall be required to form laps.
- B. Sheet Membrane Waterproofing Physical Characteristics

Property	Thickness	Test Method
Thickness, unless otherwise shown on the Contract Drawings	60 mils	ASTM D1000, ASTM D1777, or ASTM D3767; Method A
Pliability, 180± bend over 1" mandrel	Unaffected at -20±F	ASTM D146
The following ASTM D746 test may be referenced in lieu of the ASTM D 146 test referenced above:		
Brittleness Temperature	-25±F	ASTM D746
Tensile Strength, membrane	250 psi (min.)	ASTM D 412 Die C Modified
Elongation, ultimate failure of rubberized asphalt	300% (min)	ASTM D412 Die C Modified
Crack Cycling 100 cycles	Unaffected at -15±F	ASTM C836 Modified
Puncture Resistance, membrane	40 lb. (minimum)	ASTM E154
Resistance to Hydrostatic Head	150 ft. of water	
Exposure to Fungi in Soil, 16 Weeks	No effect	GSA-PBS 07115
Water Absorption	0.15 percent (maximum) weight gain after 48h ours of immersion at 70±F	ASTM D570

- C. Prefabricated Drainage Composite: Drainage composite shall be designed to promote positive drainage while serving as a protection course.
1. Drainage Composite shall consist of a 3/8-inch dimpled high impact polymeric drainage core and a woven filter fabric adhered to the core Drainage Composite shall conform to the following physical properties.

Property	Test Method	Typical Value
<u>Drain Core</u>		
Thickness (in.)	ASTM D1777	0.38
Compression Strength (psf)	ASTM D1621	18,000
<u>Filter Fabric</u>		
Equivalent Opening Size (U.S. Std.	COE CW 02215 or	70-100
	ASTM D4751	
Flow (gpm/ft. width at 3600 psf)	ASTM D4491	20
Grab Strength (lb.)	ASTM D4632	250 cross direction

## 2.03 MISCELLANEOUS MATERIALS

- A. Where specific products are named in the following paragraphs, provide either the named products or equals acceptable to the Engineer which are compatible with the installed self-adhered sheet membrane waterproofing system, as recommended by the system manufacturer.

- B. Adhesives, Cant Strips, and Edge Strips: Provide types of adhesive compound, cant strips, and edge strips recommended by sheet waterproofing manufacturer for bonding to substrate, for waterproof sealing of seams in sheet, and for waterproof sealing of joints between sheet and flashing, adjoining surfaces and projections through sheet.
- C. Sheet Flashing: Self-adhering, rubberized-asphalt composite sheet of same material, construction and thickness as waterproofing sheet membrane.
- D. Liquid Membrane: Elastomeric, two-component, liquid, cold fluid-applied, trowel grade or low viscosity as recommended by waterproofing manufacturer for application.
- E. Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- F. Mastic: Type recommended by self-adhered sheet membrane waterproofing manufacturer for waterproof sealing of seams in membrane, and for waterproof sealing of joints between membrane and flashings, adjoining surfaces, and projections through membrane.
- G. Primers/Conditioners: Provide the manufacturers standard latex-based surface primer/conditioner for all concrete substrates.
- H. Insulation: Provide extruded polystyrene board insulation complying with ASTM C578, Type V (3.00 lb/cu. ft), with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively.
  - 1. Refer to Section 07207 for additional requirements.

### PART 3 - EXECUTION

#### 3.01 INSPECTION OF SUBSTRATES

- A. Examine substrates, adjoining construction and conditions under which the Work is to be installed. Prepare and submit written report to the Engineer describing conditions which would adversely affect systems. Do not proceed with the Work until unsatisfactory conditions have been corrected.
  - 1. Do not proceed with installation until after minimum concrete curing period recommended by the self-adhered sheet membrane waterproofing manufacturer.
  - 2. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
- B. Pre-Installation Meeting: Prior to installation of self-adhered sheet membrane waterproofing, but following submittal and acceptance of required submittal, meet at the Project site to review the material selections, installation procedures and coordination of the Work with other trades.
- C. The manufacturer of the self-adhered sheet membrane waterproofing and the applicator shall inspect the substrates to review their acceptability for the application of the waterproofing systems specified.

- D. Final Inspection: After all self-adhered sheet membrane waterproofing work is completed, an inspection shall be made by the membrane manufacturer's representative. He shall certify that the waterproofing has been installed according to the specifications and manufacturer's requirements.

### 3.02 PREPARATION

- A. Clean, prepare and treat substrate according to manufacturer's written instructions. Provide clean, dust-free and dry substrate for waterproofing application.
1. Remove grease, oil, form release agents, paints and other penetrating contaminants from concrete.
  2. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes and other voids.
  3. Prepare, fill, prime, and treat joints and cracks in substrate. Remove dust and dirt from joints and cracks according to ASTM D4258.
- B. Do not proceed with installation until drains, and other projections through the wall have been installed. Holes, honeycombs and cavities shall be pointed or filled and finished flush in accordance with manufacturer's directions utilizing materials recommended by the manufacturer of the sheet waterproofing. Fill gaps or voids greater than 0.5 inch in diameter, depth and length. Remove standing water prior to membrane applications.
- C. Install cant strips, flashing and accessory items as shown on approved shop drawings, and as recommended by the manufacturer even though not shown. Install membrane strip and center over construction and control joints and cracks exceeding a width of 1/16 inch.
1. Corners: Prepare, prime and treat inside corners according to self-adhered sheet membrane waterproofing manufacturer's written instructions.
    - a. Install strip of membrane 12 inches wide, centered over corner.
  2. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to waterproofing manufacturer's written instructions.
    - a. Treat expansion joints and discontinuous deck-to-wall or deck-to-deck joints, per the manufacturer's recommendations.
- D. Prevent compounds from entering drains and conductors, and from spilling or migrating onto surfaces of other work.

### 3.03 INSTALLATION, GENERAL

- A. At the start of the installation and periodically as work progresses, employ the services of the manufacturer's technical representative at the job site as often as deemed necessary by the manufacturer to advise on and supervise all phases of this Work.
- B. Install the sheet waterproofing in accordance with manufacturer's written instructions, except where more stringent requirements are shown or specified to provide a sheet waterproofing system which does not permit water penetration into the structure.

- C. Provide flashing materials at cracks and penetrations and with such materials and designs as recommended by the manufacturer of the sheet waterproofing.
- D. Fill non-moving cracks and joints with sealant or other compounds as recommended by the sheet waterproofing materials manufacturer for compatibility.
- E. Prime/condition all concrete substrates in accordance with the manufacturer's instructions. Use specified products, and comply with methods recommended by the self-adhered sheet membrane waterproofing materials manufacturer.
- F. Flashing:
  - 1. Install elastomeric flashing using products and systems specified in the sheet waterproofing materials manufacturer's requirements.
  - 2. Install stainless steel sheet metal flashing where shown on the Contract Drawings. Refer to Section 04220.
- G. Pipe Seals: Furnish and install pipe seal assemblies and covers in compliance with manufacturer's instructions.

#### 3.04 SELF-ADHERED SHEET MEMBRANE WATERPROOFING INSTALLATION

- A. Comply with manufacturer's printed instructions for handling and installation of waterproofing materials.
  - 1. Horizontal self-adhered sheet membrane waterproofing systems shall be installed in a "double" thick membrane approach. Sheet membranes will be completely adhered to the properly prepared substrates, and initial membrane installation. Seams and laps shall be offset and staggered in accordance with the manufacturer's instructions and recommendations, and the Contract Drawings.
- B. Schedule installation to minimize period of exposure of waterproofing materials.
- C. Apply primer/surface conditioner to all concrete substrates at the rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of primer. Reprime surfaces not covered by waterproofing membrane on the day of primer application.
- D. Apply initial application of the two-ply membrane system, in the thickness in accordance with the details shown on the Contract Drawings, at inside corners, pipe penetrations, and other protrusions shown on the Contract Drawings. Thicknesses shown are minimum thicknesses, if not shown provide in thicknesses recommended by the sheet waterproofing manufacturer for the applications shown.
  - 1. Apply membrane to extent shown on the Contract Drawings and roll in place. On vertical surfaces, apply from low points to high points. Overlap joints a minimum of 6 inches unless otherwise shown on the Contract Drawings.
  - 2. Apply and firmly adhere sheet membrane over area to receive waterproofing. Accurately align sheets and maintain uniform 6 inches minimum lap widths and

- end laps. Overlap and seal seams and stagger end laps to ensure watertight installation
3. Terminate self-adhered sheet membrane waterproofing to properly prepared substrates, HDPE waterproof membranes and other such substrates as indicated on the Contract Drawings,; and as required to maintain a waterproof system.
- E. Seal seams, projections through initial waterproof membrane and terminations.
- F. Inspect membrane prior to covering for the presence of fishmouths, wrinkles, buckles, pockets, blisters or other defects, including improperly sealed seams, projections or terminations which would impair watertightness. Repair all defects immediately and to the satisfaction of the Engineer.
1. Repair tears, voids, and lapped seams in waterproofing not meeting requirements. Slit and flatten fishmouths and blisters. Patch with sheet membrane extending 6 inches beyond repaired areas in all directions.
- G. Install a second layer/application of the specified self-adhered sheet membrane waterproofing material over the properly installed and inspected primary layer. Comply with the manufacturer's strict instructions and recommendations. Installed membranes shall completely cover the initial installation, and all seams, laps, and other such tie-in conditions shall be carefully installed in a "shingle-like" fashion with membranes being offset between plies.
1. Roll membranes after installation to insure complete adhesion; work out trapped air and similar conditions so resulting installation is flat and capable of maintaining a permanent waterproof condition.
- H. Install prefabricated composite drainage panels (protection board) with filter fabric matting side of board facing away from the waterproofing membrane. Install, and secure drainage/protection panels in strict accordance with the manufacturer's instructions and recommendations.
1. Drainage Composite: Adhere drainage composite to the substrate with strips of approved adhesive applied at approximately 10 foot intervals. More adhesive may be required in high wind. Panels shall be butted tightly. Overlap fabric onto the previous panel. Adhere overlapped filter fabric with Bitustik or Bituthene Mastic if necessary. At corners, cut the core and cover the core with filter fabric or tape.
  2. Waterproofed decks will require a temporary protection course if the Drainage Composite is not placed promptly.

### 3.05 FIELD QUALITY CONTROL

- A. The Contractor shall engage a full-time site representative qualified by waterproofing systems manufacturer to inspect substrate conditions; surface preparation; membrane application, flashings, protection, and drainage components; and to furnish daily reports to Engineer.
- B. The Contractor shall engage an independent testing agency, acceptable to the Authority, to observe the membrane waterproofing systems installation. Agency shall prepare

reports indicating acceptance of conditions and installations to manufacturer to secure the necessary warranties specified.

### 3.06 FIELD TESTS

- A. On horizontal surfaces, test for leaks with 2 inches depth of water maintained for 24 hours. Repair all leaks revealed by examination of substructure and repeat test until no leakage is observed before installation of protection course. Replace insulation and/or other Work damaged by water leaks.

### 3.07 CLEANING

- A. Protect completed waterproofing systems from damage and wear during application and remainder of construction period, according to manufacturer's written instructions. Inspect waterproofing systems for damage just prior to backfilling or placement of concrete and make repairs in accordance with manufacturer's recommendations.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Clean up and legally dispose of all debris resulting from the waterproofing installation. Remove waterproofing equipment and similar appurtenance from the project site.

### 3.08 PROTECTION

- A. Provide for protection of completed waterproofing installation during the installation of other materials on or about the waterproof sheet membrane system; and throughout the remainder of construction period.

**END OF SECTION**

**SECTION 07175**  
**HDPE WATERPROOFING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section specifies requirements for high density polyethylene waterproofing systems for the following locations:
1. Blindside waterproofing (vertical) systems of abutting, existing building foundations, below grade bedrock and other inaccessible below grade conditions/structures, as indicated on Drawings.
  2. Waterproofing systems of below grade cast-in-place concrete building slabs (horizontal surfaces) and similar below grade structures, as indicated on Drawings.
  3. Protection board and waterproofing accessories.
  4. Provide substrate preparation including, but not limited to the application of suitable substrate materials (plywood, shotcrete, plastic insulation or other acceptable material) over irregular, rough, or otherwise unacceptable textured substrates as required to install the HDPE waterproofing membranes.

**1.02 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. General: Provide a complete waterproofing system (WP-1) that prevents the passage of liquid water under hydrostatic pressure, and complies with requirements as demonstrated by testing performed by an independent testing agency of manufacturer's current high-density polyethylene membranes.
1. Waterproofing is defined as a complete unified system, both vertical and horizontal, that will prevent the passage of water through and about the building foundation/enclosure system.
  2. Refer to Section 07116 for additional requirements.

**1.03 RELATED SECTIONS**

- A. Section 01352 – Sustainable Design Requirements
- B. Section 04220 – Concrete Masonry Units
- C. Section 07116 – Self-Adhered Sheet Membrane Waterproofing

## 1.04 REFERENCES

- A. ACI International (ACI)
  - 1. 301 - Specification for Structural Concrete
  
- B. ASTM International (ASTM)
  - 1. C578 - Specification for Rigid, Cellular Polystyrene Thermal Insulation
  - 2. D412 - Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
  - 3. D570 - Test Method for Water Absorption of Plastics
  - 4. D882 - Test Methods for Tensile Properties of Thin Plastic Sheeting
  - 5. D903 - Test Method for Peel or Stripping Strength of Adhesive Bonds
  - 6. D1876 - Test Method for Peel Resistance of Adhesives (T-Peel Test)
  - 7. D1970 - Standard Specification for Self Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
  - 8. D4258 - Practice for Surface Cleaning Concrete for Coating
  - 9. D4263 - Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
  - 10. D5385 - Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
  - 11. E96 - Test Methods for Water Vapor Transmission of Materials
  
- C. Forest Stewardship Council (FSC)
  - 1. FSC-STD-01-001 (April 2004) - FSC Principles and Criteria for Forest Stewardship
  
- D. US Department of Commerce, National Institute of Standards and Technology (DOC/NIST)
  - 1. DOC PS 1 - US Product Standard for Construction and Industrial Plywood

## 1.05 SUSTAINABLE DESIGN REQUIREMENTS

- A. Sustainable Design General Requirements
  - 1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Section 01352 and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the Work proposed by the Contractor shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.
  
- B. Sustainable Design Performance Criteria

1. The manufacturing location (final assembly) of the HDPE waterproofing shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.

#### 1.06 QUALITY ASSURANCE

- A. **Manufacturer:** HDPE waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past five years.
- B. **Installer Qualifications:** A firm which has specialized in this type of waterproofing, and which is certified by the manufacturer of primary waterproofing materials.
  1. Installer shall have no less than five years of successful experience in the installation of the exact waterproofing systems specified for this Project. The qualified installer shall also have completed three projects in the past five years similar in size and scope.
  2. In addition, the qualified installer shall possess extensive experience in the below grade waterproofing of sites with similar ground water/water table conditions.
- C. **Source Quality Control:** Obtain primary HDPE waterproofing materials from a single manufacturer with no less than 10 years of successful experience in sheet waterproofing work and having material manufacturer qualified field personnel to inspect all surface preparation and material application is in compliance with all material manufacturer's installation recommendations. Copies of all such quality control inspection reports shall be formally submitted within 5 business days of each inspection.
  1. Provide secondary materials as manufactured by the primary materials manufacturer; where secondary materials are not produced by the primary materials manufacturer, provide products recommended by the primary materials manufacturer.
- D. **Preinstallation Conference:** Conduct a pre-installation conference at the Project site.
  1. Before installing the HDPE waterproofing systems (WP-1 and WP-2), meet at the site with the Engineer, Contractor, trade contractor, and other concerned entities whose work is directly related to or penetrating the each HDPE waterproofing system.
  2. Review requirements for HDPE waterproofing, including surface preparation, substrate condition and pretreatment, minimum curing period, weather conditions, special details (including waterstops, penetrations, flashing, terminations horizontal and vertical taped seams and laps, and similar conditions), installation procedures, inspection and testing procedures, drainage interface, and protection and repairs.
  3. Notify participants at least seven days before conference.

- E. Forest Certification: For plywood used in the below grade substrate work, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC Principles and Criteria for Forest Stewardship".

#### 1.07 SUBMITTALS

- A. General: Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 - GENERAL PROVISIONS.
- B. Product Data: Submit manufacturer's product data including manufacturer's printed instructions for evaluating, preparing and treating waterproofing substrates, technical data, specifications and tested physical and performance properties for each waterproofing material required.
1. Include data substantiating compliance with requirements.
- C. Samples: Submit 6 inch by 12 inch samples of each HDPE sheet waterproofing, protection board and auxiliary materials as requested by the Engineer.
1. Include full size samples of the manufacturer's standard "taped" seamed waterproofing sheets and splices.
- D. Shop Drawings: Provide shop drawings showing locations and extent of HDPE waterproofing; include sheet layout drawings, flashing profiles and terminations, reglets, accessories, taped splice, seam and lap details, substrate preparation (including details for substrate joints and cracks), penetrations, waterstops and similar conditions. Include (where indicated on the Drawings) details of the "selvage" edge membrane materials (measuring no less than 24 inches), interface on continuity details of the waterproof membranes.
1. Provide large scale details of the substrate repairs and support structure/assemblies as required in order to provide an acceptable substrate for the membrane waterproofing systems. Include erection details of typical and atypical conditions, pile caps, mini piles and other substrate conditions; include sizes, and overall approach to the proposed system (shotcrete, plywood structure or insulation) and other specifics to the Engineer's satisfaction.
  2. Provide general sheet layout drawings at 1/4 inch scale; details, flashing and similar special conditions shall be prepared at full scale.
  3. Clearly identify/indicate the sub-drainage, insulations and other work not specified herein, but required for coordination purposes and the overall system success.
- E. Research/Evaluation Reports: For foam-plastic insulation.
- F. Installer Certificates: Provide installer certificates signed by primary material manufacturer certifying that Installers comply with requirements under 1.06.

- G. **Product Test Reports:** Submit product test reports from a qualified independent testing agency evidencing compliance of waterproofing with requirements and other physical properties reported by manufacturer based on comprehensive testing of products according to current standard test methods within previous five years.
- H. **Sustainable Design Submittal Requirements:** The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.
    - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
      - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
      - 2) The manufacturing location of the supplied product(s).
      - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
      - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
      - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
  2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  3. Product cut sheets for materials that meet the SDMCF.
  4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
  5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

## 1.08 DEFINITIONS

- A. **General:** HDPE waterproofing systems (WP-1) shall include all primary and secondary materials required to complete the indicated work, and as recommended by the manufacturer. Materials and accessories not specifically indicated or specified but are recommended by, or required by the primary materials manufacturer to complete the "systems" shall be included as part of the specified HDPE waterproofing system.

- B. **Waterproofing System:** The waterproofing system shall be comprised of two distinctly different, yet totally compatible, waterproof membranes. The HDPE waterproof membrane (WP-1; specified herein) shall be for vertical blind-side wall conditions and horizontal underslab and structural concrete conditions concrete conditions. The self-adhered sheet waterproofing membrane (WP-2; specified in Section 07116) shall consist of a multi-ply application of a 100 percent compatible rubberized asphalt-type membrane. These two systems comprise the waterproofing system inclusive of all primary and secondary materials, surface preparations both indicated and as recommended by the membrane manufacturer.

## 1.09 JOB CONDITIONS

- A. **General:** Proceed with Work of this Section only after substrate construction and penetrating work have been completed. Apply HDPE waterproofing within range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply HDPE waterproofing to a damp or wet substrate.
1. Do not apply sheet waterproofing in snow, rain, fog or mist.
- B. **Ventilation:** Provide ventilation to remove fumes during application and cure of HDPE waterproofing system components in enclosed spaces, and maintain ventilation until such components have thoroughly cured and fumes have dissipated.
- C. **Weather:** Proceed with sheet waterproofing and associated work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations and warranty requirements.

## 1.10 WARRANTY

- A. **Special Warranty:** The manufacturer and the installer shall jointly and severally furnish "Manufacturer's Warranty" and "Contractor's Warranty" in which manufacturer and installer agrees to repair or replace components of the HDPE waterproofing systems which fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Water penetrating the building or structure resulting from substrate cracking of up to 1/8 inch.
    - b. Failure of seams, laps, terminations and joints between both HDPE and rubberized asphalt membrane materials.
    - c. Deteriorated or displaced waterproofing materials.
  2. **Warranty Period:** Five years after date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide HDPE waterproofing systems/products as manufactured by W.R. Grace & Company, or an approved equal.
1. Selected Systems: Provide HDPE waterproofing systems (WP-1) "Preprufe 300R Membrane" as manufactured by W. R. Grace & Co.; meeting the following minimum performance criteria:
    - a. Adhesive-Coated HDPE Sheet for Horizontal and Vertical Applications: 46-mil-thick, uniform, flexible sheets consisting of 30-mil-thick, HDPE sheet coated with a pressure-sensitive rubber adhesive, a protective adhesive coating, a detackifying surface treatment, an uncoated self-adhering side lap strip, and a release liner.
    - b. Tensile Strength, Film: 4,000 psi minimum; ASTM D412.
    - c. Low-Temperature Flexibility: Pass at minus 10 deg F; ASTM D1970.
    - d. Peel Adhesion to Concrete: 5 lbf/in.; ASTM D903, modified.
    - e. Lap Adhesion: 2.5 lbf/in.; ASTM D 1876, modified.
    - f. Hydrostatic-Head Resistance: 231 feet; ASTM D5385, modified.
    - g. Vapor Permeance: 0.01 perms; ASTM E96, Water Method.

## 2.02 MISCELLANEOUS MATERIALS

- A. Where specific products are named in the following paragraphs, provide either the named products or equals acceptable to the Engineer which are compatible with the installed HDPE waterproofing system, as recommended by the system manufacturer.
- B. Adhesives, Cant Strips and Edge Strips: Provide types of adhesive compound, cant strips, and edge strips recommended by sheet waterproofing manufacturer for bonding to substrate, for waterproof sealing of seams in sheet, and for waterproof sealing of joints between sheet and flashing, adjoining surfaces, and projections through sheet.
- C. Sheet Flashing: Self-adhering, rubberized-asphalt composite sheet of same material, construction, and thickness as HDPE waterproofing sheet membrane.
- D. Liquid Membrane: Elastomeric, two-component, liquid, cold fluid-applied, trowel grade or low viscosity as recommended by waterproofing manufacturer for application.
- E. Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- F. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
- G. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side; type formulated for temperature at time of application.
1. Selected Product: Provide "Preprufe Tape" as manufactured by W. R. Grace & Co.

- H. Penetration Seal: Self-adhering reinforced membrane, 2-1/2 inches wide, with a tack-free protective adhesive coating on 1 side and a release film on self-adhering side.
- I. Substrate for HDPE Vertical Waterproofing: Provide HDPE waterproofing manufacturer's recommended three-dimensional drainage composite "Hydroduct 660 Drainage Composite" as manufactured by W.R. Grace & Company.
- J. Primers/Conditioners: Provide the manufacturers standard latex-based surface primer/conditioner for concrete substrates.
1. Selected Product: Provide "Bituthene 400 Surface Conditioner" as manufactured by W.R. Grace & Co.
- K. Protection Board: Provide the manufacturer's standard premolded, semi-rigid, 1/4 inch thick, asphalt impregnated protection board.
1. Include manufacturer's recommended adhesive for attachment of the specified protection boards.
  2. Selected Product: Provide "Bituthene Asphaltic Hardboard" as manufactured by W. R. Grace & Co.
- L. Plywood: Provide plywood panels that will provide continuous, true, and smooth substrate suitable for the installation/application of the waterproofing. Furnish in largest practicable sizes to minimize number of joints.
1. Exterior-grade plywood panels, suitable for concrete and waterproofing work complying with DOC PS 1. Provide one of the following:
    - a. High-density overlay, Class 1 or better.
    - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    - c. Structural 1, B-B or better; mill oiled and edge sealed.
    - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- M. Shotcrete: Refer to Division 3 Concrete for materials and requirements of the cast-in-place concrete and shotcrete work.
- N. Insulation: Provide extruded polystyrene board insulation complying with ASTM C578, Type V (3.0 lb/cu. ft), with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively.

### **PART 3 - EXECUTION**

#### **3.01 INSPECTION OF SUBSTRATES**

- A. Examine substrates, adjoining construction and conditions under which the Work is to be installed. Prepare and submit written report to the Contractor describing conditions

which would adversely affect systems. Do not proceed with the Work until unsatisfactory conditions have been corrected.

1. Notify Engineer in writing of anticipated problems using waterproofing over substrate.
- B. Pre-Installation Meeting: Prior to installation of HDPE waterproofing, but following submittal and acceptance of required submittal, meet at the Project site to review the material selections, installation procedures and coordination of the Work with other trades.
- C. The manufacturer of the HDPE waterproofing and the applicator shall inspect the substrates to review their acceptability for the application of the waterproofing systems specified.
- D. Final Inspection: After all HDPE waterproofing work is completed, an inspection shall be made by the membrane manufacturer's representative. He shall certify that the waterproofing has been installed according to the specifications and manufacturer's requirements.

### 3.02 PREPARATION

- A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free and dry substrate for waterproofing application.
1. Remove grease, oil, form release agents, paints and other penetrating contaminants from concrete.
  2. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes and other voids.
  3. Prepare, fill, prime, and treat joints and cracks in substrate. Remove dust and dirt from joints and cracks according to ASTM D4258.
- B. Do not proceed with installation until drains, and other projections through the wall have been installed. Holes, honeycombs and cavities shall be pointed or filled and finished flush in accordance with manufacturer's directions utilizing materials recommended by the manufacturer of the sheet waterproofing. Fill gaps or voids greater than 0.5 in. Remove standing water prior to membrane applications.
- C. Install drainage composite tightly against substrates in strict compliance with installation instructions in manufacturer's published literature.
- D. Install cant strips, flashing, and accessory items as shown, and as recommended by the manufacturer even though not shown. Install membrane strip and center over construction and control joints and cracks exceeding a width of 1/16 inch.
1. Inside Corners: Prepare, prime, and treat inside corners according to HDPE waterproofing manufacturer's written instructions.

2. Install membrane strip centered over vertical inside corners. Install 3/4 inch fillets of liquid membrane on horizontal inside corners and as follows
    - a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
    - b. At deck-to-wall intersections, extend liquid membrane or sheet membrane flashing onto deck waterproofing and to finished height of sheet flashing.
  3. Outside Corners: Prepare and treat outside corners according to waterproofing manufacturer's written instructions.
    - a. Install strip of membrane 12 inches wide, centered over corner.
  4. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to waterproofing manufacturer's written instructions.
    - a. Treat expansion joints and discontinuous deck-to-wall or deck-to-deck joints, per the manufacturer's recommendations.
- E. Prevent compounds from entering drains and conductors, and from spilling or migrating onto surfaces of other work.

### 3.03 INSTALLATION, GENERAL

- A. At the start of the installation and periodically as work progresses, employ the services of the manufacturer's technical representative at the job site as often as deemed necessary by the manufacturer to advise on and supervise all phases of this Work.
- B. Install the sheet waterproofing in accordance with manufacturer's written instructions, except where more stringent requirements are shown or specified to provide a sheet waterproofing system which does not permit water penetration into the structure.
  1. Treat all horizontal and vertical seams between side laps, end laps and other such terminations and transitions utilizing a continuous/uninterrupted application of the manufacturer's pressure sensitive double-sided detailing tape with removable release film designed to permanently bond multiple sheets of the HDPE membrane together.
- C. Provide flashing materials at cracks and penetrations and with such materials and designs as recommended by the manufacturer of the sheet waterproofing.
- D. Fill non-moving cracks and joints with sealant or other compounds as recommended by the sheet waterproofing materials manufacturer for compatibility.
- E. Prime/condition concrete per the manufacturer's instructions. Use specified products, and comply with methods recommended by the sheet waterproofing materials manufacturer.
- F. Flashing:

1. Install elastomeric flashing using products and systems specified in the sheet waterproofing materials manufacturer's requirements.
  2. Install stainless steel sheet metal flashing where shown on the Contract Drawings. Refer to Section 04220.
- G. Pipe Seals: Furnish and install pipe seal assemblies and covers in compliance with manufacturer's instructions.

### 3.04 ADHESIVE-COATED HDPE SHEET WATERPROOFING APPLICATION

- A. Install adhesive-coated HDPE sheets according to manufacturer's written instructions.
- B. Place and secure molded-sheet drainage panels over substrate. Lap edges and ends of geotextile to maintain continuity.
- C. Blind-Side Applications: Install adhesive-coated HDPE sheet with HDPE face against substrate. Accurately align sheets and maintain uniform 3-inch-minimum lap widths and end laps. Overlap and seal all seams; stagger seams to the greatest extent possible; treat all seams, laps, and terminations with manufacturer's double-faced detail tape to ensure a watertight installation. Mechanically fasten to substrate.
1. Securely fasten/secure the top of each membrane application with continuous application of the specified detailing tape; refer to the approved Shop Drawings for details.
- D. Horizontal Applications: Install adhesive-coated HDPE sheet with HDPE face against substrate. Accurately align sheets and maintain uniform 3-inch-minimum lap widths and end laps. Overlap and seal all seams; stagger seams to the greatest extent possible; treat all seams, laps, and terminations with manufacturer's double-faced detail tape to ensure a watertight installation. Mechanically fasten to substrate.
- E. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.
- F. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.
- G. Install sheet waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.
- H. Repair tears, punctures, voids, lapped seams and other such breeches in the waterproof membrane, and any other such conditions not complying with requirements in strict accordance with the manufacturer's instructions and recommendations. Install and otherwise execute such remedial repair work utilizing the manufacturer's double-sided pressure sensitive detail tape and additional HDPE membrane "patches/scabs" required to ensure a waterproof installation; Extend repair membranes over the entire perimeter of

damaged or nonconforming areas; extending membranes no less than 6 inches beyond damage/defects/non-conforming installations in all directions.

1. Apply "scabs/patches" of identical sheet waterproofing and firmly secure with a continuous application of the detail tape.
- I. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing and repair sheet flashings and terminations.

### 3.05 PROTECTION COURSE INSTALLATION

- A. General: Install protection course over waterproofing membrane using recommended adhesive according to manufacturer's written instructions and before commencing subsequent construction operations. Minimize exposure of membrane.

### 3.06 FIELD QUALITY CONTROL

- A. The Contractor shall engage a full-time site representative qualified by waterproofing systems manufacturer to inspect substrate conditions; surface preparation; membrane application, flashings, protection and drainage components and to furnish daily reports to Engineer.

### 3.07 CLEANING

- A. Protect completed waterproofing systems from damage and wear during application and remainder of construction period, according to manufacturer's written instructions. Inspect waterproofing systems for damage just prior to backfilling or placement of concrete and make repairs in accordance with manufacturer's recommendations.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
- C. Clean up and legally dispose of all debris resulting from the waterproofing installation. Remove waterproofing equipment and similar appurtenance from the project site.

### 3.08 PROTECTION

- A. Provide for protection of completed waterproofing installation during the installation of other materials on or about the waterproof sheet membrane system; and throughout the remainder of construction period.

**END OF SECTION**

**SECTION 07190**  
**VAPOR BARRIER**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. This Section specifies requirements for under-slab type vapor barriers.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. General: Vapor barrier shall be capable of performing as a continuous vapor-retarding barrier. Vapor barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and vapor leakage exceeding specified limits.

1.03 RELATED SECTIONS

- A. Section 01352 - Sustainable Design Requirements.
- B. Section 03303 - Placement of Portland Cement Concrete

1.04 REFERENCES

- A. ASTM International (ASTM)
1. D1709 - Standard Test Method for Impact Resistance of Plastic Film by the Free-Falling Dart Method
  2. E96 - Standard Test Method for Water Vapor Transmission of Materials
  3. E154 - Standard Test Method for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
  4. E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
  5. E1745 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
- B. American Concrete Institute (ACI)
1. 302.1R -- Guide for Concrete Floor and Slab Construction.

## 1.05 SUSTAINABLE DESIGN REQUIREMENTS

- A. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section 01352 and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the Work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.
- B. SUSTAINABLE DESIGN PERFORMANCE CRITERIA
1. The post-industrial and/or post-consumer recycled content (by weight) of the Vapor barrier shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
  2. The manufacturing location (final assembly) of the Vapor Barrier shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
  3. All field-applied adhesives, sealants, paints and coatings relating to interior Work of this Section shall meet the requirements of Section 01352.

## 1.06 QUALITY ASSURANCE

- A. **Installer Qualifications:** A firm experienced in applying vapor barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. **Source Limitations:** Obtain vapor barrier materials from single source from single manufacturer.
- C. **Preinstallation Conference:** Conduct conference at Project site. Include installers of other construction connecting to vapor barriers.
1. Review vapor barrier requirements including substrate preparation and conditions, forecasted weather conditions, special details and flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

## 1.07 SUBMITTALS

- A. **General:** Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS.
- B. **Product Data:** For each type of product indicated. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

- C. Shop Drawings: Show locations and extent of vapor barriers. Include details for substrate joints and cracks, flashings, penetrations, inside and outside corners, tie-ins with adjacent materials and construction.
- D. Include layout drawings showing sheet membrane layout, sizes, seam locations, laps, penetrations and other typical and atypical vapor barrier
- E. Samples: For the following products:
1. Vapor barrier sheet, 24 by 18 inches
  2. Sealing, lapping and detailing tape, 4 by 4 inches.
  3. Penetration boots, one full size of each different type.
  4. Bituthene liquid membrane or mastic
- F. Qualification Data: For Installer.
- G. Product Test Reports: For vapor barrier based on evaluation of comprehensive tests performed by a qualified independent testing agency.
- H. Field quality-control reports by a qualified independent testing agency.
- I. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.
    - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
      - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
      - 2) The manufacturing location of the supplied product(s).
      - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
      - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
      - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
  2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  3. Product cut sheets for materials that meet the SDMCF.

4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
  1. Grace Construction Products.
  2. W.R. Meadows Inc.
  3. Raven Industries
  4. Stego Industries Inc.
- B. Basis of Design: Provide high performance polyolefin sheet membrane type vapor barrier "Florprufe 120 Vapor Barrier" as manufactured by Grace Construction Products, or equivalent acceptable to the Engineer.

### **2.02 MATERIALS**

- A. Polyolefin Vapor Barrier: Minimum 0.015- inches (15 mil) and shall conform to ASTM E1745, Class A.
  1. Water Vapor Permeance: 0.03 perms when tested in accordance with ASTM E96.
  2. Tensile Strength: 65 lbs/in in accordance with ASTM E154.
  3. Puncture Resistance: 3300 gms in accordance with ASTM D1709.
- B. Vapor Barrier Tape: Pressure sensitive tape of type as recommended by the vapor barrier manufacturer, for sealing of seams, penetrations and joints in polyolefin vapor barriers.
- C. Liquid Membrane: Provide the manufacturer's recommended liquid membrane designed specifically for sealing penetrations and seal vapor barriers to dissimilar construction.

## 2.03 INSTALLATION ACCESSORIES

- A. Provide installation accessories indicated; if not indicated as recommended by the system manufacturer. Accessories shall include, but not be limited to, fasteners, adhesives, tapes and sealants.
- B. Prefabricated Pipe Boot: Provide manufacturer's prefabricated pipe boot and clamp for installation at penetrations through slab.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. General: Extend vapor barrier to extremities of areas to be protected from vapor transmission. Secure in place with anchorage system as recommended by the manufacturer.
- B. Prepare substrate for under slab vapor barrier installation in accordance with ACI 302.1R section 4.1.

### 3.02 UNDER SLAB VAPOR BARRIER INSTALLATION

- A. General: Extend vapor barrier to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as recommended by the manufacturer. Extend vapor barrier to cover miscellaneous voids in insulated substrates.
  - 1. Installation shall be in accordance with manufacturer's instructions and ASTM E1643.
  - 2. Coordinate the installation of the vapor barrier with the work of Section 03303.
- B. Seal vertical and horizontal joints in vapor barriers as per manufacturer's recommendation. Seal all laps, ends, edges, penetrations and other conditions to result in an uninterrupted sheet free of gaps, voids and other breaches.
  - 1. Where indicated, seal overlapping joints in vapor barriers with adhesives or vapor-barrier tape according to vapor-barrier manufacturer's instructions.
  - 2. Firmly attach vapor barriers to substrates with mechanical fasteners or adhesives as recommended by vapor-barrier manufacturer.
  - 3. Only utility penetration of the vapor barrier will be acceptable; utility penetrations shall be properly sealed with prefabricated boots and liquid detailing membrane in accordance with the manufacturer's instructions.
  - 4. Repair any tears or punctures in vapor barriers immediately before concealment by other work. Cover with vapor-barrier tape or another layer of vapor barrier.

3.03 PROTECTION

- A. General: Protect installed vapor barrier from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where vapor barrier is subject to exposure, and until such time of concrete placement.
1. Legally dispose of all protective film and other debris resulting from vapor barrier installation.
  2. Protect vapor barrier from damage during installation of reinforcing steel and during placement of concrete slab.
  3. Immediately repair damage vapor barrier in accordance with manufacturer's instructions.

**END OF SECTION**

**SECTION 07207**  
**EXTRUDED FOAM INSULATION**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section specifies requirements for extruded foam insulation.

**1.02 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. Physical properties and dimensions of cellular polystyrene boards made by extrusion of expandable polystyrene shall be in accordance with ASTM C578.

**1.03 RELATED SECTIONS**

- A. Section 01352 – Sustainable Design Requirements

**1.04 REFERENCES**

- A. ASTM International (ASTM)
1. C578 - Specification for Rigid, Cellular Polystyrene Thermal Insulation
  2. E84 – Testing Method for Surface Burning Characteristics of Building Materials.

**1.05 SUSTAINABLE DESIGN REQUIREMENTS**

- A. Sustainable Design General Requirements
1. The Authority requires the Contractor to implement practices and procedures to meet the Contract's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Section 01352 and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the Work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.
- B. Sustainable Design Performance Criteria
1. Extruded Foam insulation shall contain a minimum of 5 percent (by weight) recycled content, calculated by adding the post-consumer recycled content percentage to one-half of the post-industrial recycled content percentage. Certify the recycled content in accordance with the Sustainable Design Submittal Requirements of this section.

2. The manufacturing location (final assembly) of the foam-plastic insulation shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
3. Insulation products that must be expanded or extruded (e.g. expanded polystyrene (EPS), polyisocyanurate board, and sprayed polyurethane, etc), shall avoid blowing agents containing chlorine-based gas used for manufacture or installation.
4. All field-applied interior adhesives, sealants, paints and coatings relating to Work of this Section shall meet the requirements of Section 01352.

#### 1.06 QUALITY ASSURANCE

- A. **Source Limitations:** Obtain insulation through one source from a single manufacturer.

#### 1.07 SUBMITTALS

- A. **General:** Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS.
- B. **Product Data:** For each type of product indicated.
- C. **Product Test Reports:** Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.
- D. **Research/Evaluation Reports:** For foam-plastic insulation.
- E. **Samples for Verification:** Full-size units for each type of exposed insulation indicated.
- F. **Sustainable Design Submittal Requirements:** The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
  1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.
    - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
      - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
      - 2) The manufacturing location of the supplied product(s).
      - 3) The location (source) of the raw materials used to manufacture the supplied product(s).

- 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
  - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  3. Product cut sheets for materials that meet the SDMCF.
  4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
  5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

#### 1.08 DELIVERY, STORAGE AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing and protecting during installation.
- B. Protect foam-plastic insulation as follows:
  1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
  2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
  3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.02 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C578, of type, min. compressive resistance and min. density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, tested in accordance with ASTM E 84.
1. Manufacturers
    - a. Dow Chemical Company.
    - b. Owens Corning.
  2. Type V, 3.00 lb/cubic feet; 100 lb/in<sup>2</sup>.
  3. Type IV, 1.55 lb/cubic feet; 25 lb/in<sup>2</sup>.

## 2.03 AUXILIARY INSULATING MATERIALS

- A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

## 2.04 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
1. Products:
    - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
    - b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
    - c. Gemco; Spindle Type.
  2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
1. Products:
    - a. AGM Industries, Inc.; TACTOO Adhesive.
    - b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
    - c. Gemco; Tuff Bond Hanger Adhesive.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

### 3.03 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.
- E. Coordinate placement of high density insulation with sleeves, block-outs, and other embedded items to prevent prolonged exposure of the membrane materials.

### 3.04 INSTALLATION OF INSULATION

- A. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
- B. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.
- C. Install board insulation on vertical concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness and application indicated.
2. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness. Stagger vertical board joints, with the exception of ends and expansion joints.

### 3.05 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

**END OF SECTION**

**SECTION 07250**  
**SPRAY-APPLIED FIRE-RESISTIVE MATERIALS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section specifies requirements for spray-applied fire-resistive materials (SFRM) of structural steel substrates.
- B. Refer to Section 09910 for prime painting of structural steel prior to applying spray-applied fire-resistive materials, where required.

**1.02 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. General: It is the intent of this Section to provide a complete spray-applied fire-resistive material system that is primarily field applied. It is understood that the majority of this Work will be conveyed via commercial spray equipment designed specifically for this purpose, and certain areas will be applied manually (trowel) as a result of patching, repair and inaccessibility/constructability.
- B. Fire Performance Characteristics: Provide materials and construction which are identical to those tested for the following fire performance characteristics, according to test method indicated, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction. The Contractor shall be responsible for Fire Performance Testing.
  - 1. Fire Resistance Ratings: As indicated by reference to design designation in UL "Fire Resistance Directory" for fire-rated assemblies in which spray-applied fire-resistive material serves as direct-applied protection, tested per ASTM E119.
  - 2. Surface Burning Characteristics: As indicated for each spray-applied fire-resistive material required, tested per ASTM E84 and listed in UL "Building Materials Directory."
  - 3. Ratings: As per the Building Code of the City of New York, for building classification and construction group; refer to the Contract Drawings for additional requirements.
- C. Material must have B.S.A. or M.E.A. approval for use in New York City.
- D. Materials must contain low VOC's per New York City Code.
- E. United States Environmental Protection Agency (USEPA).

## 1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements
- B. Section 09910 - Painting

## 1.04 REFERENCES

- A. ASTM International (ASTM)
  - 1. E84 - Test Method for Surface Burning Characteristics of Building Materials
  - 2. E119 - Method for Fire Tests of Building Construction and Materials.
  - 3. E605 - Test Methods for Thickness and Density of Sprayed Fire Resistive Material Applied to Structural Members
  - 4. E699 - Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
  - 5. E736 - Test Method for Cohesion/Adhesion of Sprayed Fire Resistive Materials Applied to Structural Members
  - 6. E759 - Test Method for Effect of Deflection of Sprayed Fire Resistive Material Applied to Structural Members
  - 7. E760 - Test Method for Effect of Impact on Bonding of Sprayed Fire Resistive Material Applied to Structural Members
  - 8. E761 - Test Method for Compressive Strength of Sprayed Fire Resistive Material Applied to Structural Members
  - 9. E859 - Test Method for Air Erosion of Sprayed Fire Resistive Materials Applied to Structural Members
  - 10. E937 - Test Method for Corrosion of Steel by Sprayed Fire Resistive Material Applied to Structural Members
- B. Association of Wall and Ceiling Industries, International (AWCI)
  - 1. Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials Guide; An Annotated Technical Manual 12-A
- C. Underwriters Laboratories, Inc. (UL)
  - 1. Fire Resistance Directory
  - 2. ANSI/UL 263 Fire Tests of Building Construction and Materials.
- D. United States Environmental Protection Agency (USEPA)
  - 1. 40 CFR Part 763

## 1.05 SUSTAINABLE DESIGN REQUIREMENTS

### A. Sustainable Design General Requirements

1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Section 01352 and the articles below, are implemented to the fullest extent. Substitutions or other changes to the Work proposed by the Contractor shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.

### B. Sustainable Design Performance Criteria

1. The post-industrial and/or post-consumer recycled content (by weight) of spray-applied fire-resistive material shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
2. All field-applied adhesives, sealants, paints and coatings relating to work of this section shall meet the requirements of Section 01352.
3. The manufacturing location (final assembly) of the spray-applied fire-resistive material shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
4. The origin of the raw materials from which the spray-applied fire-resistive materials were manufactured shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.

## 1.06 QUALITY ASSURANCE

### A. Fire-Test-Response Characteristics

1. Provide spray-applied fire-resistive materials identical to those used in assemblies tested for the following fire-test-response characteristics, per test method indicated below, by UL or another testing and inspecting agency meeting the Testing Agency Qualifications specified in this Section. Identify packages (bags) containing spray-applied fire-resistive material with appropriate classification markings of applicable testing and inspecting agency.
2. Fire-Resistance Ratings
  - a. As indicated by reference to fire-resistive designs listed in UL "Fire Resistance Directory," or in the comparable publication of another testing and inspecting agency meeting the Testing Agency Qualifications specified in this Section, for fire-resistive assemblies where spray-applied fire-resistive material serves as direct-applied protection, tested per ASTM E119 (ANSI/UL 263).
  - b. Surface-Burning Characteristics: As indicated for each spray-applied fire-resistive material required, for densities shown on the Contract Drawings tested per ASTM E84.

### B. Installer Qualifications

1. The entity performing Work of this Section shall be an experienced installer certified, licensed, and qualified by the spray-applied fire-resistive material manufacturer as having the necessary experience, staff and training to install manufacturer's products per specified requirements.

C. Single Source Responsibility

1. Provide spray-applied fire-resistive materials from a single manufacturer for each product required.

D. Testing Agency Qualifications

1. To qualify for acceptance, an independent testing agency hired by the Contractor or manufacturer to test spray-applied fire-resistive materials must demonstrate to the Engineer, based on evaluation of testing agency-submitted criteria conforming to ASTM E699, that it has the capability to conduct the testing indicated herein.

- E. Provide spray-applied fire-resistive materials containing no asbestos as determined according to the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, Polarized Light Microscopy.

- F. The Contractor shall sequence and coordinate application of spray-applied fire-resistive materials with other related Work specified in other Sections of these Specifications to comply with the following requirements:

1. Provide temporary enclosures to prevent deterioration of spray-applied fire-resistive materials for interior applications due to exposure to unfavorable environmental conditions.
2. Avoid unnecessary exposure of spray-applied fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
3. Do not apply spray-applied fire-resistive material to metal roof decking substrates until roofing has been completed; prohibit roof traffic during application and drying of spray-applied fire-resistive materials.
4. Do not begin applying spray-applied fire-resistive material until clips, hangers, supports, sleeves and other items penetrating spray-applied fire-resistive material are in place.
5. Defer installing ducts, piping and other items, or remove all existing construction that would interfere with application of spray-applied fire-resistive material, until the spray-applied fire-resistive material specified herein has been installed.
6. Do not install enclosing or concealing construction or re-install removed construction, until after spray-applied fire-resistive material has been applied, inspected, tested, approved by the Engineer, and corrections have been made to all defective spray-applied fire-resistive material.

## 1.07 SUBMITTALS

- A. General: Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of Division 1 GENERAL PROVISIONS.
- B. List certified by manufacturer, for approval, showing minimum thickness of spray-applied fire-resistive material required to satisfy hourly ratings shown on the Contract Drawings for all members and areas to be coated including the applicable design numbers from the Underwriters Laboratories, "Fire Resistance Directory" or other listing directory of another testing and inspecting agency acceptable to the Engineer for each use.
- C. Product certificates from spray-applied fire-resistive material manufacturers that each spray-applied fire-resistive material complies with specified requirements including those for firetest-response characteristics and compatibility with adhesives, primers, and other surface coatings on substrates as shown on the Contract Drawings to receive spray-applied fire-resistive material.
- D. Results from tests and inspections performed by independent testing agency shall be reported promptly to the Engineer.
- E. Test Reports: Submit the following for the spray-applied fire-resistive material that will actually be installed under this Contract:
  - 1. Certified test reports from an approved independent testing laboratory verifying that spray-applied fire-resistive material meets the requirements of the ASTM and Federal Specifications cited in this Section and as required by this Section.
  - 2. Evidence that spray-applied fire-resistive material meets the requirements for Fire Hazards Classification of the Underwriters Laboratories or similar requirements of a testing agency acceptable to the Engineer.
  - 3. New tests and reports will be required at any time when, in the sole opinion of the Engineer, there is any evidence that the material on which the tests are run is not representative of the material being furnished.
- F. Submit copies of New York City MEA or BSA approvals for proposed spray-applied fire-resistive material assemblies.
- G. Submit the following to the Engineer:
  - 1. The manufacturer's notification of approval of the entity performing the application Work of this Section as stipulated herein.
  - 2. The testing agency qualifications as stipulated herein.
  - 3. The manufacturer's 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 spray-applied fire-resistive materials.
  - 4. Executed warranty as stipulated herein.

5. The site report as required herein.
- H. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.
    - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
      - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
      - 2) The manufacturing location of the supplied product(s).
      - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
      - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
      - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
  2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  3. Product cut sheets for materials that meet the SDMCF.
  4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
  5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

#### 1.08 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply spray-applied fire-resistive materials when the ambient temperature and/or the temperature of the substrate is below 40 degrees F or below the temperature recommended in the manufacturer's printed instructions, whichever is higher. Maintain such minimum ambient temperature for a minimum of 24 hours before and 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 adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of spray-applied fire-resistive materials.
  3. Clean up and remove fallout 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 the handling and use of fuel for heaters.

#### 1.09 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 spray-applied fire-resistive materials 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.

#### 1.10 WARRANTY

- A. Warranty
1. Submit a written warranty, executed by the 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:
    - a. Cracking, flaking, eroding in excess of specified requirements, peeling, and delaminating of spray-applied fire-resistive materials from substrates due to defective materials and workmanship within the specified warranty period.
    - b. 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
1. Four years from the date of the issuance of the Certificate of Final Completion.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Available Products: Products that may be incorporated in the Work include, but are not limited to, the following:
1. Cementitious spray-applied fire-resistive material, Medium and High Densities (Type 1)
    - a. Pyrocrete 239, Carboline Company; St. Louis, MO.
    - b. Pyrocrete 240, Carboline Company; St. Louis, MO.
    - c. Monokote Type Z106, Construction Products Div., W.R. Grace & Co.; Cambridge, MA.
    - d. Monokote Type Z146, Construction Products Div., W.R. Grace & Co.; Cambridge, MA.
    - e. Cafco 400, Isolatak International Corp; Stanhope, NJ
    - f. Fendolite M II, Isolatak International Corp; Stanhope, NJ

### 2.02 MATERIALS

- A. Material Composition of Spray-applied Fire-resistive Materials
1. Spray-applied fire-resistive material consisting of factory-mixed, dry formulation of portland cement binders and lightweight mineral or synthetic aggregates mixed with 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. For use on each different substrate and with each different spray-applied fire-resistive material, provide primer or encapsulant that complies with one or more of the following requirements:
    - b. Bond strength complies with requirements specified in UL "Fire Resistance Directory" for coating materials based on a series of bond tests per ASTM E736. Determination of the compatibility of paint or primer with the spray-applied fire-resistive material shall be the responsibility of the spray-applied fire-resistive material manufacturer.
    - c. Primer or encapsulant is identical to those used in assemblies tested for the firetest-response characteristics of spray-applied fire-resistive material, per ASTM E119, by UL or another testing and inspecting agency meeting the Testing Agency Qualifications specified in this Section.
  2. Auxiliary Bonding Materials
    - a. Bonding Agent: Product shall be identical to those used in assemblies tested for the fire-test response characteristics spray-applied fire-resistive material, per ASTM E119, by UL or another testing and inspecting agency meeting the Testing Agency Qualifications specified in this Section.

- b. Metal Lath: Expanded metal lath fabricated from material of weight, configuration and finish to comply with fire-resistance ratings shown on the Contract Drawings and spray-applied fire-resistive material manufacturer's recommendations. Include clips and other anchorage devices required to attach lath.
  - c. Metal studs or other similar approved devices.
3. Topcoats: Type as recommended by the approved manufacturer of spray-applied fire-resistive material required for application shown on the Contract Drawings.

## 2.03 CONSTRUCTION FEATURES

### A. Medium and High Densities (Type 1)

- 1. Flame spread shall be 5 or less, as determined in accordance with ASTM E84.
- 2. Smoke developed shall be 0, as determined in accordance with ASTM E84.
- 3. Bond Strength 434 lbf per sq. ft. for medium density and 1000 lbf per sq. ft. for high density as determined in accordance with ASTM E736.
- 4. Compressive Strength 52 lbf per sq. inch for medium density and 300 lbf per sq. inch for high density as determined per ASTM E761.
- 5. Corrosion Resistance no evidence of corrosion as determined per ASTM E937.
- 6. Deflection no cracking, spalling, delamination or the like, as determined per ASTM E759.
- 7. Effect of Impact on Bonding no cracking, spalling, delamination or the like as determined in accordance with ASTM E760.
- 8. Dry Density values of average and individual densities as required for fire-resistance ratings indicated on the Contract Drawings, as determined per ASTM E605 or Appendix A "Alternate Method for Density Determination" of AWCI Technical Manual 12-A, but with an average density of not less than 22 pcf for medium density and not less than 40 pcf high density.
- 9. Air Erosion maximum weight loss of 0.000 gram per sq. ft. as determined per ASTM E859.
- 10. For exterior spray-applied fire-resistive material applications, provide manufacturer's formulation approved for exterior surfaces.

## 2.04 MIXES

- A. Provide materials to produce the hourly spray-applied fire-resistive material rating(s) for the building construction classification shown on the Contract Drawings.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. After review and approval of all required submittals, the Engineer will hold a meeting at the construction site, with representatives of the Contractor, the manufacturer of the spray-applied fire-resistive material and the entity performing the application Work for this Section. The Contractor shall prepare a report of determinations made at the meeting and submit a copy to the Engineer for his approval.
1. The Contractor shall determine, record, and implement the methods and techniques of application including masking and protection of adjacent surfaces, heating requirements, and cleanup.
  2. *The group shall inspect the substrate and the Contractor shall determine what surface preparations have to be made such as scraping loose defective paint and loose rust, removal of grease, oil, dirt and other foreign materials and measures to be employed to ensure an adequate bond. If surfaces are primed, see paragraph 2.02.B.1.*
- B. Sequence and coordinate application of spray-applied fire-resistive material with other related Work specified in other Sections of these Specifications and as specified in this Section.
- C. Substrate Preparation
1. In the event that, in the opinion of the Engineer, the suitability of a particular substrate could not be determined at said meeting, apply full depth spray-applied fire-resistive material to a small section and after it has completely dried and cured, test it for adhesion per ASTM E736. Submit test results to the Engineer.
- D. Trial Beams and Substrate
1. For each type of sprayed spray-applied fire-resistive material to be used, prepare at the construction site a trial beam and/or 25 square foot substrate section, as applicable. Do not proceed with the application of spray-applied fire-resistive material until the trial beam and/or substrate has been approved by the Engineer.
  2. All spray-applied fire-resistive material application shall match the appropriate approved trial beam or substrate section.

### 3.02 APPLICATION

- A. Coordinate spray-applied fire-resistive material application with steel erector to ensure that steel sections and conditions scheduled to receive spray-applied fire-resistive material, are accessible after erection. In the event that such conditions are unavoidable, apply spray-applied fire-resistive materials prior to erection, unless otherwise acceptable to the Engineer.

- B. Mixing and application of materials shall comply with the manufacturer's printed instructions.
- C. Apply by sprayed-on method with thickness and density no less than that required to achieve required fire resistance ratings.
- D. To ensure minimal overspray and to provide increased resistance to vibration, apply with a maximum nozzle length of 5 feet.
- E. All finished surfaces shall be free of cracks, holes and pits.
- F. Apply spray-applied fire-resistive material that is identical to materials approved by the Engineer with respect to rate of application, use of sealers, topcoats, tamping troweling, water overspray or other materials and procedures affecting tests results.
- G. Secure metal lath or other similar devices, if required by UL or other agency meeting The Testing Agency qualifications specified in this Section, to substrate in position required for support and reinforcement of spray-applied fire-resistive material. Use anchorage devices of type recommended by spray-applied fire-resistive material manufacturer.
- H. Masking and Filling of Voids
  - 1. Beams and girders under steel decking or concrete slabs, that will be exposed in the finished construction, shall be fireproofed so as to provide a minimum of two inches 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 fireproofing material or other approved method of providing the required hourly protection of the upper flanges of beams and girders.
- I. Where shown on the Contract Drawings, apply topcoat to spray-applied fire-resistive material.

### 3.03 FIELD TESTS

- A. The Engineer will perform a minimum of one of each of the following tests for each 10,000 sq. ft. of floor area and inspect as follows:
  - 1. Applied thickness and dry density of samples in accordance with ASTM E605 removed from actual installation at random locations.
  - 2. Bond strength of samples adjacent to samples meeting the specification requirements for thickness and dry density, in accordance with ASTM E736. Perform all required bond tests in the field.

- B. 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.
- C. Repair or replace spray-applied fire-resistive material at all test areas, and within area(s) where test results indicate spray-applied fire-resistive material does not comply with requirements, at no additional cost to the Authority. Repair or replace to match existing.

3.04 CLEANING, REPAIR AND PROTECTION

- A. Cleaning: Immediately after completing spraying operations in each containable area of Work, remove material over-spray and fall-out from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Cure exposed spray-applied fire-resistive material materials according to spray-applied fire-resistive material manufacturer's recommendations to prevent premature drying.
- C. Protect fireproofed construction at all times so that spray-applied fire-resistive material will be without damage or deterioration at the time of issuance of the Certificate of Final Completion.
- D. Coordinate installation of spray-applied fire-resistive material with other construction to minimize the need to cut or remove spray-applied fire-resistive material. As installation of other construction proceeds, inspect spray-applied fire-resistive material and patch all areas where spray-applied fire-resistive material was removed or damaged.
- E. Repair or replace Work that has not been successfully protected, at no additional cost to the Authority.

**END OF SECTION**

**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 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 E84.
- 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 E814 (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.

### 1.03 RELATED SECTIONS

- A. Section 01352 – Sustainable Design Requirements
- B. Section 03301 – Cast-in-Place Concrete
- C. Section 04220 – Concrete Masonry Units.
- D. Section 09250 – Gypsum Drywall.
- E. Section 09270 – Gypsum Shaft Systems.
- F. Division 15 – Mechanical Work.
- G. Division 16 – Electrical Work.

### 1.04 REFERENCES

- A. ASTM International (ASTM)
  1. E84 - Test Method for Surface Burning Characteristics of Building Materials
  2. E119 - Test Methods for Fire Tests of Building Construction and Materials
  3. E136 - Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
  4. E814 - Test Method for Fire Tests of Through-Penetration Fire Stops
- B. Underwriters Laboratories (UL)
  1. Fire Resistance Directory

## 1.05 SUSTAINABLE DESIGN REQUIREMENTS

### A. Sustainable Design General Requirements

1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Specification Section 01352 and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria

### B. Sustainable Design Performance Criteria

1. The post-industrial and/or post-consumer recycled content (by weight) of Mineral Fiber Insulations shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
2. The manufacturing location (final assembly) of the Mineral fiber insulation and other firestopping products(s) shall be documented in accordance with the Sustainable Design Submittal Requirements of this Section.
3. All field-applied adhesives, sealants, paints and coatings relating to work of this section shall meet the requirements of Section 01352.
4. Mineral-fiber firestopping materials that are exposed to supply or return air plenums, or that are located above suspended ceilings, must be encapsulated or fully sealed to prevent direct exposure of the mineral fibers to the plenum. Where sealants are used to encapsulate the mineral fiber materials (e.g. smoke sealants used at perimeter firestopping joints), the sealants shall meet the requirements of Section 01352.

## 1.06 QUALITY ASSURANCE

### A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "Design and Performance Requirements" article:

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.
2. Through-penetration firestop systems are identical to those tested per ASTM E814 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 E119 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.
  - 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's inspection agency 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's inspection agency and authorities having jurisdiction, if required, have examined each installation.

#### 1.07 SUBMITTALS

- A. General: Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS.
- B. Product data for each type of product specified.
- 1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.
- C. 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.
- D. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop configuration for construction and penetrating items.

- E. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration approved by firestopping manufacturer's fire protection engineer with modifications marked.
- F. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.
- G. 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.
- H. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Engineers and Owners, and other information specified.
- I. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's work. Cost breakdowns shall include total cost plus itemized material costs.
    - b. \*The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
    - c. \*The manufacturing location of the supplied product(s).
    - d. \*The location (source) of the raw materials used to manufacture the supplied product(s).
    - e. \*The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this work.
    - f. \*Include total cost for all wood products and itemized costs for all FSC-certified wood products.

\* If applicable- requirements are defined per the SUSTAINABLE DESIGN Performance Criteria, this section.
  2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  3. Product cut sheets for materials that meet the SDMCF.
  4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).

5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer of review.

#### 1.08 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.

#### 1.09 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 multi component materials.
- B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
1. Endothermic, Latex Sealant:
    - a. LC-150 Firestop Sealant; Specified Technologies, Inc.; Somerville, NJ;
    - b. 3M Fire Dam 150; 3M Company, Construction Markets Division; St. Paul, MN;
    - c. Tremstop Acrylic Latex; Tremco, Inc.; Cleveland, OH.
  2. Endothermic, Latex Compounds:
    - a. LC-150 Firestop Compound; Specified Technologies, Inc.;
    - b. 3M Fire Dam 150; 3M Company, Construction Markets Division.
  3. Firestop Sleeve:
    - a. Biostop Pipe Collars; Bio Fireshield, Inc.;
    - b. Metacaulk Universal Collar 880; The RectorSeal Corporation;
    - c. 3M Plastic Pipe Devices; 3M Company, Construction Markets Division;
    - d. Fyre Can; Tremco, Inc.; Cleveland, OH.
  4. Intumescent Latex Sealant:

- a. Biostop 700 Spray Applied Mastic, Bio Fireshield, Inc.;
  - b. LBC Latex Based Caulk; Nelson Firestop Products; Tulsa, OK;
  - c. Metacaulk 950; The RectorSeal Corporation;
  - d. Metacaulk 1000 Spray Applied Mastic; The RectorSeal Corporation;
  - e. SSS-100 Firestop Sealant; Specified Technologies, Inc.;
  - f. 3M CP 25 WB+; 3M Company, Construction Markets Division;
  - g. Tremstop WBM G; Tremco, Inc.; Cleveland, OH.
5. Intumescent Putty:
- a. Biostop Fire Rated Putty Stix/Pads; Bio Fireshield, Inc.;
  - b. FSP Firestop Putty; Nelson Firestop Products;
  - c. Metacaulk Fire-Rated Putty Sticks/Pads; The RectorSeal Corporation;
  - d. SSP-100 Firestop Putty; Specified Technologies, Inc.;
  - e. 3M Moldable Putty+ (Stix/Pads); 3M Company, Construction Markets Division;
  - f. Tremco Flowable Putty; Tremco, Inc.; Cleveland, OH.
6. Intumescent Wrap Strips:
- a. Biostop Pipe Collars; Bio Fireshield, Inc.;
  - b. WRS Wrap Strip; Nelson Firestop Products;
  - c. Metacaulk Wrap Strip; The RectorSeal Corporation;
  - d. SSW-12 Wrap Strips; Specified Technologies, Inc.;
  - e. 3M FS 195+ Wrap Strips; 3M Company, Construction Markets Division;
  - f. Tremco Wrap Strips; Tremco, Inc.; Cleveland, OH.
7. Job-Mixed Vinyl Compound:
- a. USG Firecode Compound, United States Gypsum Co.; Chicago, IL.
8. Mortar:
- a. K-2 Firestop Mortar, Bio Fireshield, Inc.;
  - b. Novasit K-10 Firestop Mortar, Bio Fireshield, Inc.;
  - c. CMP Firestop Compound; Nelson Firestop Products;
  - d. SSM-228 Firestop Mortar; Specified Technologies, Inc.;
  - e. 3M Fire Barrier Mortar; 3M Company, Construction Markets Division;
  - f. Tremstop Mortar System; Tremco, Inc.; Cleveland, OH.
9. Pillows/Bags:
- a. Firestop Pillows, Bio Fireshield, Inc.;
  - b. PLW Firestop Pillows; Nelson Firestop Products;
  - c. SSB Series Firestop Pillows; Specified Technologies, Inc.;
  - d. Tremstop Pillow System; Tremco, Inc.; Cleveland, OH.
10. Silicone Sealants:
- a. BioTherm 100/200; Bio Fireshield, Inc.;
  - b. CLK Firestop Caulk; Nelson Firestop Products;
  - c. SSB Series Firestop Pillows; Specified Technologies, Inc.;
  - d. Pensil 300 Firestop Sealant, GE Silicones; Waterford, NY;
  - e. Metacaulk 835, The RectorSeal Corporation;
  - f. Metacaulk 880, The RectorSeal Corporation;
  - g. 3M Fire Barrier 2000, 2000+ and 2003; 3M Company, Construction Markets Division;
  - h. 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 E136, with flame-spread and smoke-developed ratings of zero per ASTM E84.*
  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.
  - 1. Provide metal cover plates over exposed assemblies where applicable to contain installed material.
- 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 Substantial 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 07921**  
**INTERIOR SEALANTS – NON-MOVING JOINTS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This Section specifies requirements for interior joint sealant assemblies.

**1.02 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. Elastomeric joint sealants shall establish and maintain watertight continuous seals without causing staining or deterioration of joint substrates when installed.
- B. Non elastomeric joint sealants that have been produced and installed to establish and maintain continuous air-tight 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 seven 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.

**1.03 RELATED SECTIONS**

- A. Section 01352 – Sustainable Design Requirements

**1.04 REFERENCES**

- A. American Architectural Manufacturers Association (AAMA)
1. CW-13 - Curtain Wall Manual #13 - Structural Sealant Glazing Systems
- B. ASTM International (ASTM)
1. C834 - Standard Specification for Latex Sealants
  2. C920 – Standard Specification for Elastomeric Joint Sealants
  3. C1021 - Practice for Laboratories Engaged in Testing of Building Sealants

4. C1193 - Standard Guide for Use of Joint Sealants
5. C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants
6. D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber

#### 1.05 SUSTAINABLE DESIGN REQUIREMENTS

##### A. Sustainable Design General Requirements

1. The Authority requires the Contractor to implement practices and procedures to meet the Project's sustainable design requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Section 01352 and the articles below, are implemented to the fullest extent. Substitutions, or other changes to the Work proposed by the Contractor, shall not be allowed if such changes compromise the stated Sustainable Design Performance Criteria.
2. All field-applied adhesives, sealants, paints and coatings relating to Work of this Section shall meet the requirements of Section 01352.

#### 1.06 QUALITY ASSURANCE

- A. **Installer Qualifications:** The entity performing installation Work of this Section shall have successfully completed at least three joint sealant installations within the last three years, involving quantities and complexities at least equal to those required for the Work of this Section.
- B. **Single Source Responsibility:** Obtain joint sealant and primer materials from a single manufacturer for each different product required.
- C. **Testing Laboratory Qualifications:** To qualify for acceptance, an independent testing laboratory must demonstrate to Engineer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM C1021 that it has the experience and capability to conduct satisfactorily the testing indicated without delaying progress of the Work.

#### 1.07 SUBMITTALS

- A. **General:** Submittals listed in this article shall be in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS.
- B. **Product Data:** 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 sealant application.
- C. **Certifications:** 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.

- D. Samples: When color sealant is required, submit two separate bead sample strips of manufacturer's standard colors showing full range of colors available, for each product exposed to view.
- E. Test Reports
1. Preconstruction field adhesion test report results are directed by the Engineer.
  2. Compatibility and adhesion test reports from sealant manufacturer indicating that materials forming joint substrates and 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 sealant manufacturer's recommendations for primers and substrate preparation needed to obtain adhesion.
- F. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. *Cost breakdowns shall include total cost plus itemized material costs.*
    - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
      - 1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
      - 2) The manufacturing location of the supplied product(s).
      - 3) The location (source) of the raw materials used to manufacture the supplied product(s).
      - 4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
      - 5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
  2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  3. Product cut sheets for materials that meet the SDMCF.
  4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
  5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

## 1.08 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(s).
  2. When joint substrates are wet due to rain, frost, condensation, or other causes.
  3. Where joint widths are less than or greater than that allowed by sealant manufacturer(s) for application(s) shown on the Contract Drawings.
  4. When contaminants capable of interfering with sealant adhesion are present on joint substrates(s).

## 1.09 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 multi-component materials.
- B. Store and handle materials to prevent deterioration or damage due to moisture, temperature changes, contaminants or other causes.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Subject to compliance with the requirements of this Section, provide products of the following manufacturers, or approved equal:
1. One-Part Mildew-Resistant Silicone (Interior Wet Areas)
    - a. "Dow Corning 786," Dow Corning Corp., Midland, MI
    - b. "Sanitary 1700," GE Sealants & Adhesives, Waterford, NY
    - c. Bondaflex Sil 100 WF; May National Associates, Inc., Clifton, NJ
    - d. "Proglaze," Tremco Inc., Beechwood, OH
  2. One-Part Latex Sealant (Interior Painted locations)
    - a. AC-20 FTR Acoustical and Insulation Sealant, Pecora Corp.; Harleysville, PA
    - b. SHEETROCK Acoustical Sealant, United States Gypsum Co.; Chicago, IL
    - c. Tremflex 834; Tremco, Inc.; Beachwood, OH
  3. One-Part Non-Acid Curing Silicone (Interior Non-Wet, Non-Painted Locations)
    - a. Dow Corning 795; Dow Corning Corp., Midland, MI
    - b. SilPruf NB SCS9000; GE Sealants & Adhesives, Waterford, NY
    - c. Bondaflex 295; May National Associates, Inc., Clifton, NJ
    - d. Spectrem 2; Tremco Inc., Beechwood, OH

4. One-Part or Two-Part Non-Sag Polyurethane
  - a. Dynatrol I-XL or II; Pecora Corp., Harleysville, PA
  - b. Sikaflex 15LM or Sikaflex 2c NS; Sika Corp., Lyndhurst, NJ
  - c. Vulkem 921 or Dymeric 240; Tremco Inc. , Beechwood, OH
5. One-Part or Two-Part Pourable Polyurethane: (Horizontal Floor Joints)
  - a. Sonolastic SL 1 or SL 2; Degussa Building Systems, Shakopee, MN
  - b. Urexpam NR-201 or NR-200; Pecora Corp., Harleysville, PA
  - c. Vulkem 45 or 245; Tremco Inc., Beechwood, OH

## 2.02 MATERIALS

- A. Sealants shall conform to the following requirements of ASTM C920 and ASTM C834 (latex-based sealants):
  1. Type: S, except type S or M (for polyurethane)
  2. Grade: NS or P (for pourable polyurethane)
  3. Use: T, NT, M, G, A or O as applicable to joint substrate shown on the Contract Drawings.
  4. Color: Select sealant colors, in accordance with the following, at exposed locations only.
    - a. As shown on the Contract Drawings, or if not shown, as selected by the Engineer from manufacturer's standard colors.
- B. Joint Sealant Backing: Provide sealant backings of material and type which are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved by sealant manufacturer for application(s) shown on the Contract Drawings, based on field experience and laboratory testing.
  1. Plastic foam joint fillers, where shown on the Contract Drawings, shall be preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam of material depth and otherwise contribute to producing optimum sealant performance and complying with ASTM C1330.
    - 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 joint-fillers, where shown on the Contract Drawings shall be neoprene, butyl or EPDM tubing complying with ASTM D1056, non-absorbent to water and gas, capable of remaining resilient at temperatures down to minus 26 degrees F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth and otherwise contribute to optimum sealant performance.

## 2.03 ACCESSORIES

- A. 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. Provide self-adhesive tape where applicable. Duct tape is not acceptable.

- B. Primer: Provide type 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. The maximum allowable VOC content for field-applied sealant primers is 250 grams/liter (non-porous), and 775 grams/liter (porous).
- C. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials that are not harmful to substrates and adjacent nonporous materials.
- D. Masking Tape: Provide non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Ensure that the entity performing sealant installation inspects 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 unless 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(s) 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 repellants; 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, acid washing or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
  3. Remove laitance and form release agents from concrete.
  4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile and other non-porous surfaces by chemical cleaners or other means which are not harmful

to substrates or leave residues 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 manufacturers' printed installation instructions and recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions shown on the Contract Drawings.
- B. **Sealant Backings:** Install to comply with the following requirements:
  - 1. Install joint-fillers of type shown on the Contract Drawings, or if not shown, in accordance with this Section, 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 to allow optimum sealant movement capability.
    - a. Do not leave gaps between ends of joint fillers.
    - b. Do not stretch, twist, puncture or tear joint-fillers.
    - c. Remove absorbent joint-fillers that have become wet prior to sealant application and replace with dry material.
  - 2. Install bond breaker tape between sealants and 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 this Section for joint fillers.
- C. **Sealants:** Install 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 widths which allow optimum sealant movement capability.
- D. **Tooling:** Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration as shown on the Contract Drawings, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Concave joint configuration per Figure 8A in ASTM C1193, unless otherwise shown on the Contract Drawings.
  2. Flush joint configuration per Figure 8B in ASTM C1193, where shown on the Contract Drawings.
  3. Recessed joint configuration per Figure 8C in ASTM C1193, of recess depth and at locations shown on the Contract Drawings.
    - a. Use masking tape to protect adjacent surfaces of recessed, tooled joints.
- E. Clean off excess sealants or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occurred.

### 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, cut out and remove damaged or deteriorated joint sealants 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**

**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 D 521	Standard Methods for Chemical Analysis of Zinc Dust
ASTM D 523	Test Method for Specular Gloss
ASTM D 562	Standard Test Method for Consistency of Paints Using the Stormer Viscometer
ASTM D 1475	Standard Test Method for Density of Paint, Varnish, Lacquer, 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 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 Test Method for Measurement of Wet Film Thickness by Notch Gages
ASTM D 4417	Standard Test Method 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 Sub-Floor using Anhydrous Calcium Chloride

### 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 structural 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 1.03A.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

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.

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.

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

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

1. Product Data

Manufacturer's technical data sheets including the following information for each coating:

- Volume Solids
- VOC
- DFT range
- DFT maximum
- Zinc content (zinc primers only)
- Slip coefficient (zinc primers only)
- Substrates
- Surface preparation
- Profile
- Storage temperature
- Primers
- Topcoats
- Application equipment, including touchup
- Mixing
- Thinners
- Thinning maximum
- 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

2. Samples

- a. 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.
- b. On a 12 inch by 12 inch hardboard or metal panels, two samples of each paint and coating material, if required 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.
- Identify each sample as to manufacturer, color name and number, location and application.
- c. On actual wood surfaces, two 4 inch by 8 inch samples of each natural and stained wood material. Identify each sample as to manufacturer and location application.

- B. Submit to the Engineer one copy of U.S. Department of Labor, Material Safety Data Sheets (MSDS) for hazardous chemicals utilized during the Work of this Section.

- C. Submit the paint applicator's qualifications and/or experience.
- D. Submit a copy of the quality control program, as required by 1.04 C.2, if requested by the Engineer.
- E. Submit instructor qualifications and training records for blasters and painters as required by 1.04 C.1.b, if requested by the Engineer.
- F. Submit copy of daily inspection reports if requested by the Engineer.
- G. Sustainable Design Submittal Requirements: The Contractor shall submit the Sustainable Design certification items listed herein. Sustainable Design submittals shall include the following:
  - 1. A completed Sustainable Design Materials Certification Form (SDMCF), appended to Section 01352. Information to be supplied for this form shall include:
    - a. Cost breakdowns for the materials included in the Contractor's Work. Cost breakdowns shall include total cost plus itemized material costs.
    - b. Where required by the Sustainable Design Performance Criteria of this Section, the following information shall also be supplied:
      - (1) The amount of post-consumer and/or post-industrial recycled content in the supplied product(s).
      - (2) The manufacturing location of the supplied product(s).
      - (3) The location (source) of the raw materials used to manufacture the supplied product(s).
      - (4) The VOC content of all adhesives, sealants, paints, and coatings applied on site as part of this Work.
      - (5) Include total cost for all wood products and itemized costs for all FSC-certified wood products.
  - 2. Published product literature or letters of Certification, provided from the product manufacturer on the manufacturer's letterhead, to verify the product information supplied for the SDMCF.
  - 3. Product cut sheets for materials that meet the SDMCF.
  - 4. Material Safety Data Sheets (MSDS), for applicable products. Applicable products include, but are not limited to field-applied adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
  - 5. The Sustainable Design submittal information shall be assembled into one (1) package per Section or trade, and sent to the Engineer.

**END OF APPENDIX "A"**

**SECTION 09910**

**PAINTING**

**APPENDIX "B"**

**PAINT SCHEDULE**

**A. Exterior**

<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 Gloss	S-1G	Organic Zinc Rich	Carboline Carbozinc 859 (Shop Applied)	Epoxy	Not Applicable	Aliphatic Polyurethane Gloss	Not Applicable
			PPG / Ameron Amercoat 68 HS (Shop Applied)		Not Applicable		Not Applicable
			Carboline Carbozinc 859 VOC (Applied on Site)		Not Applicable		Not Applicable
			PPG / Ameron Amercoat 68 HS VOC (Applied on Site)		Not Applicable		Not Applicable

**B. Interior (Not Used)**

**C. Overcoat Systems (Not Used)**

**D. Interior - Sustainable Design (Not Used)**

**END OF APPENDIX "B"**

**APPENDIX 1**

**PERMIT**

June 14, 2006

The Port Authority of NY & NJ  
Environmental Engineering Unit  
2 Gateway Center, 14<sup>th</sup> Floor SW  
Newark, NJ 07102

Attn: Matt Masters,  
Supervisor, Permits &  
Governmental Approvals

Re: PATH Tunnel E & World Trade  
Center Discharge  
File Case # C-3192

Dear Ms. Masters:

This is in response to your June 5<sup>th</sup> and June 14, 2006 submissions, requesting for an extension and an amendment to the Letter of Approval for the above case to discharge up to 500,000 gallons per day (mgd) of wastewater for a period of one-year, to the manhole leading to the combined sewer on the East side of West Street between Liberty and Vesey Streets in Manhattan. However, all other conditions remain unchanged. This Letter of Approval will be expired at midnight on June 13, 2007.

Based upon the information and analytical data submitted, you are hereby conditionally authorized to discharge 500,000 gallons per day of wastewater for a period of one year, to the manhole leading to the combined sewer on the East side of West Street between Liberty and Vesey Streets in Manhattan.

You must submit to this office analysis for pH on a weekly basis and MTBE on a quarterly basis. All analytical results must be delivered on the quarterly basis. If any of parameters exceeds limitations of the Sewer Use Regulations, this office must be notified immediately. In addition, you must submit analytical result for asbestos to this office within thirty days from the date of the permit renewal.

You are required to hold the wastewater to the maximum extent practicable during heavy wet weather events. Refer to the File Case C-3192 in any correspondence to this office.

Payment shall be made to the Bureau of Customer Service for groundwater discharge into the New York City Wastewater System in accordance with the Water and Wastewater Rate Schedule established by the New York City Water Board.

If you have any questions concerning this matter, please telephone Mr. Saied Islam, Assistant Mechanical Engineer, at (718) 595-4707.

Sincerely,

*Frances Leung*  
Frances Leung, P.E., Chief,  
IPP Inspection & Permit Section

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DEPARTMENT OF  
ENVIRONMENTAL  
PROTECTION

59-17 Jackson Boulevard  
Flushing, New York, 11375

Emily Doyd  
Commissioner

Douglas S. Greeley, P.E.  
Deputy Commissioner

Bureau of Wastewater  
Treatment

Tel: (718) 595-5330  
Fax: (718) 595-8950  
DGreeley@dep.nyc.gov



GENERAL DECISION: NY20080003 01/02/2009 NY3

Date: January 2, 2009

General Decision Number: NY20080003 01/02/2009

Superseded General Decision Number: NY20070003

State: New York

Construction Types: Building, Heavy, Highway and Residential

Counties: Bronx, Kings, New York, Queens and Richmond  
Counties in New York.

BUILDING & RESIDENTIAL CONSTRUCTION PROJECTS (includes single  
family homes and apartments up to and including 4 stories),  
HEAVY AND HIGHWAY CONSTRUCTION PROJECTS

Modification Number	Publication Date
0	02/08/2008
1	02/15/2008
2	02/22/2008
3	02/29/2008
4	03/14/2008
5	03/21/2008
6	07/04/2008
7	07/18/2008
8	07/25/2008
9	08/08/2008
10	08/22/2008
11	08/29/2008
12	09/19/2008
13	10/03/2008
14	10/24/2008
15	11/28/2008
16	01/02/2009

ASBE0012-001 12/31/2007

	Rates	Fringes
Asbestos Workers/Insulator includes application of all insulating materials, protective coverings, coatings and finishing to all types of mechanical systems.....	\$ 46.86	26.97
HAZARDOUS MATERIAL HANDLER.....	\$ 24.45	8.50

BOIL0005-001 01/01/2007

	Rates	Fringes
BOILERMAKER.....	\$ 44.98	28.95+a

FOOTNOTE:

a. PAID HOLIDAYS: New Year's Day, Thanksgiving Day, Memorial

Day, Independence Day, Labor Day and Good Friday, Friday  
after Thanksgiving, Christmas Eve Day and New Year's Eve

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BRNY0001-001 07/01/2008

	Rates	Fringes
BRICKLAYER.....	\$ 46.68	20.21
MASON - STONE.....	\$ 55.34	22.13

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BRNY0001-002 07/01/2008

	Rates	Fringes
Pointer, cleaner and caulker.....	\$ 39.34	19.79

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BRNY0003-001 07/01/2006

	Rates	Fringes
TERRAZZO FINISHER.....	\$ 38.75	21.75
TERRAZZO WORKER/SETTER.....	\$ 40.09	21.75

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BRNY0004-001 07/01/2007

	Rates	Fringes
MARBLE SETTER.....	\$ 47.83	22.20

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BRNY0020-001 07/01/2007

	Rates	Fringes
MARBLE FINISHER.....	\$ 39.65	22.03

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BRNY0024-001 01/01/2007

	Rates	Fringes
BRICKLAYER MARBLE POLISHERS.....	\$ 35.66	17.40

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BRNY0052-001 06/01/2007

	Rates	Fringes
Tile Layer.....	\$ 42.94	22.33

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BRNY0088-001 06/01/2007

	Rates	Fringes
TILE FINISHER.....	\$ 34.95	18.90

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CARP0001-009 07/01/2008

	Rates	Fringes
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Carpenters:  
Carpenters & Soft floor

layers.....	\$ 43.02	35.96
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CARP0740-001 07/01/2005		
	Rates	Fringes
MILLWRIGHT.....	\$ 38.13	35.40
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CARP1456-004 07/01/2008		
	Rates	Fringes
Dock Builder & Piledrivermen		
DOCKBUILDERS.....	\$ 43.61	38.06
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CARP1456-005 07/01/2008		
	Rates	Fringes
Diver Tender.....	\$ 39.18	38.06
Diver.....	\$ 54.63	38.06
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CARP1536-001 07/01/2003		
	Rates	Fringes
Carpenters:		
TIMBERMEN.....	\$ 34.47	26.05
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ELEC0003-001 05/10/2007		
	Rates	Fringes
ELECTRICIAN		
Electricians.....	\$ 46.00	34.81
Jobbing, and maintenance		
and repair work.....	\$ 25.30	12.87+a
-----		
PAID HOLIDAYS:		
a. New Years Day, Martin Luther King, Jr.'s Birthday,		
Washington's Birthday, Memorial Day, Independence Day,		
Labor Day, Columbus Day, Election Day, Thanksgiving Day,		
the day after Thanksgiving Day, and Christmas Day		
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ELEC1049-001 04/06/2008		
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QUEENS COUNTY		
	Rates	Fringes
Line Construction (Substation		
and Switching structures pipe		
type cable installation and		
maintenance jobs or projects;		
Railroad electrical		
distribution/transmission		
systems maintenance (when		
work is not performed by		
railroad employees) Overhead		

and Underground  
 transmission/distribution  
 line work. Fiber optic,  
 telephone cable and equipment)

Groundman.....	\$ 24.83	17.91
Heavy Equipment Operator....	\$ 33.10	17.91
Lineman and Cable Splicer...	\$ 41.38	17.91
Tree Trimmer.....	\$ 23.06	9.84

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 ELEV0001-002 03/17/2008

	Rates	Fringes
ELEVATOR MECHANIC		
Elevator Constructor.....	\$ 48.19	21.085+a+b
Modernization and Repair....	\$ 38.46	20.935+a+b

FOOTNOTE:

a. PAID HOLIDAYS: New Year's Day, Good Friday, President's Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving Day, Friday after Thanksgiving, and Christmas Day.

b. PAID VACATION: An employee who has worked less than 5 years shall receive vacation pay credit on the basis of 4% of his hourly rate for all hours worked; an employee who has worked 5 to 15 years shall receive vacation pay credit on the basis of 6% of his hourly rate for all hours worked; an employee who has worked 15 or more years shall receive vacation pay credit on the basis of 8% of his hourly rate for all hours worked.

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 ENGI0014-001 07/01/2008

	Rates	Fringes
Pavement equipment operator		
Asphalt Plants.....	\$ 42.39	25.90+a
Asphalt roller.....	\$ 50.53	25.90
Asphalt spreader.....	\$ 51.95	25.90+a
Power Equipment Operator (HEAVY & HIGHWAY)		
GROUP 1.....	\$ 67.83	25.90+a
GROUP 2.....	\$ 55.53	25.90+a
GROUP 3.....	\$ 57.36	25.90+a
GROUP 4.....	\$ 55.96	25.90+a
GROUP 5.....	\$ 54.81	25.90+a
GROUP 6.....	\$ 52.53	25.90+a
GROUP 7.....	\$ 53.54	25.90+a
GROUP 8.....	\$ 51.95	25.90+a
GROUP 9.....	\$ 50.78	25.90+a
GROUP10.....	\$ 48.48	25.90+a
GROUP11.....	\$ 45.12	25.90+a
GROUP12.....	\$ 46.15	25.90+a
GROUP13.....	\$ 46.56	25.90+a
GROUP14.....	\$ 34.53	25.90+a
GROUP15.....	\$ 31.90	25.90+a
Steel erector Compressors, Welding		

Machines.....	\$ 35.90	25.90+a
Cranes, Hydraulic Cranes, 2 drum derricks, Forklifts, Boom Trucks.....	\$ 58.59	25.90+a
Three drum derricks.....	\$ 61.38	25.90+a
Utility Laborer		
Horizontal boring rig.....	\$ 49.28	25.90+a
Off shift compressors.....	\$ 40.56	25.90+a
Utility Compressors.....	\$ 31.69	25.90

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Tower crane

GROUP 2: Backhoes, power shovel, Hydraulic clam shells, moles and machines of a similar type

GROUP 3: Mine hoists and crane, etc. used as mine hoists

GROUP 4: Gradalls, keystones, cranes (with digging buckets), bridge cranes, trenching machines, vermeer cutter and machines of a similar nature

GROUP 5: Piledrivers, derrick boats, tunnel shovels

GROUP 6: All drills, and machines of a similar nature

GROUP 7: Back filling machines, cranes, mucking machines, dual drum pavers

GROUP 8: Mixers (concrete w/loading attachments), concrete pavers, cableways, land derricks, power house (low pressure units), concrete pumps

GROUP 9: Concrete plants, well drilling machines, stone crushers double drum hoist, power house (other than above)

GROUP 10: Concrete mixers

GROUP 11: Elevators

GROUP 12: Concrete breaking machine, Hoists (single drum), load masters, locomotive and dinkies over 10 tons

GROUP 13: Vibratory console

GROUP 14: Compressors (portable 3 or more in battery), tugger machine (caissons), well point pumps, chum drill

GROUP 15: Boilers, (high pressure, compressors (portable, single, or 2 in battery, not over 100' apart), pumps (river cofferdam and welding machines (except where arc is operated by members of local 15) push button machines, all engines irrespective of power (power pac) used to drive auxilliary equipment, air, hydraulic etc.

PREMIUMS ON CRANES (Crawler or Truck):

- 100' to 149' boom - add .50
- 150' to 249' boom - add .75
- 250' to 349' boom - add 1.00

350' to 450' boom - add 1.50

Premiums for Cranes on Steel Erection:

100' to 149' boom - add 1.75  
150' to 249' boom - add 2.00  
250' to 349' boom - add 2.25  
350' to 450' boom - add 2.75  
Tower crane - add 2.00

FOOTNOTE:

a. Paid Holidays: New Year's Day; Lincoln's Birthday; Washington's Birthday; Memorial Day; Independence Day; Labor Day; Veterans Day; Columbus Day; Election Day; Thanksgiving Day; and Christmas Day; provided the employee works one day the payroll week in which the holiday occurs.

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ENGI0014-002 07/01/2008

	Rates	Fringes
Power Equipment Operator		
BUILDING & RESIDENTIAL		
GROUP 1.....	\$ 55.25	25.90+a
GROUP 2.....	\$ 58.59	25.90+a
GROUP 3.....	\$ 53.32	25.90+a
GROUP 4.....	\$ 48.38	25.90+a
GROUP 5.....	\$ 35.90	25.90+a

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Double drum

GROUP 2: Stone derrick, cranes, hydraulic cranes, boom trucks

GROUP 3: 4 pole Hoist, Single Drum Hoists

GROUP 4: Fork lift, house cars, plaster (platform machine), plaster bucket, concrete pump and all other equipment used for hoisting material

GROUP 5: Compressors, welding machines (cutting concrete work), paint spraying, sand blasting, pumps (with the exclusion of concrete pumps), house car (settlement basis only), all engines irrespective of power (power pac) used to drive auxiliary equipment, air, hydraulic, etc., boilers

Premiums for Cranes:

100'-149' boom - add 1.75  
150'-249' boom - add 2.00  
250'-349' boom - add 2.25  
350'-450' boom - add 2.75  
Tower cranes add 2.00

FOOTNOTE:

a. PAID HOLIDAYS: New Year's Day, Lincoln's Birthday, Memorial Day, Independence Day, Labor Day, Veteran's Day, Columbus Day, Election Day, Thanksgiving Day, and Christmas Day, provided the employee works one day in the payroll week in which the holiday occurs

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IRON0040-002 07/01/2008

BRONX, NEW YORK, RICHMOND

	Rates	Fringes
IRONWORKER, STRUCTURAL.....	\$ 39.65	49.81

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IRON0046-003 07/01/2007

	Rates	Fringes
IRONWORKER METALLIC LATHERS.....	\$ 43.80	30.37

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\* IRON0197-001 01/01/2009

	Rates	Fringes
IRONWORKER STONE DERRICKMAN.....	\$ 40.50	36.82

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IRON0361-002 07/01/2008

KINGS, QUEENS

	Rates	Fringes
Ironworkers: (STRUCTURAL) .....	\$ 39.65	49.81

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IRON0580-001 07/01/2008

	Rates	Fringes
IRONWORKER, ORNAMENTAL.....	\$ 39.55	38.70

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LABO0006-001 07/01/2003

	Rates	Fringes
Laborers: BUILDING CONSTRUCTION CEMENT AND CONCRETE WORKERS.....	\$ 31.50	15.27

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LABO0029-001 07/01/2001

	Rates	Fringes
Laborers: Heavy Blasters (hydraulic trac drill).....	\$ 32.08	16.70
Blasters.....	\$ 31.53	16.70
Hydraulic Trac Drill.....	\$ 28.38	16.70
Jackhammers, Chippers, Spaders, Concrete Breakers, All Other		

Pneumatic Tools, Walk Behind Self-Propelled Hydraulic Asphalt and Concrete Breaker.....	\$ 27.14	16.70
Powder Carriers.....	\$ 24.50	16.70
Wagon; Airtrac; Quarry Bar Drill Runners.....	\$ 27.83	16.70

LABO0078-001 12/01/2006

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR		
BUILDING CONSTRUCTION ASBESTOS (Removal, Abatement, Encapsulation or Decontamination of asbestos); LEAD; & HAZARDOUS WASTE LABORERS (Hazardous Waste, Hazardous Materials, Biochemical and Mold Remediation, HVAC, Duct Cleaning, Re-spray Fireproofing, etc).....	\$ 27.00	9.81

LABO0079-001 07/01/2007

	Rates	Fringes
Laborers Building Construction Demolition Laborers		
Tier A.....	\$ 30.38	18.91
Tier B.....	\$ 20.74	12.41
Mason Tenders.....	\$ 30.38	18.91

CLASSIFICATIONS

TIER A: Responsible for the removal of all interior petitions and structural petitions that can consist of sheet rock, block or masonry. Also, all structural slab openings for ducts, mechanical, shafts, elevators, slab openings and exterior walls where the building is not being completely demolished.

TIER B: Responsible for shoveling of debris into containers, pushing containers from the inside to the outside of the building.

LABO0147-001 07/01/2003

	Rates	Fringes
Laborers:		
LABORERS.....	\$ 28.86	30.51

FREE AIR TUNNEL WORKERS Tunnel Workers (including Maintenance Men, Inside Muck Lock Tenders, Pump Men, Electricians, Cement Finishers, Caulkers, Hydraulic Men,

Shield Men, Monorail Operators, Motor Men, Conveyor Men,  
 Powder Carriers, Pan Men, Riggers, Chuck Tenders, Track Men  
 Painters, Nippers, Brakemen, Cable Men, Hose Men, Grout  
 Men, Gravel Men, Form Workers, Concrete Workers, Tunnel  
 Laborers, Mole Nipper (one (1) Mole Sipper per Working  
 Shaft per Shift for up to and including Two (2) Moles)

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 LABO0731-001 07/01/2007

	Rates	Fringes
Laborers:		
Building, Heavy and Residential Construction		
UNSKILLED.....	\$ 34.89	22.61
UTILITY LABORER.....	\$ 34.74	22.61
Heavy & Highway Construction		
LABORER/EXCAVATION {Asbestos, Lead, Hazardous Waste Removal (including soil).....	\$ 34.89	22.61

Paid Holidays: Labor Day and Thanksgiving Day

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 LABO1010-001 07/01/2001

	Rates	Fringes
Laborers:		
HIGHWAY CONSTRUCTION		
Fence Installer & Repairer..	\$ 28.84	15.55+a
FORMSETTERS.....	\$ 32.04	15.55+a
LABORERS.....	\$ 28.94	15.55+a
Landscape Planting & Maintenance.....	\$ 28.84	15.55+a
Maintenance Safety Surface..	\$ 28.44	15.55+a
Slurry/Sealcoater/Play Equipment Installer.....	\$ 28.69	15.55+a
Small Equipment Operator (Not Operating Engineer).....	\$ 28.94	15.55+a
Small Power Tools Operator..	\$ 28.44	15.55+a

FOOTNOTES:

a. PAID HOLIDAYS: Memorial Day, Fourth of July, Labor Day,  
 Columbus Day, Election Day and Thanksgiving Day, provided  
 the employee has worked one (1) day in the calendar week in  
 which the said holiday occurs.

-----  
 LABO1018-001 07/01/2001

	Rates	Fringes
Laborers:		
Asphalt Rakers.....	\$ 32.36	15.55+a
Asphalt Tampers.....	\$ 29.92	15.55+a
Landscape Planting & Maintenance Fence		

Installer/Maintenance.....	\$ 29.81	15.55+a
Line Striping Installers....	\$ 29.56	15.55+a
Play Equipment/Safety		
Surface Installer.....	\$ 29.31	15.55+a
Screedman/Micropaver.....	\$ 32.73	15.55+a
Shoveler, General		
Laborers/ All other		
incidental work.....	\$ 29.81	15.55+a
Slurry/Sealcoater.....	\$ 29.31	15.55+a
Small Equipment Operator...	\$ 29.56	15.55+a

FOOTNOTE:

a. Paid Holidays: Memorial Day, Independence Day, Labor Day, Columbus Day, Election Day, Veterans Day, and Thanksgiving Day

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PAIN0009-001 05/01/2008

	Rates	Fringes
GLAZIER.....	\$ 38.00	29.59
Painters:		
Painters, Drywall		
Finishers, Lead Abatement		
Worker.....	\$ 34.50	19.84
Spray, Scaffold and		
Sandblasting.....	\$ 37.50	19.84

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PAIN0806-001 10/01/2008

	Rates	Fringes
Painters:		
Structural Steel and Bridge.	\$ 45.25	27.58

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PAIN1974-001 07/04/2007

	Rates	Fringes
Painters:		
Drywall Tapers/Pointers.....	\$ 38.32	19.39

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PLAS0260-001 07/01/1999

BRONX, NEW YORK AND RICHMOND COUNTIES:

	Rates	Fringes
PLASTERER.....	\$ 27.91	15.55

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PLAS0260-002 07/01/1999

KINGS AND QUEENS COUNTIES

	Rates	Fringes
PLASTERER.....	\$ 27.91	15.16

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PLAS0530-001 08/03/2005

	Rates	Fringes
PLASTERER		
DRYWALL PLASTERERS.....	\$ 37.03	18.30
-----		
PLAS0780-001 07/01/2007		

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 44.40	26.10
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* PLUM0001-001 01/01/2009		

	Rates	Fringes
PLUMBER		
MECHANICAL EQUIPMENT AND SERVICE		
Any repair and/or replacement of the present plumbing system that does not change the existing roughing.....	\$ 31.01	13.77
PLUMBERS:.....	\$ 51.36	30.74
-----		
PLUM0638-001 07/05/2006		

	Rates	Fringes
PLUMBER		
SERVICE FITTERS.....	\$ 26.30	2.55
SPRINKLER FITTERS,		
STEAMFITTERS.....	\$ 43.82	32.72

Service Fitter work shall consist of all repair, service and maintenance work on domestic, commercial and industrial refrigeration, air conditioning and air cooling, stoker and oil burner apparatus and heating apparatus etc., including but not exclusively the charging, evacuation, leak testing and assembling for all machines for domestic, commercial and industrial refrigeration, air conditioning and heating apparatus. Also, work shall include adjusting, including capacity adjustments, checking and repairing or replacement of all controls and start up of all machines and repairing all defects that may develop on any system for domestic, commercial and industrial refrigeration and all air conditioning, air cooling, stoker and oil burner apparatus and heating apparatus regardless of size or type.

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ROOF0008-003 07/01/2008

	Rates	Fringes
ROOFER, Including Built Up, Composition and Single Ply Roofs.....	\$ 36.25	26.34
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SHEE0028-002 01/31/2008

Rates	Fringes
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Sheet metal worker.....\$ 43.69 34.69

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TEAM0282-001 07/01/2008

	Rates	Fringes
Truck drivers:		
TRUCK DRIVERS:		
Asphalt.....	\$ 35.40	29.2025+a+b
Euclids & Turnapulls.....	\$ 35.50	29.2025+a+b
High Rise.....	\$ 41.81	27.1025+a+b

FOOTNOTES:

PAID HOLIDAYS: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Election Day, Veterans' Day (Armistice Day), Thanksgiving Day and Christmas Day. Employees working two (2) days in the calendar week in which a holiday falls are to be paid for such holiday, provided that they shape each remaining workday during such calendar week.

b. VACATION: For each 15 days worked within the contract year an employee will receive one day's vacation with pay with a maximum vacation of 3 weeks per year.

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TEAM0813-001 12/01/1998

	Rates	Fringes
Truck drivers:		
GROUP 1.....	\$ 19.49	3.61+a
GROUP 2.....	\$ 19.76	3.61+a
GROUP 3.....	\$ 19.90	3.61+a
GROUP 4.....	\$ 20.23	3.61+a
GROUP 5.....	\$ 20.40	3.61+a
GROUP 6.....	\$ 21.29	3.61+a
GROUP 7.....	\$ 22.40	3.61+a
GROUP 8.....	\$ 19.90	3.61+a

FOOTNOTE:

a. PAID HOLIDAYS: New Year's Day, Martin Luther King, Jr.'s Birthday, Presidents' Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Thanksgiving Day, Christmas Day, Employee's Birthday, Two (2) Personal Days, and any holiday or day of mourning proclaimed as such by the State or Federal Government.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Closed body trucks with self contained loading unit up to and including 22 yard capacity

GROUP 2: Open trucks, rack body or trucks with no self contained mechanical loading device, up to 22 yard capacity. One-container tractor hoist

GROUP 3: 10 wheel, open trucks, container loaders,

dino-master, over-cab loaders, rack body trucks, or any trucks 22 yards to and including 25 yards capacity

GROUP 4: Rubbish and garbage trucks, 26 yards to and including 31 yards

GROUP 5: Single axle working non-compactor containers up to 15 yards capacity on rubbish and garbage removal

GROUP 6: Roll-off trucks up to and including 42 yard capacity

GROUP 7: Roll-off truck with more than 42 yard capacity or any tractor trailer trucks

GROUP 8: One-container tractor hoist on construction and alteration debris removal

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.  
=====

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

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In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.  
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#### WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

**NOTIFICATION  
OF  
MINORITY BUSINESS ENTERPRISES  
AND  
WOMEN'S BUSINESS ENTERPRISES  
ON-LINE DIRECTORY  
AND  
FORMS**

The Port Authority has a long-standing practice of making its contract available to as many firms as possible and has taken affirmative steps to encourage Minority Business Enterprises (MBEs) and Women's Business Enterprises (WBEs) to seek business opportunities with it. The Port Authority's on-line Directory of Qualified MBE/WBEs lists the firms that are registered to assist Contractors in meeting and exceeding their Good Faith Goals.

The MBE/WBE Directory specifies the firms the Authority has determined to be (1) MBEs/WBEs and (2) experienced in performing work in the trades and contract dollar ranges indicated.

Contractors are provided with an interactive directory and the ability to view and print a current listing of M/WBE contractors. Information may be selected and sorted according to categories, state, dollar range, and type (MBE, WBE, DBE, and SBE).

To view the directory, type in [www.panynj.gov/mwbe](http://www.panynj.gov/mwbe) or go to [www.panynj.gov](http://www.panynj.gov), select Engineering - M/W/S/DBE Information (under Doing Business with the Port Authority), and then select MWBE Qualified Vendor Search. For further information about MWBE Qualified Vendors, contact the Office of Business and Job Opportunity at (212) 435-7802.

**THE PORT AUTHORITY OF NY & NJ**Certification Application for the Minority and Women-owned  
Business Enterprise Program

PLEASE PRINT OR TYPE CLEARLY

**General Instructions:**

- DO NOT LEAVE ANY SPACES BLANK ON THE APPLICATION - if a question is not applicable to your business insert "N/A" in the space provided for your answer
- Whenever the space is insufficient to answer the questions completely, attach additional sheets as necessary. Use the question number to identify any answer continued on an additional sheet
- For questions, call the Certification Helpline at 212-435-7808 or E-mail objocert@panynj.gov.
- Once you have completed the application, please return it and all required documentation to:

**The Port Authority of NY & NJ**  
**Office of Business & Job Opportunity - Certification Unit**  
**233 Park Avenue South, 4<sup>th</sup> floor**  
**New York, NY 10003**

**SECTION I: MAIN COMPANY INFORMATION**

1. Business Name

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*Legal name of company applying to be certified*

2. D.B.A.

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*"Doing Business As"- Complete if company does business under a name which is different from its legal name.*

3. Business Address (must represent a physical location; cannot be a Post Office Box)

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Street Address

Suite / Apt / Room/ Unit

---

City

State

Zip/Zip+4

---

County

4. Business Mailing Address (complete only if different from the address given in Question 3)

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Street Address

Suite / Apt / Room/ Unit

---

City

State

Zip/Zip+4

5. Business Phone

( )

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5a. Business Fax

( )

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6. Business Website

7. Your E-mail Address

7a. Your Cell Phone Number

( )

8. Federal EIN or SSN

9. Name/title of an authorized representative to contact during the application review process:

Mr./Miss/Mrs./Ms.	First Name	:	Last Name
Title	Phone Ext.		E-Mail Address

10. This company is applying for certification as ("X"all that apply)

Minority-owned Business Enterprise (MBE)

Women-owned Business Enterprise (WBE)

Refer to page \_\_\_\_\_ of the Application Guidelines to determine the appropriate designation for your company.

11. Are you currently involved in the bidding process or other contract/purchase order negotiations with the Port Authority or Port Authority tenants?

Yes \_\_\_\_\_ No \_\_\_\_\_

If "Yes", identify the department within the Port Authority and/or name of tenant and contact name

12. Has your company ever applied for certification as an M/W/SBE, or a DBE (whether SBA 8(a), Transportation, or other) with another governmental agency, department, or authority?

Yes \_\_\_\_\_ No \_\_\_\_\_

If "Yes", provide the following details

Name of Governmental Entity	Program (MBE, WBE, SBE, DBE)	Status (Pending, Certified, Decertified, Denied, Rejected, Revoked, On Appeal)	Date (mm/yy)

13. How did you first hear about The Port Authority of NY & NJ's M/W/DBE Certification program(s)? (please choose only one)

Letter/Call/E-mail

Port Authority Web site

Event

Please specify name or sponsor of event and date

Other

Please specify what and when

**SECTION II: COMPANY OWNERSHIP**

14. Business Structure

- Sole Proprietorship  Partnership (including LLP)   
 Limited Liability Company (LLC)  Corporation (including S-Corp.)

15. Date company was established \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

16. Has the business existed under a different type of business structure prior to the Date Established indicated in question? 16

Yes \_\_\_\_\_ No \_\_\_\_\_

If "Yes", please provide copy of original Business Certificate

17. Has your Certificate of Incorporation, Business Certificate, or Certificate of Trade Name been amended?

Yes \_\_\_\_\_ No \_\_\_\_\_

If "Yes", please provide copy of amended Business Certificate

18. Method of Business Origination or Acquisition (check all applicable)

- Started New Business  Secured Franchise   
 Bought Existing Business  Secured Concession   
 Merger or Consolidation  Inherited Business   
 Other  \_\_\_\_\_

19. Date of origination (or acquisition, if later) \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_

For the remaining questions in Section II which ask for ethnic identification of owners, shareholders, officers, board members, and managers, please use the following group codes to identify the ethnicity of each individual where required.

01 Black	02c Spanish	04 Native American
02a Hispanic	03a Asian-Pacific	05 White (Non-Minority)
02b Portuguese	03b Asian-Indian	06 Other

20. Please provide the following information for all person(s) with ownership interest in the company (all proprietors, partners, and members OR, in the case of a corporation, all shareholders).

Name (First and Last)	Position In Company	% Owned	Date Ownership Established (mm/yy)	Gender (M/F)	Ethnicity (see group code table)	US Citizen or Permanent Resident Alien (Y/N)

\*\*\* QUESTIONS 22-24 APPLY ONLY TO CORPORATIONS. \*\*\* \*\*\* IF YOUR COMPANY IS NOT A CORPORATION, SKIP TO QUESTION 25 \*\*\*

21. If the company is a corporation, please provide the following information for all shareholders identified in Question 21

Name (First and Last)	Position In Company	Number of Shares Owned	Unit Share Price Paid When Purchased

22. State the number of company shares in each of the following

Common Authorized \_\_\_\_\_ Common Issued \_\_\_\_\_  
 Preferred Authorized \_\_\_\_\_ Preferred Issued \_\_\_\_\_

23. Name and position of current Officers and/or Board of Directors

Name (First and Last)	Position	Position Effective Date (mm/yy)	Gender (M/F)	Ethnicity (see group code table)

**\*\* ALL APPLICANTS SHOULD RESUME COMPLETING THE APPLICATION HERE \*\***

24. Please identify the capital contributions to the company by each person identified in Question 21, including cash, equipment, property, and expertise

Name (First and Last)	Type of Contribution	Total Dollar Value	Date of Contribution (mm/yy)

25. If your company is owned in whole or in part by another company, please identify the company and the percentage of ownership interest. Include venture capitalists and other similar investors

Company Name	Percentage Owned	Date Ownership Established (mm/yy)

**SECTION III: COMPANY MANAGEMENT**

26. Identify individuals responsible for managerial operations (*state if owner or non-owner*). Refer to group code definitions on prior page.

Name & Title	Gender (M/F)	Group Code	Owner? (Y/N)
a) Financial Decisions			
b) Estimating			
c) Preparing Bids			
d) Negotiating Bonding			
e) Marketing & Sales			
f) Hiring & Firing			
g) Supervising Field Operations			
h) Purchasing Equipment/Supplies			
i) Managing & Signing Payroll			
j) Negotiating Contracts			
k) Signatures for Business Accounts			

27. Do any principals, officers, employees and/or owners of the firm have an affiliation, i.e. business interest or employment with any other firm?

Yes \_\_\_\_\_ No \_\_\_\_\_ (If "Yes", complete the following)

Name (First and Last)	Name and Address of Affiliated Firm	Nature of Business	Nature of Affiliation

28. Number of Employees (if necessary, average over the past year)

<u>Permanent</u>	<u>Temporary</u>	<u>Field</u>
Full-Time _____	Full-Time _____	Full-Time _____
Part-Time _____	Part-Time _____	Part-Time _____

**SECTION IV: COMPANY FINANCES**

29. Does your company have a Line of Credit?

Yes \_\_\_\_\_ No \_\_\_\_\_ If "Yes", please provide details:

Bank	Dollar Limit	Name of Guarantor(s)
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30. Please list all major current lenders to the company

Name of Lender	Amount of Loan	Terms of Repayment

31. Identify bank(s) where company accounts are maintained

Bank Name	Address	Contact Name	Contact Title	Type of Account

32. Please provide gross receipts (sales) for each of the last three fiscal years. (If in business for less than three years, complete as applicable)

Current Year	_____	\$ _____
Last Year	_____	\$ _____
Previous Year	_____	\$ _____

**SECTION V: COMPANY OPERATIONS**

33. Check the industry which best describes your PRIMARY line of business

- Construction-related
- Consultants
- Consumer Service
- Manufacturer/Supplier
- Professional Service
- Purchasing
- Technical Service
- Other \_\_\_\_\_

34. If a license, permit or certification (e.g. Master Electrical License, PE for engineers, CDL for truck drivers, etc.) is required to conduct any part of your company's business, please identify the individual(s) holding the license, permit or certification and provide a copy

Name of the Holder/Registrant	Type of License/ Permit/Certification	Issued by	Issue Date (mm/yy)	Exp. Date (mm/yy)

35. Is your company bonded? Yes \_\_\_\_\_ No \_\_\_\_\_

If "Yes", please provide detail:

Name of Agent/Broker	Surety Co.	Bonding Limit	
		Single \$	Aggregate \$

36. Is your company insured? Yes \_\_\_\_\_ No \_\_\_\_\_ If "Yes", please provide detail:

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Carrier Name \$ Amount of Liability Insurance

37. Please list the company's major equipment or machinery

Type	Depreciated \$ Value	Acquisition Date (mm/yy)	Owned or Leased

38. List rented, leased or owned warehouse, plant and office facilities – Submit copy of lease, deed or mortgage

Facility Type	Owner or Name of Lessor and/or rental agent	Amt of yearly payment

39. Does your company share office space, personnel or equipment with any other company?

Yes \_\_\_\_\_ No \_\_\_\_\_

If "Yes", please provide details.

Company Name	Phone	Personnel (X)	Office Space ("X")	Yard Space (X)	Equipment ("X")	Machinery (X)

### ACKNOWLEDGEMENTS AND VERIFICATION

FIRST, this certification application form, the supporting documents, and any other information provided in support of the application is considered part of the application. Any false statements or misrepresentations in the application may result in the applicant's disqualification from certification as Minority and/or Woman-owned Business Enterprise (M/WBE) by The Port Authority of New York and New Jersey for him/herself and its subsidiaries, which are included in the term "Port Authority".

SECOND, the information contained herein is subject to the Port Authority's Freedom of Information policy as reflected in the resolution adopted by the Committee on Operations of the Port Authority on August 13, 1992.

THIRD, the Port Authority may require further proof of eligibility for certification in addition to the information disclosed in this application and the applicant shall cooperate with the Port Authority in supplying the additional information. By completing this application, the applicant agrees to submit the additional proof required and acknowledges that the Port Authority may decide to deny the application if the additional proof is not submitted within 30 days after it is requested.

FOURTH, by filing this application, the applicant consents to examination of its books and records and interviews of its principals and employees by the Port Authority for the purpose of determining whether the applicant is, or continues to be, an eligible M/WBE. The applicant acknowledges that its certification may be denied if such examinations or interviews are refused or if the Port Authority determines, as a result of the examinations or interviews, that the applicant does not qualify for certification as a M/WBE.

FIFTH, by filing this application, the applicant consents to inquiries being directed by the Port Authority to the applicant's bonding companies, banking institutions, credit agencies, contractors, clients and other certifying agencies for the purpose of ascertaining the applicant's eligibility for certification. If the applicant fails to permit such inquiring to be made, such failure may be grounds for denying or revoking the applicant's certification.

SIXTH, the applicant agrees that it will advise the Port Authority of any change in the ownership or operational and managerial control of applicant's business after the certification application has been filed within 30 days of such change.

SEVENTH, certification is normally granted for a period of five (5) years. However, the Port Authority may require submission of a new application, additional information, examinations of the applicant's principals and employees at any time before the expiration of the five-year certification period. The applicant's failure to submit such material or to consent to such examinations and interviews will be grounds for revocation of certification.

EIGHT, the filing of this application, its acceptance by the Port Authority, and any subsequent certification of the applicant by the Port Authority, is not intended to and does not create any procedural or substantive rights enforceable at law by the applicant against the Port Authority, its Commissioners, officers, agents or employees and any such certification is only intended to facilitate the identification of qualified and bona fide M/WBEs.

NINTH, the Code of Ethics certification attached hereto shall be considered part of this certification application and the applicant is advised to familiarize him/herself with the terms of the certification prior to submitting this application.

TENTH, in submitting this application the applicant and each person signing on behalf of the applicant certifies that, to the best of their knowledge and belief, the following statements are true and correct:

- A) No individual who is current or former employee of the Port Authority or its subsidiaries (i.e., Port Authority Trans-Hudson Corporation (PATH), Newark Legal and Communications Center Urban Renewal Corporation) other than those individuals identified in the space immediately below (1) owns an interest in; or (2) has involvement in a relationship with the applicant firm (a) from or as a result of which the individual has received within the past year, or is entitled to receive in any future year, more than \$1,000 or its equivalent; or (b) which has a market value in excess of \$1,000. \*(List here any such current or former Port Authority Employee (s))

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- B) No individual who is a current or former employee of the Port Authority or its subsidiaries other than those individuals identified in the space immediately below (1) holds a position in the applicant firm such as an officer, director, trustee, partner, employee, or a position of management; or (2) acts as a consultant, agent or representative of the firm in any capacity. \*(List here any current or former Port Authority Employee (s))

\*Included within the scope of this certification are the individuals identified by the applicant in response to questions 4, 4a, 8d, 9, 10, 10a, 17, 18, 19, 24 and 25.

ELEVENTH, the criteria for certification by the Port Authority as a Small Business Enterprise are outlined in the documentation entitled "Small Business Enterprise Program (SBE) Administered by The Port Authority of New York and New Jersey" which accompanies this application. If the applicant believes that he/she is eligible for SBE certification, he/she may request that this application also be treated as an SBE certification application by signing below. If signature is provided, all acknowledgments and provisions of this M/WBE certification shall also apply.

Applicant \_\_\_\_\_

Date \_\_\_\_\_

VERIFICATION

STATE OF \_\_\_\_\_ )

SS:

COUNTY OF \_\_\_\_\_ )

(A) (For Sole Proprietorships, Partnerships, and Limited Liability Partnerships)

\_\_\_\_\_, being duly sworn, states that he or she is the owner of (or a Partner in) the entity making the foregoing application and that the statements and representations made in the application are true to his/her own knowledge.

\_\_\_\_\_  
Signature Date

(B) (For Corporations and Limited Liability Companies)

\_\_\_\_\_, being duly sworn, states that he/she is the  
Name of Corporate Officer

\_\_\_\_\_ of \_\_\_\_\_  
Title of Corporate Officer Name of Corporation

the entity making the foregoing application, that he/she has read the application and knows its contents, that the statements and representations made in the application are true to his/her knowledge, and that the application is made at the direction of the Board of Directors of the Corporation.

Corporate Seal \_\_\_\_\_ Signature Date

Sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_

\_\_\_\_\_  
Notary Public

Mail to: *The Port Authority of New York and New Jersey  
Office of Business & Job Opportunity – Certification Unit  
233 Park Avenue South, 4<sup>th</sup> Floor  
New York, NY 10003*

## CODE OF ETHICS CERTIFICATION

In signing and submitting the annexed Certification Application, each applicant and each person signing on behalf of any applicant certifies that they have not made any offers or agreements or given or agreed to give anything of value or taken any other action with respect to any employee or former employee of The Port Authority of New York and New Jersey or any of its subsidiaries (hereinafter referred to as the "Authority") or any immediate family member of either which would constitute a breach of ethical standards under the Code of Ethics and Financial Disclosure dated as of July 18, 1994 (a copy of which is available upon request to the Office of Regional and Economic Development /Business & Job Opportunity), nor do they have any knowledge of any act on the part of such employee or former employee relating either directly or indirectly to the applicant which constitutes a breach of the ethical standards set forth in said code.

As used herein, "anything of value" shall include but not be limited to any (a) favors, such as meals, entertainment, transportation (other than that contemplated by an Authority contract), etc., which might tend to obligate the Authority employee to the Contractor and (b) gift, gratuity, money, goods, equipment, services, lodging, discounts not available to the general public, offers or promises of employment, loans or the cancellation thereof, preferential treatment or business opportunity. Such term shall not include compensation contemplated by any Authority contract.

The foregoing certification shall be deemed to have been made by the applicant as follows: If the applicant is a corporation, such certification shall be deemed to have been made not only with respect to the application itself, but also with respect to each director and officer, as well as, to the best of the certifier's knowledge and belief, each stockholder with an ownership interest in excess of 10%; if the applicant is a partnership, such certification shall be deemed to have been made not only with respect to the applicant itself, but also with respect to each partner. Moreover, the foregoing certification, if made by a corporate applicant, shall be deemed to have been authorized by the Board of Directors of the applicant, and such authorization shall be deemed to include the signing and submission of the bid and the inclusion therein of such certification as the act and deed of the corporation.

In any case where the applicant cannot make the foregoing certification, the applicant shall so state and shall furnish with the application, a signed statement that sets forth in detail the reasons thereof.

*The foregoing certification or signed statement shall be deemed to have been made by the applicant with full knowledge that it would become part of the records of the Authority and that the Authority will rely on its truth and accuracy in granting certification.*

Applicants are advised that knowingly providing a false certification or statement pursuant hereto may be the basis for prosecution for offering a false instrument for filing (see e.g., New York Penal Law, Section 175.30 et. Seq.). Applicants are also advised that the inability to make such certification will not, in and of itself disqualify an applicant, and that in each instance the Authority will evaluate the reasons therefore provided by the applicant.

## Supporting Documentation Checklist

REQUIRED FOR ALL APPLICANTS Attach copies of the following documents, as applicable. Indicate documents submitted by checking appropriate boxes. PLEASE PROVIDE COPIES OF SUPPORTING DOCUMENTS ONLY - NOT THE ORIGINALS. The minimum documentation required for certification is listed below, but is not limited to this list. A representative may request additional documents during the application review process, if warranted.

- 1 Résumés for all principals, partners, officers and/or key employees of the firm. Provide home address, telephone number, education, training, and employment with dates and specific duties with the company
- 2 Proof of ethnicity for each person with ownership interest (valid passport, ethnic birth certificate)\*
- 3 Proof of U.S. Citizenship (valid U.S. passport, ethnic birth certificate, naturalization certificate)\*
- 4 Proof of permanent resident alien status (valid permanent resident alien "green" card showing expiration date)\*
- 5 Bank signature card, bank resolution or letter from bank identifying persons authorized to conduct transactions on each account
- 6 Lease agreement or proof of ownership (deed/mortgage) for business location(s)
- 7 Proof of any certification (including SBA 8(a)), decertification, or denial from another governmental agency, department, or authority
- 8 Copies of any licenses, permits and/or accreditations required for conducting business
- 9 Proof of sources of capitalization/investments (purchase receipts, any loan agreements)
- 10 Any employment agreements
- 11 All third party agreements including: equipment rental, purchase agreements, management service agreements, etc.
- 12 Vehicle registration(s) for any vehicle used for business purposes
- 13 Current financial statement (statement of cash flows, balance sheet, or profit and loss statement)
- 14 Most recent three years' business Federal, State and City tax returns (all pages, all schedules); Prior two (2) years of personal tax returns (1040's) for each person with ownership interest, including all applicable W-2 forms and schedules if in business less than three years

***\*If you have one document that satisfies the requirements for numbers 2 – 4, submit only one copy.***

**REQUIRED FOR A SOLE PROPRIETORSHIP**

- Copy of Business Trade Name or Certification Trade Name filed with County Clerk  
(If doing business under an assumed name)

**REQUIRED FOR A PARTNERSHIP AND JOINT VENTURE PARTNERSHIP**

Attach copies of the following: (Indicate documents submitted by checking appropriate boxes)

- 1. Business Certificate
- 2. Partnership Agreement

**REQUIRED FOR A LIMITED LIABILITY COMPANY (Check appropriate boxes below)**

- 1. Sole Proprietorship
- 2. Corporation
- 3. Partnership Agreement

*Attach required documents and indicate documents submitted by checking appropriate boxes*

- 1. Certificate of formation and/or organization
- 2. Operating and/or managing agreements
- 3. Franchise and/or third-party agreement

**REQUIRED FOR A CORPORATION**

Attach documents of the following: (Indicate documents submitted by checking appropriate boxes)

- 1. Articles of incorporation, including date approved by State
- 2. Corporation By-Laws
- 3. Minutes of first corporate organizational meeting and amendments
- 4. Copies of all issued stock certificates front and back, as well as next un-issued certificate
- 5. Copy of stock ledger
- 6. If applicable, furnish copies of agreements relating to:
  - a. stock options
  - b. shareholder agreements
  - c. shareholder voting rights
  - d. restriction on the disposal of stock loan agreements
  - e. facts pertaining to the value of shares
  - f. buy-out rights
  - g. restrictions on the control of the corporation

**SMALL BUSINESS ENTERPRISE PROGRAM  
ADMINISTERED BY  
THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY**

The Small Business Enterprise Programs are designed to promote New York and New Jersey businesses and to provide them with the advantage of competing against firms of like size and expertise in a limited competitive environment. In order to be eligible to participate in opportunities set-aside for the programs, the Port Authority must certify a firm as a Small Business Enterprise. To be eligible for certification, firms at a minimum:

- Must have a principal place of business in either New York or New Jersey.
- Must have operated that specific type of business for at least three (3) years.
- Must not exceed the average annualized gross revenue limitations cited below for the last three (3) fiscal years.

**Average Annualized Gross Revenue Limitation and other Port Authority Pre-requisites by Procurement Category.**

❑ **Construction - \$14 million**

The Port Authority's Engineering Department must also qualify construction firms. This requires the submittal of acceptable references for completed contracts. A minimum of three acceptable references is required for each construction specialty area.

❑ **Architectural & Engineering (A&E) - \$4.5 million**

- *Landscape Architectural Services - \$7 million*
- *Marine Engineering & Naval Architecture - \$18.5 million*

In addition to adhering to maximum gross revenues Thresholds, A&E firms must also have minimum average annual revenues of more than \$100,000 over the last three (3) fiscal years.

❑ **Commodity - \$7 million**

Commodity firms eligible to participate are provided a five percent (5%) price preference in designated contracts solicited by the Port Authority's Procurement Division.

❑ **Janitorial Maintenance - \$16.5 million**

❑ **Unarmed Guard Service - \$18.5 million**

❑ **Financial Services - \$7 million**

**INFORMATION FOR DETERMINING JOINT VENTURE ELIGIBILITY**

Return your submittal to: *The Port Authority of NY & NJ  
Office of Business and Job Opportunity  
233 Park Avenue South, 4<sup>th</sup> Floor  
New York, NY 10003*

*Firms not currently certified should call (212) 435-7808 for information*

(NOTE: This form need not be completed if all joint venture firms are *M/W/DBEs*  
The Joint Venture approval is valid through the duration of the Port Authority contract)

1. NAME OF JOINT VENTURE: \_\_\_\_\_
  
2. ADDRESS OF JOINT VENTURE: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  
3. TELEPHONE NUMBER (S) OF JOINT VENTURE: \_\_\_\_\_  
\_\_\_\_\_
  
4. (A) IDENTIFY THE FIRMS WHICH COMPRISE THE JOINT VENTURE. (THE MINORITY OR WOMAN-OWNED OR DISADVANTAGED BUSINESS ENTERPRISE PARTNER MUST COMPLETE A UNIFORM CERTIFICATION APPLICATION - SCHEDULE A)  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
  
(B) DESCRIBE THE ROLE OF THE M/W/DBE IN THE JOINT VENTURE:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  
5. NATURE OF THE JOINT VENTURE'S BUSINESS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  
6. PROVIDE A COPY OF THE JOINT VENTURE AGREEMENT.

7. WHAT IS THE CLAIMED PERCENTAGE OF MBE OR WBE OF DBE OWNERSHIP? \_\_\_\_\_

8. OWNERSHIP OF JOINT VENTURE: (THIS NEED NOT BE FILLED IN IF DESCRIBED IN THE JOINT VENTURE AGREEMENT)

(A) PROFIT AND LOSS SHARING: \_\_\_\_\_  
\_\_\_\_\_

(B) CAPITAL CONTRIBUTIONS, INCLUDING EQUIPMENT:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(C) OTHER APPLICABLE OWNERSHIP INTERESTS:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

9. CONTROL OF AND PARTICIPATION IN THIS CONTRACT. IDENTIFY BY NAME, RACE, SEX AND "FIRM" THOSE INDIVIDUALS AND THEIR TITLES WHO ARE RESPONSIBLE FOR DAY-TO-DAY MANAGEMENT AND POLICY DECISION-MAKING, BUT NOT LIMITED TO, THOSE WITH PRIME RESPONSIBILITY FOR:

<u>NAME &amp; TITLE</u>	<u>SEX</u>	<u>GROUP CODE*</u>	<u>FIRM</u>
FINANCIAL DECISIONS			
_____	DM <input type="checkbox"/> OF <input type="checkbox"/>	_____	_____
_____	DM <input type="checkbox"/> OF <input type="checkbox"/>	_____	_____
MANAGEMENT DECISIONS, SUCH AS:			
ESTIMATING			
_____	DM <input type="checkbox"/> OF <input type="checkbox"/>	_____	_____
_____	DM <input type="checkbox"/> OF <input type="checkbox"/>	_____	_____
MARKETING AND SALES			
_____	DM <input type="checkbox"/> OF <input type="checkbox"/>	_____	_____
_____	DM <input type="checkbox"/> OF <input type="checkbox"/>	_____	_____

**HIRING AND FIRING OF MANAGEMENT PERSONNEL**

\_\_\_\_\_ M F \_\_\_\_\_  
\_\_\_\_\_ M F \_\_\_\_\_

**PURCHASING OF MAJOR ITEMS OR SUPPLIES**

\_\_\_\_\_ M F \_\_\_\_\_  
\_\_\_\_\_ M F \_\_\_\_\_

**SUPERVISION OF FIELD OPERATIONS**

\_\_\_\_\_ M F \_\_\_\_\_  
\_\_\_\_\_ M F \_\_\_\_\_

**\*GROUP CODE KEY**

01 - BLACK	02A - HISPANIC	03A - ASIAN-PACIFIC	04 - NATIVE AMERICAN
	02B - PORTUGUESE	03B - ASIAN-INDIAN	05 - NON-MINORITY
	02C - SPANISH		06 - OTHER

Affidavit

"The undersigned swear that the foregoing statements are correct and include all material information necessary to identify and explain the terms and operation of the joint venture and the intended participation by each joint venturer in the undertaking. Further, the undersigned agree to provide to the grantee current and complete information and any proposed changes to the joint venture arrangement. The undersigned also agree to permit authorized representatives of the grantee or the Federal-funding agency to audit and examine the books, records and files of the joint venture, or those of each joint venturer relevant to the joint venture. Any material misrepresentation will be grounds for terminating any contract which may be awarded and for initiating action under Federal or State laws concerning false statement."

_____ NAME OF FIRM	_____ NAME OF FIRM
_____ SIGNATURE	_____ SIGNATURE
_____ NAME	_____ NAME
_____ TITLE	_____ TITLE
_____ DATE	_____ DATE
State of _____	County of _____

On this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, before me appeared (name) \_\_\_\_\_ to me personally known, who, being duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by (name of firm) \_\_\_\_\_ to execute the affidavit and did so as his or her free act and deed.

\_\_\_\_\_  
Notary Public

State of _____	County of _____
----------------	-----------------

On this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, before me appeared (name) \_\_\_\_\_ to me personally known, who, being duly sworn, did execute the foregoing affidavit, and did state that he or she was properly authorized by (name of firm) \_\_\_\_\_ to execute the affidavit and did so as his or her free act and deed.

\_\_\_\_\_  
Notary Public



## INSTRUCTIONS

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**CONTRACTOR INSTRUCTIONS:** Contractor is required to submit a MBE/WBE Participation Plan and/or best efforts documentation to the designee identified in the contract book within 7 days after the opening of the Proposals for this Contract.

**ENGINEER OF CONSTRUCTION INSTRUCTIONS:** After the review of the submitted MBE/WBE Participation plan, forward to the Office of Business and Job Opportunity via fax at (212) 435-7828 or PAD to 233 PAS 4<sup>th</sup> Floor for review and approval. Approved/waived/rejected plan will be returned within 10 business days of receipt of this document. Engineer of Construction will advise vendor of the results of the MBE/WBE Participation Plan review.





ATTACHMENT "C"  
INVENTORY OF STOCK

PROCURED AND STORED STEEL  
WORK PACKAGE 4B

## MASTER 4B

### BUSHWICK METALS

	<u>PIECES</u>	<u>UNIT WEIGHT</u>	<u>FOOTAGE</u>	<u>WEIGHT</u>
ASTM A572, GR. 50				
1/2" X 72" X 240"	55	20.42	6,600	134,772
1/2" X 72" X 120"	10	20.42	600	12,252
1/2" X 96" X 240"	5	20.42	800	16,336
<b>TOTAL BUSHWICK</b>				<b>163,360</b>

### METALS USA

	<u>PIECES</u>	<u>UNIT WEIGHT</u>	<u>FOOTAGE</u>	<u>WEIGHT</u>
ASTM A572, GR. 50				
2-1/2" X 96" X 240"	10	102.1	1,600	163,360
<b>TOTAL METALS USA</b>				<b>163,360</b>

### TRANS AMERICAN (EX CHAPEL)

	<u>PIECES</u>	<u>UNIT WEIGHT</u>	<u>FOOTAGE</u>	<u>WEIGHT</u>
ASTM A572, GR. 50				
7/8" X 96" X 240"	22	35.74	3,520	125,805
7/8" X 96" X 168"	1	35.74	160	5,718
<b>TOTAL CHAPEL</b>				<b>131,523</b>

### LUTZ

<u>WT6 x 20</u>	<u>PIECES</u>	<u>SIZE</u>	<u>FOOTAGE</u>	<u>WEIGHT</u>
BEAM	71	50	3,550	142,000
WT	112	50	5,800	112,000
WT	12	49	588	11,760
WT	12	16	192	3,840
<b>TOTAL</b>			<b>9,930</b>	<b>269,600</b>

### WT7 x 26.5

	<u>PIECES</u>	<u>SIZE</u>	<u>FOOTAGE</u>	<u>WEIGHT</u>
BEAM	16	35	560	29,680
WT	104	40	4,160	110,240
WT	8	35	280	7,420
WT	8	19	152	4,028
<b>TOTAL</b>			<b>5,152</b>	<b>151,388</b>

### WT8 x 33.5

	<u>PIECES</u>	<u>SIZE</u>	<u>FOOTAGE</u>	<u>WEIGHT</u>
BEAM	30	50	1,500	100,500
BEAM	4	46	184	12,328
BEAM	16	32.5	520	34,840
BEAM	4	19	76	5,092
WT	12	50	600	20,100
<b>TOTAL</b>			<b>2,880</b>	<b>172,860</b>

### WT9 x 53

	<u>PIECES</u>	<u>SIZE</u>	<u>FOOTAGE</u>	<u>WEIGHT</u>
BEAM	2	60	120	12,720
BEAM	3	50	150	15,900
BEAM	43	40	1,720	182,320
WT	28	40	1,120	59,360
<b>TOTAL</b>			<b>3,110</b>	<b>270,300</b>

### WT10.5 x 55.5

	<u>PIECES</u>	<u>SIZE</u>	<u>FOOTAGE</u>	<u>WEIGHT</u>
BEAM	2	70	140	15,540
BEAM	3	65	195	21,645
BEAM	40	40	1,600	177,600
BEAM	1	30	30	3,330

TOTAL 218,115

TOTAL LUTZ 1,082,243

TOTAL NON-SELCO  
1,540,486

<u>SELCO</u>	<u>*CLAMPS MISSING</u>		<u>FOOTAGE</u>	<u>WEIGHT</u>
<u>BRACES</u>	<u>PIECES</u>	<u>SIZE</u>		
WT6X20	9	50	450	9,000
WT7X26.5	92	40	3680	97,520
WT7X26.5	11	46	508	13,409
WT8X33.5	1	19	19	637
WT8X33.5	1	30	30	1,005
WT8X33.5	1	10	10	335
WT8X33.5	31	50	1550	51,925
WT10.5X55.5	10	40	400	22,200
WT18x91	1	50	50	4,550
WT18x91	1	18	18	1,638
<b>TOTAL</b>				<b>202,219</b>

FRICITION COLLARS

Level 2 Friction Collars from PCW 17 1/2"

<u>TYPE</u>	<u>LENGTH</u>	<u>LENGTH (in)</u>	<u>PIECES (SETS)</u>	<u>PIECES (SLEEVES)</u>	<u>SLEEVE WT</u>	<u>TOTAL WT</u>
Type 1	4'- 11"	59"	0	0	147	0
Type 2	2'- 9"	33"	6	12	81.8	982
Type 3	5'- 3"	63"	12	24	157	3,768
Type 4	8'- 3"	99"	15	30	245	7,350
Type 5	8'- 9"	105"	9	18	261	4,698
Type 6	6'- 3"	75"	16	32	186.5	5,968
Type 7	7'- 3"	87"	0	0	216	0
Type 8	10'-6"	126"	0	0	314	0
<b>TOTAL</b>			<b>58</b>	<b>116</b>		<b>22,766</b>

Level 2-5 Friction Collars Formed at Selco 17 9/16"

<u>TYPE</u>	<u>LENGTH</u>	<u>LENGTH (in)</u>	<u>PIECES (SETS)</u>	<u>PIECES (SLEEVES)</u>	<u>SLEEVE WT</u>	<u>TOTAL WT</u>
Type 1	4'- 11"	59"	3	6	147	882
Type 2	2'- 9"	33"	32.5	65	81.8	5,317
Type 3	5'- 3"	63"	46	92	157	14,444
Type 4	8'- 3"	99"	0	0	245	0
Type 5	8'- 9"	105"	5	10	261	2,610
Type 6	6'- 3"	75"	4.5	9	186.5	1,679
Type 7	7'- 3"	87"	0.5	1	216	216
Type 8	10'-6"	126"	1	2	314	628
<b>TOTAL</b>			<b>92.5</b>	<b>185</b>		<b>25,148</b>

Level 2-5 Friction Collar Plate at Selco 17 9/16"

<u>TYPE</u>	<u>LENGTH</u>	<u>LENGTH (in)</u>	<u>PIECES (SETS)</u>	<u>PIECES (SLEEVES)</u>	<u>SLEEVE WT</u>	<u>TOTAL WT</u>
Type 1	4'- 11"	59"	0	0	147	0
Type 2	2'- 9"	33"	77.5	155	81.8	12,679
Type 3	5'- 3"	63"	0	0	157	0
Type 4	8'- 3"	99"	42.5	85	245	20,825
Type 5	8'- 9"	105"	0	0	261	0
Type 6	6'- 3"	75"	0	0	186.5	0
Type 7	7'- 3"	87"	12.5	25	216	5,400
Type 8	10'-6"	126"	0	0	314	0
<b>TOTAL</b>			<b>132.5</b>	<b>265</b>		<b>38,904</b>

Level 2-5 Friction Collar Plate Balance 17 1/2"

<u>TYPE</u>	<u>LENGTH</u>	<u>LENGTH (in)</u>	<u>PIECES (SETS)</u>	<u>PIECES (SLEEVES)</u>	<u>SLEEVE WT</u>	<u>TOTAL WT</u>
Type 1	4'- 11"	59"	5	10	147	1,470
Type 2	2'- 9"	33"	173	346	81.8	28,303
Type 3	5'- 3"	63"	4	8	157	1,256
Type 4	8'- 3"	99"	72	144	245	35,280
Type 5	8'- 9"	105"	2	4	261	1,044
Type 6	6'- 3"	75"	33	66	186.5	12,309
Type 7	7'- 3"	87"	6	12	216	2,592
Type 8	10'-6"	126"	0	0	314	0
<b>TOTAL</b>			<b>295</b>	<b>590</b>		<b>82,254</b>

	<u>PIECES</u>	<u>WEIGHT</u>
Friction Collar Fabricated	301	47,913
Friction Collar 1/2" Plate	955	121,158
Tension Bar 2" x 6" x 20'	21	17,136
Braces		202,219
<b>TOTAL SELCO</b>		<b>388,425</b>

\*NOT ACCOUNTED FOR IN INVENTORY ABOVE

LINDEN

TRAILER # 7460

<u>BRACES</u>	<u>PIECES</u>	<u>LENGTH</u>	<u>WEIGHT</u>
WT10.5x 55.5	1	9'	499.5
WT10.5x 55.5	1	9'	499.5
WT10.5x 55.5	1	9' - 2"	508.8
WT10.5x 55.5	1	5' - 1"	282.1
WT10.5x 55.5	1	9' - 3"	513.4
WT10.5x 55.5	1	9'	499.5
WT10.5x 55.5	1	9' - 2"	508.8
WT10.5x 55.5	1	5' - 1"	282.1
WT10.5x 55.5	1	14' - 8"	814.0
WT10.5x 55.5	1	8' - 3"	346.9
WT10.5x 55.5	1	9' - 3"	513.4
WT10.5x 55.5	1	9' - 5"	522.6
WT10.5x 55.5	1	9' - 4"	518.0
WT10.5x 55.5	1	5' - 8"	314.5
WT10.5x 55.5	1	8' - 11"	494.9
WT10.5x 55.5	1	13' - 8"	758.5
WT10.5x 55.5	1	11' - 8"	647.5
WT10.5x 55.5	1	6' - 5"	356.1
WT10.5x 55.5	1	9' - 4"	518.0
WT10.5x 55.5	1	5' - 6"	305.3
WT10.5x 55.5	1	9' - 2"	508.8
WT10.5x 55.5	1	8' - 7"	476.4
WT10.5x 55.5	1	9' - 2"	508.8
WT10.5x 55.5	1	9'	499.5
WT10.5x 55.5	1	9' - 9"	541.1
WT10.5x 55.5	1	8' - 8"	481.0
WT10.5x 55.5	1	4' - 10"	268.3
<b>TOTAL</b>			<b>12987.0</b>

TRAILER #7079

<u>COLLAR CLAMPS</u>	<u>PIECES</u>	<u>LENGTH</u>	<u>WEIGHT</u>
1 1/2" holes	1069	53450.0	53144.9
1 1/2" holes	20	1000.0	994.3

54139.2

**TRAILER #7455**

<u>BRACES</u>	<u>PIECES</u>	<u>LENGTH</u>	<u>WEIGHT</u>
WT6x 20	1	14' - 2"	283.3
WT6x 20	1	14' - 3"	285.0
WT6x 20	1	18' - 4"	366.7
WT6x 20	1	14' - 5"	288.3
WT6x 20	1	14' - 9"	295.0
WT6x 20	1	14' - 6"	290.0
WT6x 20	1	14' - 9"	295.0
WT6x 20	1	14' - 5"	288.3
WT6x 20	1	14' - 10"	296.7
WT6x 20	1	13' - 10"	276.7
WT6x 20	1	14' - 8"	293.3
WT6x 20	1	18' - 9"	375.0
WT6x 20	1	16' - 10"	336.7
WT6x 20	1	15' - 3"	305.0
WT6x 20	1	15' - 6"	310.0
WT6x 20	1	16' - 3"	325.0
WT6x 20	1	15' - 2"	303.3
WT6x 20	1	17' - 2"	343.3
WT10.5x 55.5	1	18' - 9"	1040.6
WT10.5x 55.5	1	18' - 6"	1026.8
WT10.5x 55.5	1	20' - 3"	1123.9
WT10.5x 55.5	1	19'	1054.5
WT6x 20	1	15' - 6"	310.0
WT10.5x 55.5	1	20' - 7"	1142.4
WT10.5x 55.5	1	20' - 2"	1119.3
WT6x 20	1	3' - 1"	61.7
WT6x 20	1	9' - 11"	198.3
WT10.5x 55.5	1	17' - 4"	962.0
WT10.5x 55.5	1	18' - 5"	1022.1
WT6x 20	1	8'	160.0
WT6x 20	1	8' - 3"	165.0
WT6x 20	1	16' - 4"	326.6
WT6x 20	1	19' - 5"	388.3
WT10.5x 55.5	1	16' - 2"	897.3
WT10.5x 55.5	1	20' - 9"	1151.6
WT6x 20	1	8' - 5"	168.3
WT6x 20	1	8' - 6"	170.0
WT6x 20	1	8' - 9"	175.0
WT6x 20	1	9' - 11"	198.3
WT6x 20	1	15' - 1"	301.7
WT6x 20	1	15' - 7"	311.7
WT6x 20	1	19' - 1"	381.7
<b>TOTAL</b>			<b>19413.6</b>

**TRAILER #8058**

<u>COLLAR CLAMPS</u>	<u>PIECES</u>	<u>LENGTH</u>	<u>WEIGHT</u>
1 7/16" holes	972	48600.0	48322.6
<b>TOTAL</b>			<b>48322.6</b>

**TRAILER #7274**

<u>BRACES</u>	<u>PIECES</u>	<u>LENGTH</u>	<u>WEIGHT</u>
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WT7x 26.5	1	1.96	51.9
WT7x 26.5	1	2' - 10"	75.0
WT7x 26.5	1	2' - 11"	77.4
WT6x 20	1	4.08	81.6
WT7x 26.5	1	3.23	85.6
WT7x 26.5	1	3.32	88.0
WT7x 26.5	1	3.38	89.6
WT7x 26.5	1	3.62	95.9
WT7x 26.5	1	3.69	97.8
WT7x 26.5	1	3' - 9"	99.4
WT7x 26.5	1	3' - 9"	99.4
WT7x 26.5	1	4.03	106.8
WT7x 26.5	1	4.05	107.3
WT7x 26.5	1	4.13	109.4
WT7x 26.5	1	4.22	111.8
WT7x 26.5	1	4.3	114.0
WT7x 26.5	1	4.32	114.5
WT7x 26.5	1	5.06	134.1
WT7x 26.5	1	5.15	136.5
WT6x 20	1	8.43	168.6
WT6x 20	1	8.43	168.6
WT6x 20	1	9	180.0
WT6x 20	1	9	180.0
WT6x 20	1	9.25	185.0
WT7x 26.5	1	7.08	187.6
WT7x 26.5	1	7' - 4"	194.2
WT7x 26.5	1	7' - 7"	200.9
WT7x 26.5	1	7' - 9"	205.4
WT7x 26.5	1	7' - 10"	207.5
WT7x 26.5	1	7.93	210.1
WT7x 26.5	1	8'	212.0
WT7x 26.5	1	8'	212.0
WT7x 26.5	1	8' - 3"	218.6
WT7x 26.5	1	8' - 3"	218.6
WT7x 26.5	1	8.26	218.9
WT7x 26.5	1	8.3	220.0
WT7x 26.5	1	8.4	222.8
WT7x 26.5	1	8' - 5"	223.1
WT7x 26.5	1	8.44	223.7
WT7x 26.5	1	8.48	224.7
WT7x 26.5	1	8.48	224.7
WT7x 26.5	1	8.5	225.3
WT7x 26.5	1	8.58	227.4
WT7x 26.5	1	8' - 8"	229.8
WT7x 26.5	1	8' - 8"	229.8
WT7x 26.5	1	8.69	230.3
WT7x 26.5	1	8.71	230.8
WT7x 26.5	1	8.84	234.3
WT7x 26.5	1	8.94	236.9
WT7x 26.5	1	8.98	238.0
WT7x 26.5	1	9.08	240.6
WT7x 26.5	1	9.11	241.4
WT7x 26.5	1	9.16	242.7
WT7x 26.5	1	9.16	242.7
WT7x 26.5	1	9.2	243.8

WT7x 26.5	1	9.24	244.9
WT7x 26.5	1	9.26	245.4
WT7x 26.5	1	9.29	246.2
WT7x 26.5	1	9.3	246.5
WT7x 26.5	1	9.35	247.8
WT7x 26.5	1	9.44	250.2
WT7x 26.5	1	9.61	254.7
WT7x 26.5	1	9.7	257.1
WT7x 26.5	1	9.93	263.1
WT7x 26.5	1	11.35	300.8
WT7x 26.5	1	12.33	326.7
WT7x 26.5	1	12.71	336.8
WT7x 26.5	1	12' - 10"	340.0
WT7x 26.5	1	12' - 11"	342.4
WT7x 26.5	1	13'	344.5
WT7x 26.5	1	8' - 10"	234.1
WT7x 26.5	1	12' - 10"	340.1
WT6x 20	1	16' - 5"	328.3
WT7x 26.5	1	13.34	353.5
WT7x 26.5	1	3' - 7"	95.0
WT7x 26.5	1	13.44	356.2
WT7x 26.5	1	7' - 7"	201.0
WT7x 26.5	1	7' - 8"	203.2
WT6x 20	1	21' - 9"	415.0
WT7x 26.5	1	8' - 3"	218.6
WT6x 20	1	18' - 6"	370.0
WT6x 20	1	18' - 7"	371.7
WT7x 26.5	2	7' - 9"	410.8
WT7x 26.5	1	7' - 11"	209.8
WT7x 26.5	1	14'	371.0
WT7x 26.5	1	7' - 11"	209.8
WT7x 26.5	2	3' - 9"	198.8
WT6x 20	1	16' - 3"	325.0
WT6x 20	1	16' - 5"	328.3
WT7x 26.5	1	2' - 11"	77.3
WT6x 20	1	18' - 11"	378.3
WT6x 20	1	19'	380.0
WT7x 26.5	1	2' - 8"	70.7
WT7x 26.5	1	8' - 5"	223.0
WT7x 26.5	1	8' - 9"	231.9
WT7x 26.5	1	8' - 8"	229.7
WT7x 26.5	1	8' - 9"	231.9
WT7x 26.5	1	8' - 9"	231.9
WT7x 26.5	2	8' - 9"	463.8
WT7x 26.5	1	14.62	387.4
WT7x 26.5	1	8' - 6"	225.3
WT7x 26.5	1	8' - 7"	227.5
WT6x 20	1	22' - 1"	441.7
WT7x 26.5	1	7' - 9"	205.4
WT6x 20	1	18' - 7"	371.7
WT6x 20	1	16' - 7"	331.7
WT6x 20	1	18' - 10"	376.7
WT7x 26.5	2	7' - 10"	415.0
WT7x 26.5	1	2' - 11"	77.3
WT7x 26.5	1	8'	212.0

WT6x 20	1	17'	340.0
WT7x 26.5	1	16.48	436.7
WT7x 26.5	1	2' - 11"	77.3
WT6x 20	1	21' - 6"	430.0
WT6x 20	1	22' - 4"	446.7
WT7x 26.5	1	8' - 8"	229.7
WT7x 26.5	1	8' - 8"	229.7
WT7x 26.5	2	8.58	454.7
WT7x 26.5	1	17.23	456.6
WT7x 26.5	1	8' - 9"	231.9
WT7x 26.5	1	3' - 9"	99.4
WT7x 26.5	1	17.63	467.2
WT7x 26.5	2	8.82	467.5
WT7x 26.5	1	3' - 10"	101.6
WT6x 20	1	18' - 10"	376.7
WT7x 26.5	1	8' - 9"	231.9
WT6x 20	1	19' - 3"	385.0
WT7x 26.5	2	8' - 8"	459.3
WT6x 20	1	20' - 3"	405.0
WT7x 26.5	2	9.18	486.5
WT7x 26.5	1	18.4	487.6
WT7x 26.5	1	2' - 2"	57.4
	1	8' - 9"	293.1
WT6x 20	1	32' - 1"	641.7
WT7x 26.5	1	8' - 9"	231.9
WT6x 20	1	14' - 3"	285.0
WT6x 20	1	14'	280.0
WT7x 26.5	1	16'	424.0
WT7x 26.5	1	4' - 7"	121.5
WT6x 20	1	13' - 7"	271.7
WT7x 26.5	1	10' - 10"	287.1
WT6x 20	1	15' - 3"	305.0
WT7x 26.5	1	17' - 11"	474.8
WT7x 26.5	1	7' - 1"	187.7
WT7x 26.5	1	11' - 10"	313.6
WT7x 26.5	1	12' - 1"	320.2
WT7x 26.5	1	9' - 3"	245.1
WT7x 26.5	1	12' - 10"	340.1
WT6x 20	1	15'	300.0
WT7x 26.5	1	6' - 10"	181.1
WT6x 20	1	15' - 2"	303.3
WT7x 26.5	1	2' - 9"	72.9
WT7x 26.5	1	4' - 3"	112.6
WT9x 53	1	16' - 9"	887.8
WT9x 53	1	17'	901.0
WT7x 26.5	1	24.5	649.3
TOTAL	1		41041.7

TRAILER #14433			
<u>COLLAR CLAMPS</u>	<u>PIECES</u>	<u>LENGTH</u>	<u>WEIGHT</u>
1 7/16" holes	880	44000	43748.8
TOTAL			43748.8

TRAILER #19845			
<u>COLLAR CLAMPS</u>	<u>PIECES</u>	<u>LENGTH</u>	<u>WEIGHT</u>

1 7/16" holes	44246.0
<b>TOTAL</b>	<b>44246.0</b>

**TRAILER #12702**

<u>BRACES</u>	<u>PIECES</u>	<u>LENGTH</u>	<u>WEIGHT</u>
WT7x 26.5	8	50'	10600.0
WT7x 26.5	12	46'	14628.0
WT7x 26.5	26	40'	27560.0
<b>TOTAL</b>			<b>52788.0</b>

**TRAILER #21209**

<u>BRACES</u>	<u>PIECES</u>	<u>LENGTH</u>	<u>WEIGHT</u>
WT8x 33.5	1	14'	469.0
WT8x 33.5	1	14' - 11"	499.7
WT8x 33.5	1	14' - 6"	485.8
WT8x 33.5	1	15'	502.5
WT8x 33.5	1	15'	502.5
WT8x 33.5	1	15'	502.5
WT8x 33.5	1	15'	502.5
WT8x 33.5	1	15' - 1"	505.3
WT8x 33.5	3	15' - 1"	1515.9
WT8x 33.5	1	15' - 1"	505.3
WT8x 33.5	1	15' - 1"	505.3
WT8x 33.5	1	15' - 10"	530.4
WT8x 33.5	1	15' - 11"	533.2
WT8x 33.5	1	15' - 2"	508.1
WT8x 33.5	1	15' - 2"	508.1
WT6x 20	32	40'	25600.0
WT8x 33.5	1	15' - 2"	508.1
WT8x 33.5	1	15' - 3"	510.9
WT8x 33.5	1	15' - 3"	510.9
WT8x 33.5	1	15' - 4"	513.7
WT8x 33.5	1	15' - 4"	513.7
WT8x 33.5	1	15' - 6"	519.3
WT8x 33.5	1	15' - 7"	522.0
WT8x 33.5	1	16' - 6"	552.8
WT8x 33.5	1	16' - 8"	558.3
WT8x 33.5	1	17'	569.5
WT8x 33.5	1	17' - 10"	597.4
WT8x 33.5	1	17' - 2"	575.1
WT8x 33.5	1	17' - 6"	586.3
WT8x 33.5	1	17' - 8"	591.8
WT8x 33.5	1	18' - 10"	630.9
WT8x 33.5	1	18' - 10"	630.9
WT8x 33.5	1	18' - 3"	611.4
WT8x 33.5	1	22'	737.0
WT8x 33.5	1	9' - 2"	307.1
WT8x 33.5	1	9' - 6"	318.3
<b>TOTAL</b>			<b>45041.2</b>

**TRAILER #19922**

<u>COLLAR CLAMPS</u>	<u>PIECES</u>	<u>LENGTH</u>	<u>WEIGHT</u>
	808	40400	40169.4
<b>TOTAL</b>			<b>40169.4</b>

TOTAL LINDEN

401897.5

TOTAL STEEL

2330809.1

PROCURED AND STORED STEEL  
WORK PACKAGE 4C

## MASTER 4C

### METALS USA

	<u>PIECES</u>	<u>TOTAL WT</u>
WT10 X 55.5 X 575 LINEAR FT. A992	1	319125
WT6 X 20 X 1115 LINEAR FT. A992	1	13800
WT4 X 61 X 170 LINEAR FT. A992	1	145180
PL 1/2 X 96 X 240 A572-50	1	3280
PL 2 1/2 X 96 X 240 A572-50	2	16400
<b>TOTAL METALS USA</b>		<b>497785</b>

### CHAPEL

	<u>PIECES</u>	<u>TOTAL WT</u>
PL 1/2 X 96 X 288 A572-50	4	3936
PL 5/8 X 96 X 240 A572-50	1	4100
PL 7/8 X 96 X 240 A572-50	4	5740
<b>TOTAL CHAPEL</b>		<b>13776</b>

### HAYDON

	<u>PIECES</u>	<u>TOTAL WT</u>
1 3/8 X 2' THREADED ROD	740	
1 3/8 HEX NUT	2960	
1 3/8 FLAT WASHER	1480	
<b>TOTAL HAYDON</b>		<b>0</b>

### PRIMARY

	<u>PIECES</u>	<u>TOTAL WT</u>
PL 1/2 X 96 X 192 A572-50	1	2624
PL 1/2 X 96 X 240 A572-50	8	3280
PL 5/8 X 96 X 240 A572-50	1	4100
<b>TOTAL PRIMARY</b>		<b>10004</b>

### CERTIFIED

	<u>PIECES</u>	<u>TOTAL WT</u>
L4 X 3 X 3/8 X 40' A529-50	8	392
PL 2 1/2 X 96 X 240 A572-50	1	16400
WT6 X 20 X 30' A992	1	3600
WT6 X 20 X 40' A992	16	4800
WT6 X 20 X 30' A992	3	3600
WT9 X 53 X 40' A992	4	19080
WT6 X 20 X 50' A992	7	6000
WT6 X 20 X 45' A992	4	5400
WT6 X 20 X 40' A992	3	4800
WT6 X 20 X 35' A992	2	4200
<b>TOTAL CERTIFIED</b>		<b>68272</b>

### **TOTAL STEEL**

**589837**

PROCURED AND STORED STEEL  
WORK PACKAGE 9X

# WP 9X

## CIVES STEEL - NORTHERN DIVISION

	<u>PIECES</u>	<u>TOTAL WT</u>
36 x 650 # x 51 ft 3 in	1	33313.
14 x 730 # x 32 ft 6 in	2	47450
14 x 550 # x 45 ft 0 in	1	24750
14 x 550 # x 35 ft 0 in	1	19250
14 x 455 # x 45 ft 9 in	1	20816
14 x 455 # x 39 ft 9 in	2	36173
14 x 426 # x 45 ft 9 in	1	19490
TOTAL WP 9X		201242
TOTAL STEEL		201242



**THE PORT AUTHORITY OF NY & NJ**

**THE PORT AUTHORITY OF NEW YORK & NEW JERSEY  
PROCUREMENT DEPARTMENT  
ONE MADISON AVENUE 7<sup>TH</sup> FL.  
NEW YORK, NY 10010**

Date: July 29, 2009

**ADDENDUM No. 13**

For prospective bidders on contract WTC 224,545 for Greenwich Street Corridor Construction

- Bid due date is August 11, 2009, no later than 2:30 P.M.
- Original bid due date was June 22, 2009, no later than 2:30 P.M.

The following changes are hereby made in the documents:

- I. **CHAPTER III – PROVISIONS RELATED TO TIME, Section 35 entitled Time for Completion and Damages for Delay and Incentives –Paragraph II, 3.1**  
Delete "Thirty Thousand Dollars (\$30,000)" and insert "Five Thousand Dollars (\$5,000)".
- II. **DIVISION I - GENERAL PROVISIONS, Section 92 entitled Construction Required by the Specification and Section 99 entitled Contract Drawings-**  
Add the following scope –  
Demolition of PATH Underpass Slab:  
The demolition and removal of the existing concrete slab under the #1 Subway Line Box, also known as the PATH Underpass Slab, as indicated on Work Package 4C Drawings S301 and S801 are to be included in this contract, Contract WTC 224,545.
- III. **DIVISION I -GENERAL PROVISIONS, Section 115 entitled Contractor's Field Office and Representative. Add to contract clause as follows:**

The following key positions will be carried by an associated Authority contract for the duration of the work, and labor costs associated with these positions shall not be included in this contract:

- Master Mechanic
- Maintenance Foreman
- Teamster Shop Steward

All other Terms and Conditions shall remain the same.

This communication should be initialed by you and annexed to your proposal upon submission.

In case any bidder fails to conform to these instructions, its proposal will nevertheless be construed as though this communication had been so physically annexed and initialed.

THE PORT AUTHORITY OF NY & NJ

*Shamsell Absar*  
for MITCHELL YONKIER, MANAGER  
CONSTRUCTION PROCUREMENTS  
AND INTEGRITY PROGRAMS

BIDDER'S FIRM NAME: TOTAL FERINI CORP.

INITIALED: *Jmy*

DATE: 8/11/09

QUESTIONS CONCERNING THIS ADDENDUM MAY BE ADDRESSED TO MR ALVIN CAESAR, WHO CAN BE REACHED AT (212) 435-5640 OR ACAESAR@PANYNJ.GOV.

08-11-09P02:50 RCVD



**THE PORT AUTHORITY OF NY & NJ**

**THE PORT AUTHORITY OF NEW YORK & NEW JERSEY  
PROCUREMENT DEPARTMENT  
ONE MADISON AVENUE 7<sup>TH</sup> FL.  
NEW YORK, NY 10010**

Date: July 24, 2009

**ADDENDUM No. 12**

To prospective bidders on contract WTC 224.545 for Greenwich Street Corridor Construction

- Bid due date is August 4, 2009, no later than 10:00A.M.
- Original bid due date was June 22, 2009, no later than 2:30 P.M.

The following changes are hereby made in the documents:

**I. CHAPTER I - GENERAL PROVISIONS, Sections 25 and 26 entitled Performance Bond, and Payment Bond, respectively.**

**A. Delete the following paragraph in its entirety from both Sections:**

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

**B. Replace paragraph one of Section 26 with the following:**

The Contractor shall furnish a bond for payment of all lawful claims of subcontractors, materialmen and workmen arising out of the performance of this contract. Such bond shall be in the form bound herewith entitled, "Payment Bond", shall be in a penal sum equal to 100% of the Lump Sum and such bond shall be signed by one or more sureties' satisfactory to the Authority. The bond may be executed on a separate copy of such form not physically attached to this Contract booklet. In any case, both the form of bond bound herewith and any unattached executed copy thereof shall form a part of this Form of Contract as though herein set forth in full.

**C. Replace paragraph four of Section 26 with the following:**

questions, which the Port Authority has deemed to require additional information and/or clarification.

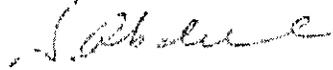
*See attached listing of Questions and Answers.*

All other Terms and Conditions shall remain the same.

This communication should be initialed by you and annexed to your proposal upon submission.

In case any bidder fails to conform to these instructions, its proposal will nevertheless be construed as though this communication had been so physically annexed and initialed.

THE PORT AUTHORITY OF NY & NJ



MITCHELL YONKLER, MANAGER  
CONSTRUCTION PROCUREMENTS  
AND INTEGRITY PROGRAMS

BIDDER'S FIRM NAME: TUTOR PERINI CORP.

INITIALED: 

DATE: 8/11/09

QUESTIONS CONCERNING THIS ADDENDUM MAY BE ADDRESSED TO MR ALVIN CAESAR, WHO CAN BE REACHED AT (212) 435-5640 OR [ACAESAR@PANYNJ.GOV](mailto:ACAESAR@PANYNJ.GOV).

08-11-09P02:50 RCVD



**THE PORT AUTHORITY OF NY & NJ**

THE PORT AUTHORITY OF NEW YORK & NEW JERSEY  
PROCUREMENT DEPARTMENT  
ONE MADISON AVENUE 7<sup>TH</sup> FL.  
NEW YORK, NY 10010

Date: July 23, 2009

**ADDENDUM No. 11**

To prospective bidders on contract WTC 224.545 for Greenwich Street Corridor Construction

- Bid due date is August 4, 2009, no later than 10:00 A.M.
- Original bid due date was June 22, 2009, no later than 2:30 P.M.

The following changes are hereby made in the documents:

**I. BIDDER QUESTIONS & ANSWERS**

The following information is made available in response to questions submitted by prospective bidders. It should not be deemed to answer all questions, which have been submitted by bidders to the Port Authority. It addresses only those questions, which the Port Authority has deemed to require additional information and/or clarification.

See attached list of bidders' questions and Authority's answers.

All other Terms and Conditions shall remain the same.

This communication should be initialed by you and annexed to your proposal upon submission.

In case any bidder fails to conform to these instructions, its proposal will nevertheless be construed as though this communication had been so physically annexed and initialed.

THE PORT AUTHORITY OF NY & NJ

*for Alvin Caesar*

MITCHELL YONKLER, MANAGER  
CONSTRUCTION PROCUREMENTS AND  
INTEGRITY PROGRAMS

BIDDER'S FIRM NAME: TOTAL PERINI CORP.

INITIALED: *JMJ*

DATE: 8/11/09

08-11-09P02:50 RCVD

QUESTIONS CONCERNING THIS ADDENDUM MAY BE ADDRESSED TO MR ALVIN CAESAR, WHO CAN BE REACHED AT (212) 435-5640 OR [ACAESAR@PANYNJ.GOV](mailto:ACAESAR@PANYNJ.GOV).



**THE PORT AUTHORITY OF NY & NJ**

**THE PORT AUTHORITY OF NEW YORK & NEW JERSEY  
PROCUREMENT DEPARTMENT  
ONE MADISON AVENUE 7<sup>TH</sup> FL.  
NEW YORK, NY 10010**

Date: July 22, 2009

**ADDENDUM No. 10**

To prospective bidders on contract WTC 224.545 for Greenwich Street Corridor Construction

- Bid due date is August 4, 2009, no later than 10:00 A.M.
- Original bid due date was June 22, 2009, no later than 2:30 P.M.

The following changes are hereby made in the documents:

**LA CHAPTER III - PROVISIONS RELATING TO TIME**, Section 35 entitled Time for Completion and Damages for Delay and Incentives  
(Note: Section 35 was modified by addendum 7)

Replace Milestone #1 with the following:

*Milestone #1. Complete excavation to elevation 235.5 in the Contractors Transit Hall work area within 122 calendar days of receipt by him of the acceptance of his proposal. Only the Contractor's access ramp to the underside of the 1 Line Box may remain.*

Replace Milestone #5 with the following:

*Milestone #5. Complete the load transfer from within the 1 Line Box to the new structure within 418 calendar days of receipt of the acceptance of his proposal.*

Replace Milestone #6 with the following:

*Milestone #6. Complete all remaining excavation in the mechanical room and Transit Hall work area for the mechanical room and Transit Hall foundations within 421 calendar days of receipt of the acceptance of his proposal. This work cannot begin until 365 calendar days of receipt by him of the acceptance of his proposal.*

**LB CHAPTER III - PROVISIONS RELATING TO TIME**, Section 35 entitled Time for Completion and Damages for Delay and Incentives  
(Note: Section 35 was modified by addenda 3 and 7)

Replace Section 35.B with the following:

*Attaining the milestones set in Section I above is essential to provide follow-on contractors access to commence work. Inasmuch as early completion of these milestones will allow the Authority to accelerate initiation of the work by follow-on contractors, the Authority shall pay the Contractor the financial incentive of Sixty*

Sheet	Title	Rev	Date
GCSA 001	Greenwich Corridor Site Access and Staging Restrictions	2	7-20-09
GCSA 002	Greenwich Corridor Site Access and Staging Restrictions Contractor Mobilization NTP- January 22, 2010	2	7-20-09
GCSA 003	Greenwich Corridor Site Access and Staging Restrictions Crane Mobilization January 22, 2010- March 1, 2010	2	7-20-09
GCSA 004	Greenwich Corridor Site Access and Staging Restrictions Structures to Grade Contractor March 1, 2010-September 1, 2010	2	7-20-09
GCSA 005	Greenwich Corridor Site Access and Staging Restrictions Greenwich Street Contract September 1, 2010-December 1, 2010	2	7-20-09
GCSA 006	Greenwich Corridor Site Access and Staging Restrictions Shared Work Zone December 1, 2010-March 31, 2011	2	7-20-09

All other Terms and Conditions shall remain the same.

This communication should be initiated by you and annexed to your proposal upon submission.

In case any bidder fails to conform to these instructions, its proposal will nevertheless be construed as though this communication had been so physically annexed and initiated.

THE PORT AUTHORITY OF NY & NJ

*for Alvin Caesar*

MITCHELL YONKLER, MANAGER  
CONSTRUCTION PROCUREMENTS AND  
INTEGRITY PROGRAMS

BIDDER'S FIRM NAME: WSPOR PERINI CORP.

INITIALED: *JMJ*

DATE: *8/11/09*

QUESTIONS CONCERNING THIS ADDENDUM MAY BE ADDRESSED TO MR. ALVIN CAESAR, WHO CAN BE REACHED AT (212) 435-5640 OR ACAESAR@PANYNJ.GOV.

08-11-09P02:51 RCVD



**THE PORT AUTHORITY OF NY & NJ**

**THE PORT AUTHORITY OF NEW YORK & NEW JERSEY  
PROCUREMENT DEPARTMENT  
ONE MADISON AVENUE 7<sup>TH</sup> FL.  
NEW YORK, NY 10010**

Date: July 17, 2009

**ADDENDUM No. 9**

To prospective bidders on contract WTC 224,545 for Greenwich Street Corridor Construction

- Bid due date is August 4, 2009, no later than 2:30 P.M.
- Original bid due date was June 22, 2009, no later than 2:30 P.M.

The following changes are hereby made in the documents:

**1.A TABLE OF CONTENTS**, page v, specifications; add the following specifications:

Section	Title
02220	Trenching and Backfilling For Utilities
02720	Manholes and Drainage Structures
02722	Storm Drainage System (Infiltration/Exfiltration Testing Not Required)
16110	Raceways
16115	Underground Conduit Systems

The attached specifications, referenced above, are hereby made part of the contract.

**1.B TABLE OF CONTENTS**; page vii Attachment "B"; Attachment "B" drawings issued in addenda 7 are replaced with the following:

Sheet	Title	Rev	Date
GCSA 001	Greenwich Corridor Site Access and Staging Restrictions	1	7-13-09
GCSA 002	Greenwich Corridor Site Access and Staging Restrictions Contractor Mobilization NTP- January 22, 2010	1	7-13-09
GCSA 003	Greenwich Corridor Site Access and Staging Restrictions Crane Mobilization January 22, 2010- March 1, 2010	1	7-13-09
GCSA 004	Greenwich Corridor Site Access and Staging Restrictions Structures to Grade Contractor March 1, 2010 -October 31, 2010	1	7-13-09
GCSA 005	Greenwich Corridor Site Access and Staging Restrictions Greenwich Street Contract October 31, 2010-December 31, 2010	1	7-13-09
GCSA 006	Greenwich Corridor Site Access and Staging Restrictions Shared Work Zone December 31.	1	7-13-09

All other Terms and Conditions shall remain the same.

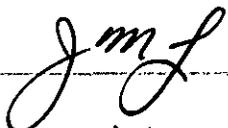
This communication should be initialed by you and annexed to your proposal upon submission.

In case any bidder fails to conform to these instructions, its proposal will nevertheless be construed as though this communication had been so physically annexed and initialed.

THE PORT AUTHORITY OF NY & NJ

  
MITCHELL YONKLER, MANAGER  
CONSTRUCTION PROCUREMENTS AND  
INTEGRITY PROGRAMS

BIDDER'S FIRM NAME: TOTD PERINI CORP.

INITIALED: 

DATE: 8/11/09

QUESTIONS CONCERNING THIS ADDENDUM MAY BE ADDRESSED TO MR ALVIN CAESAR, WHO CAN BE REACHED AT (212) 435-5640 OR ACAESAR@PANYNJ.GOV.

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PROCUREMENT DEPARTMENT  
ONE MADISON AVENUE 7<sup>TH</sup> FL.  
NEW YORK, NY 10010**

Date: July 10, 2009

**ADDENDUM No. 8**

To prospective bidders on contract WTC 224.545 for Greenwich Street Corridor Construction

- Bid due date is August 4, 2009, no later than 2:30 P.M.
- Original bid due date was June 22, 2009, no later than 2:30 P.M.

The following changes are hereby made in the documents:

**I. BIDDER QUESTIONS & ANSWERS**

The following information is made available in response to questions submitted by prospective bidders. It should not be deemed to answer all questions, which have been submitted by bidders to the Port Authority. It addresses only those questions, which the Port Authority has deemed to require additional information and/or clarification.

1	Q	The Contract Booklet contains Division 2 - Specification Section #02094 - Worker and Environmental Protection for Lead-Based Paint Removal. Please clarify if this specification section is applicable to the work in the Package 9X ALT. If so, then please clarify where this work is required.
	A	This is a standard specification section.

82	Q	The contractor in order to maintain and achieve a very aggressive schedule must have access not only from the limited widths on top of the existing I-9 subway box but also across the entire new Transit Hall site to crane service on the west side of Church Street for the contract duration. Please confirm this continuous access for the 570-day contract duration.
	A	See revised attachment "B" in Addendum 7.

All other Terms and Conditions shall remain the same.

This communication should be initialed by you and annexed to your proposal upon submission.

In case any bidder fails to conform to these instructions, its proposal will nevertheless be construed as though this communication had been so physically annexed and initialed.

THE PORT AUTHORITY OF NY & NJ

*for Alvin Caesar*  
MITCHELL YONKLER, MANAGER  
CONSTRUCTION PROCUREMENTS AND  
INTEGRITY PROGRAMS

BIDDER'S FIRM NAME: TOTX PERINI CORP.

INITIALED: *JmJ*

DATE: 8/11/09

QUESTIONS CONCERNING THIS ADDENDUM MAY BE ADDRESSED TO MR ALVIN CAESAR, WHO CAN BE REACHED AT (212) 435-5640 OR ACAESAR@PANYNJ.GOV.

08-11-09P02:51 RCVD



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PROCUREMENT DEPARTMENT  
ONE MADISON AVENUE 7<sup>TH</sup> FL.  
NEW YORK, NY 10010**

**Date: July 2, 2009**

**ADDENDUM No. 7**

To prospective bidders on contract WTC 224.545 for Greenwich Street Corridor Construction

Bid due date is August 4, 2009, no later than 2:30 P.M.

Original bid due date was June 22, 2009, no later than 2:30 P.M.

**The following changes are hereby made in the documents:**

**I. DIVISION 1 – GENERAL PROVISIONS, Section 100 entitled Reference Drawings**

The following attached drawings are made part of previous editions and are hereby incorporated into the contract documents:

**STRUCTURES TO GRADE. FITOUT AND MEP, CONTRACT# WTC-214.546  
DATED 10/15/08**

(These WP-20 reference drawings identify utilities in the Transit Hub area. Contractor is to excavate rock to accommodate future utility installation.)-- CD-ROM

P1104 CENTRAL PLANT LEVEL PART PLAN 4 EL. 228'-0" ADDENDUM 7  
DATED 6/12/09

P1105 CENTRAL PLANT LEVEL PART PLAN 5 EL. 228'-0" ADDENDUM 6  
DATED 5/31/09

P1106 CENTRAL PLANT LEVEL PART PLAN 6 EL. 228'-0" ADDENDUM 7  
DATED 6/12/09

P1113 CENTRAL PLANT LEVEL PART PLAN 13 EL. 228'-0" ADDENDUM 7  
DATED 6/12/09

P1203 CAR PARKING LEVEL PART PLAN 3 EL. 237'-0" ADDENDUM 6 DATED  
5/31/09

EP0407 15KV NORMAL POWER UNDERGROUND DUCTBANK LAYOUT EL.  
229'-6" AND EL. 237'-0" ADDENDUM 6 DATED 5/31/09

EP0408 15KV POWER CONDUIT SECTIONS SHEET 1 OF 2 ADDENDUM 7  
DATED 6/12/09

EP0408A 15KV POWER CONDUIT SECTIONS SHEET 2 OF 2 ADDENDUM 6  
DATED 5/31/09

EP0409 15KV UNDERGROUND DUCTBANK SECTIONS EL. 229'-6" AND EL.  
237'-0" SHEET 1 OF 2 ADDENDUM 6 DATED 5/31/09

EP0409 A 15KV UNDERGROUND DUCTBANK SECTIONS EL. 229'-6" AND  
EL. 237'-0" SHEET 2 OF 2 ADDENDUM 6 DATED 5/31/09

M1113 UTILITY TUNNEL LEVEL PART PLAN 13 EL. 228'-0" ADDENDUM 6  
DATED 5/31/09

All other Terms and Conditions shall remain the same.

This communication should be initialed by you and annexed to your proposal upon submission.

In case any bidder fails to conform to these instructions, its proposal will nevertheless be construed as though this communication had been so physically annexed and initialed.

THE PORT AUTHORITY OF NY & NJ

*for* *Shamsell Abdul*  
MITCHELL YONKLER, MANAGER  
CONSTRUCTION CONTRACT SERVICES

BIDDER'S FIRM NAME: TOTOR PERINI CORP.

INITIALED: *JMJ*

DATE: 8/11/09

QUESTIONS CONCERNING THIS ADDENDUM MAY BE ADDRESSED TO MR ALVIN CAESAR, WHO CAN BE REACHED AT (212) 435-5640 OR ACAESAR@PANYNJ.GOV.

08-11-09P02:51 RCVD



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PROCUREMENT DEPARTMENT  
ONE MADISON AVENUE 7<sup>TH</sup> FL.  
NEW YORK, NY 10010**

Date: July 1, 2009

**ADDENDUM No. 6**

To prospective bidders on contract WTC 224,545 for Greenwich Street Corridor Construction

- Bid due date is July 17, 2009, no later than 2:30 P.M.
- Original bid due date was June 22, 2009, no later than 2:30 P.M.

The following changes are hereby made in the documents:

**I. CHAPTER II – ADJUSTMENTS AND PAYMENTS**

Delete Section 28 entitled Compensation for Extra Work in its entirety and insert the attached Section 28 entitled Compensation for Extra Work.

**CHAPTER IV – CONDUCT OF CONTRACT**

Delete Section 46 entitled Extra Work Orders in its entirety and insert the attached Section 46 entitled Extra Work Orders.

**II. BIDDER QUESTIONS & ANSWERS**

The following information is made available in response to questions submitted by prospective bidders. It should not be deemed to answer all questions, which have been submitted by bidders to the Port Authority. It addresses only those questions, which the Port Authority has deemed to require additional information and/or clarification.

1	Q	The first sentence of General Note #2.12, on drawing #S2000, states that the Contractor shall maintain, protect, and relocate (if necessary) all lighting and power conduits, air pipes, wires (exposed and concealed), and signal and communication cables, conduits, cable and equipment during construction to maintain services. With regard to this contract requirement please clarify the following: (a) please clarify which contract documents or drawings identify where these existing utilities are impacted by the construction work; (b) since there is a significant cost difference between protecting existing utilities from damage versus relocating existing utilities that may conflict with the new work, please specifically identify which existing utilities will need to be relocated during the work; (c) if it is not known at this time which existing utilities are in conflict with the new work, then we suggest that the Port Authority provide a Lump Sum Allowance for all bidders to include in their bids to cover this contingency as there is no possible way for the bidders to accurately estimate the unknown impact and cost of complying with Note #2.12. Alternatively, this work can also be handled as a Net Cost item.
	A	Note is only applicable to permanent utilities as identified on the plans.
2	Q	The last sentence of General Note #2.12, on drawing #S2000, states that the Contractor shall insulate all construction equipment from the Ground to avoid accidental grounding. Please clarify if this statement is applicable to this contract, and if so, please identify where (what portions of the project - what work areas) the contractor's equipment must be protected from this safety hazard.
	A	Equipment grounding is required per applicable regulations.

	A	a. & b. Yes c. Yes d. No
59	Q	What are other insurance limits and deductibles for this contract?
	A	All other insurance limits and deductibles are listed in Sections 58 and 59.
60	Q	Subject: 9X All. Drawing #S2221, dated May 22, 2009: Do we need to put shear studs on these new 14 mini piles like other mini piles on this job?
	A	Yes.
61	Q	In addendum #5 RFI response #17 the Port Authority states that "All existing steel as part of underpinning shown in Package 9 steel is to be removed". Please clarify what is meant by your statement. A.) Should we include in our price the cost to remove all underpinning steel associated with package 9, such as minipiles, channels, horse-heads, tension rods, etc from items +/- -3 to 190? B.) Please identify the area on a drawing that details the limits for the removal of the underpinning steel. C.) Please clarify if the underpinning steel we are to include in our price is just the 9X zone or PKG 20 zone as well? D.) If we are to include the PKG 20 zone, and comply with item II of Article 35 TIME FOR COMPLETION AND DAMAGES FOR DELAY AND INCENTIVES and complete all remaining work within 570 calendar days after acceptance please provide us with a date for when we will be able to remove this underpinning steel in the PKG 20 zone. If you are unable to provide us with the WP-20 completion dates required for the removal of package 9 underpinning steel in the WP-20 area then we suggest deleting the removal of this steel from our scope of work.
	A	a. Yes within Pkg 9X limits b. See Pkg 9X drawings c. Pkg. 9X zone d. Not Applicable

All other Terms and Conditions shall remain the same.

This communication should be initiated by you and annexed to your proposal upon submission.

In case any bidder fails to conform to these instructions, its proposal will nevertheless be construed as though this communication had been so physically annexed and initiated.

THE PORT AUTHORITY OF NY & NJ

*for Alvin Caesar*  
 MITCHELL KONKLER, MANAGER  
 CONSTRUCTION PROCUREMENTS AND  
 INTEGRITY PROGRAMS

BIDDER'S FIRM NAME: TUTOR PERINI CORP.

INITIALED: *JMJ*

DATE: 8/11/09

08-11-09P02:51 RCVD

QUESTIONS CONCERNING THIS ADDENDUM MAY BE ADDRESSED TO MR ALVIN CAESAR, WHO CAN BE REACHED AT (212) 435-5640 OR ACAESAR@PANYNJ.GOV.



**THE PORT AUTHORITY OF NY & NJ**

**THE PORT AUTHORITY OF NEW YORK & NEW JERSEY  
PROCUREMENT DEPARTMENT  
ONE MADISON AVENUE 7<sup>TH</sup> FL.  
NEW YORK, NY 10010**

**Date: June 22, 2009**

**ADDENDUM No. 5**

To prospective bidders on contract WTC 224.545 for Greenwich Street Corridor Construction

**Bid due date is July 17, 2009, no later than 2:30 P.M.**

Original bid due date was June 22, 2009, no later than 2:30 P.M.

**The following changes are hereby made in the documents:**

**I. DIVISION 1 – GENERAL PROVISIONS**, Section 99 entitled Contract Drawings  
The following attached drawings supercede previous editions and are hereby incorporated into the contract documents:

GT 501	GT 701
GT 502	GT 702
GT 503	GT 704
S2221	GT 705
S1B	

**DIVISION 2 – SITEWORK**

Specification Section 02052 entitled Pre-Construction Condition Survey of Existing Structures is hereby incorporated into the contract documents.

**II. BIDDER QUESTIONS & ANSWERS**

The following information is made available in response to questions submitted by prospective bidders. It should not be deemed to answer all questions, which have been submitted by bidders to the Port Authority. It addresses only those questions, which the Port Authority has deemed to require additional information and/or clarification.

1	Q	The set of drawings entitled Work Package No. 9X-ALT. 1 includes the following drawings: GT701, GT702, FGT703, GT704, GT705, S1A and S1B. With regard to these drawings please clarify the following: (a) do these drawings show any work that is to be included in the bidders scope of work; (b) if so, then please clarify what work scope on these drawings is be included in the bidders Lump Sum Price; or, (c) do these drawings show existing features (work already performed by others) for reference purposes only; or (d) do these drawings show proposed work that is to be performed by others in the near future; and, (e) if the work is yet to be performed by others please clarify when the work is to be performed – during or after the work is performed in this contract.
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All other Terms and Conditions shall remain the same.

This communication should be initialed by you and annexed to your proposal upon submission.

In case any bidder fails to conform to these instructions, its proposal will nevertheless be construed as though this communication had been so physically annexed and initialed.

THE PORT AUTHORITY OF NY & NJ

  
MITCHELL YONKLER, MANAGER  
CONSTRUCTION CONTRACT SERVICES

BIDDER'S FIRM NAME: TUTOR PERINI CORP.

INITIALED: 

DATE: 8/11/09

QUESTIONS CONCERNING THIS ADDENDUM MAY BE ADDRESSED TO MR ALVIN CAESAR, WHO CAN BE REACHED AT (212) 435-5640 OR ACAESAR@PANYNJ.GOV.

08-11-09P02:51 RCVD



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**THE PORT AUTHORITY OF NEW YORK & NEW JERSEY  
PROCUREMENT DEPARTMENT  
ONE MADISON AVENUE 7<sup>TH</sup> FL.  
NEW YORK, NY 10010**

Date: June 18, 2009

**ADDENDUM No. 4**

To prospective bidders on contract WTC 22-1.545 for Greenwich Street Corridor Construction

Due back on July 17, 2009.

Originally due on June 22, 2009.

The following changes are hereby made in the documents:

**I. INFORMATION FOR BIDDERS.** Section 9 entitled Mandatory Pre-Bid Conference and Site Tour

A second voluntary Site Tour is scheduled for 10 A.M. on Tuesday, June 23, 2009. We will convene in conference room 19D at 115 Broadway, New York, New York. Each firm may have up to three (3) representatives, each of whom must bring their own personal protective equipment. Please e-mail Alvin Caesar at [acaesar@panynj.gov](mailto:acaesar@panynj.gov) to identify the representatives that will be attending by 1 P.M. Monday, June 22, 2009.

**II. DIVISION 2 – SITEWORK**

The following specification sections are hereby incorporated into the contract documents:

- Specification No. 02052 entitled "Pre-Construction Survey of Existing Structures"
- Specification No. 02340 entitled "Rock Reinforcement"

**DIVISION 4 – MASONRY**

This division, including specification sections, is deleted from the Contract.

**III. BIDDER QUESTIONS & ANSWERS**

The following information is made available in response to questions submitted by prospective bidders. It should not be deemed to answer all questions, which have been submitted by bidders to the Port Authority. It addresses only those questions, which the Port Authority has deemed to require additional information and/or clarification.

	Q	Please clarify if there is already temporary power established in the areas of work of this contract, which can be used by this Contractor during the performance of the work, and please clarify if there will be a cost to the Contractor for the use of the temporary power.
	A	See Attachment B notes for the location of temporary power

76	Q	Newly issued section 02229 sections 1.03.C and 2.02.A reference section 02228, and sections 1.03.B references section 02052. We do not have these sections. Please provide.
	A	<p>Regarding Specification No. 02228: The project site has been dewatered as a result of dewatering and excavating the remainder of the east basement to bedrock. Accordingly only dewatering due to some perched ground water remaining under the No. 1 subway structure, rain, and construction activity (i.e. drilling) would be required. Therefore a Contractor installed instrumentation program to monitor ground water and settlement is not required, so specification No. 02228 was not included in the contract. Any wells around the perimeter of the site required to monitor water levels outside of the east basement will be operated and monitored by the Authority.</p> <p>Regarding Specification No. 02052: This specification is for site pre-construction survey of existing structures. See attached specification.</p>

All other Terms and Conditions shall remain the same.

This communication should be initialed by you and annexed to your proposal upon submission.

In case any bidder fails to conform to these instructions, its proposal will nevertheless be construed as though this communication had been so physically annexed and initialed.

THE PORT AUTHORITY OF NY & NJ

*Mitchell Yonkler*  
 MITCHELL YONKLER, MANAGER  
 CONSTRUCTION CONTRACT SERVICES

BIDDER'S FIRM NAME: TOTAL PERINI CORP.

INITIALED: *Jmy*

DATE: 8/11/09

QUESTIONS CONCERNING THIS ADDENDUM MAY BE ADDRESSED TO MR ALVIN CAESAR, WHO CAN BE REACHED AT (212) 433-8630 OR ACAESAR@PANYNJ.GOV.

08-11-09P02:51 RCVD



**THE PORT AUTHORITY OF NY & NJ**

**THE PORT AUTHORITY OF NEW YORK & NEW JERSEY  
PROCUREMENT DEPARTMENT  
ONE MADISON AVENUE 7<sup>TH</sup> FL.  
NEW YORK, NY 10010**

Date: June 17, 2009

**ADDENDUM No. 3**

**TO PROSPECTIVE BIDDERS ON CONTRACT WTC 224.545, GREENWICH STREET CORRIDOR CONSTRUCTION**

**The following changes are hereby made in the documents:**

- I. INFORMATION FOR BIDDERS, Section 7 – Available Documents**  
The following drawings are removed from Section 7, Available Documents, and made part of Section 100, Reference Drawings:

DWG NO.	DRAWING TITLE
<b>ADVANCE CONTRACT - ROCK EXCAVATION AT EAST BATHTUB</b>	
<b>GEOMETRY PLANS</b>	
G5010	GEOMETRY PLAN CENTRAL PLANT LEVEL EL. 220'-0"
G5011	GEOMETRY PLAN CENTRAL PLANT LEVEL EL. 229'-6"
G5012	GEOMETRY PLAN INVERT CAR PARKING LEVEL EL. 242'/237'
G5101	GEOMETRY PLAN CENTRAL FAN PLANT LEVEL EL. 220'-0"
G5111	GEOMETRY PART PLAN CENTRAL PLANT LEVEL EL. 229'-6"
G5121	GEOMETRY PART PLAN CAR PARKING LEVEL EL. 237'
<b>GEOTECHNICAL</b>	
GT2003	INSTRUMENTATION AND ROCK EXCAVATION PLANS - EAST BATHTUB
GT7509	FOUNDATION EXCAVATION NOTES AND DETAILS
<b>STRUCTURAL</b>	
<b>GENERAL PLANS</b>	
S0112	CENTRAL PLANT LEVEL OVERALL PLAN 2 EL. 229'-6"
S0122	CAR PARK LEVEL OVERALL PLAN 2 - EL. 237'
<b>FRAMING PLANS</b>	
S1102	SUPPLY DUCT LEVEL PART PLAN 6 EL. 220'
S1103	CENTRAL PLANT LEVEL PART PLAN 3 EL. 229'-6"
S1104	CENTRAL PLANT LEVEL PART PLAN 4 EL. 229'-6"
S1105	CENTRAL PLANT LEVEL PART PLAN 5 EL. 229'-6"
S1106	CENTRAL PLANT LEVEL PART PLAN 6 EL. 229'-6"
S1203	CAR PARKING LEVEL PART PLAN 03 EL. 237'

83	Q	Please refer to Drawing GT504 which indicates both earth and rock is to be removed to the limits west of the existing Greenwich slurry wall panels G12 to G23 and under the existing PATH platform. Please advise if the platform demolition and structural steel removal is in the Greenwich Street Corridor scope.
	A	GT504 is rock excavation detail. Limits of rock excavation detail are identified in GT501 and GT502. See sketch SK-1 For limits of Slurry Wall removal.
84	Q	Please refer to Drawings GT501, GT502, and GT504 Rock Elevation Details- should the contractor assume that the Tower 2, 3, and 4 Top of Rock Elevation is Elv.240?
	A	Yes
85	Q	Please refer to Drawings GT501, GT502, and GT504 Rock Elevation Details- What is the prevailing rock elevation west of the Greenwich street Slurry Wall?
	A	Rock excavation west of the Greenwich Street slurry wall is not part of this Contract.
86	Q	Please refer to Drawings GT502, GT504 Rock Elevation Details- Will rock bolts be required in rock cuts for foundations, Super Columns, and manholes?
	A	See Note 1A on GT504
87	Q	Please refer to Drawings S1B & GT501 Cast in Place Panels VG1 & LG2- Drawing S1B shows the bottom of the wall socked to rock at EL 253. Drawing GT501 calls for rock removal to EL 239 at Liberty and 235.5 at Vesey or 17.5' below the bottom of wall. Should the rock excavation stand off the rock socket or is there a plan to buttress the bottom of the wall?
	A	See Section SB on Drawing S2130.

All other Terms and Conditions shall remain the same.

This communication should be initialed by you and annexed to your proposal upon submission.

In case any bidder fails to conform to these instructions, its proposal will nevertheless be construed as though this communication had been so physically annexed and initialed.

THE PORT AUTHORITY OF NY & NJ

*for Alvin Caesar*  
MITCHELL YONKLER, MANAGER  
CONSTRUCTION CONTRACT SERVICES

BIDDER'S FIRM NAME: TUTOR PERINI CORP.

INITIALED: *JMJ*

DATE: 8/11/09

QUESTIONS CONCERNING THIS ADDENDUM MAY BE ADDRESSED TO MR. ALVIN CAESAR, WHO CAN BE REACHED AT (212) 435-5640 OR ACAESAR@PANYNJ.GOV.

08-11-09 02:52 RCND

All other Terms and Conditions shall remain the same.

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In case any bidder fails to conform to these instructions, its proposal will nevertheless be construed as though this communication had been so physically annexed and initialed.

THE PORT AUTHORITY OF NY & NJ

  
MITCHELL YONKLER, MANAGER  
CONSTRUCTION CONTRACT SERVICES

BIDDER'S FIRM NAME: WTOR PERINI CORP.

INITIALED: 

DATE: 8/11/09

QUESTIONS CONCERNING THIS ADDENDUM MAY BE ADDRESSED TO MR ALVIN CAESAR, WHO CAN BE REACHED AT (212) 435-5640 OR ACAESAR@PANYNJ.GOV.

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PROCUREMENT DEPARTMENT  
ONE MADISON AVENUE 7<sup>TH</sup> FL.  
NEW YORK, NY 10010

Date: June 15, 2009

**ADDENDUM No. 2**

TO PROSPECTIVE BIDDERS ON CONTRACT WTC 224.515, GREENWICH STREET CORRIDOR CONSTRUCTION

The following changes are hereby made in the documents:

- I. **INFORMATION FOR BIDDER, Article 1, Form and Submission of Proposals.**  
The Bid due date is changed from Monday, June 22, 2009 to Friday, July 17, 2009.
- II. **ATTACHMENT B**  
Enclosed are Greenwich Corridor Site Access and Staging Restrictions drawings GCSA-001 and GCSA-002. Insert in contract documents as Attachment B.
- III. **DIVISION 2 – SITEWORK**  
Please insert the attached Specification Section 02229, Instrumentation, into the Contract book.
- IV. **BIDDER QUESTIONS & ANSWERS**  
The following information is made available in response to questions submitted by prospective bidders. It should not be deemed to answer all questions, which have been submitted by bidders to the Port Authority. It addresses only those questions, which the Port Authority has deemed to require additional information and/or clarification.

1	Q	Being that all bidders have pre-qualified for this project, we assume that this procurement is being handled as a public bid opening at the stated time for all pre-qualified bidders, and will be awarded to the lowest pre-qualified bidder.
	A	If Contract is awarded, it will be awarded to the lowest, pre-qualified, responsive and responsible bidder.
2	Q	Paragraph # 2D – Papers Accompanying Proposals, on page #3 of the Contract Booklet, includes an analysis of bid as being one of the documents that must accompany the bidders proposal for this project. However, the Contract Booklet does not provide an analysis of bid for the bidders to execute for this project. Please clarify.
	A	Analysis of bid has been provided in Addendum # 1.
3	Q	Typically with Port Authority bid proposals the bidders are provided with two copies of the Contract Booklet; one copy is for the bidder's use and the other copy is submitted with the bid. However, for this bid proposal, the bidders were provided with only one copy of the Contract Booklet. Therefore, please clarify whether or not the bidders are to return the entire Contract Booklet with the submittal of their bids as is usually done on Port Authority bids, or will the Port Authority issue a second Contract Booklet, or is some other procedure to be followed for this bid proposal.



**THE PORT AUTHORITY OF NY & NJ**

**THE PORT AUTHORITY OF NEW YORK & NEW JERSEY  
PROCUREMENT DEPARTMENT  
ONE MADISON AVENUE 7<sup>TH</sup> FL.  
NEW YORK, NY 10010**

Date: June 5, 2009

**ADDENDUM No. 1**

**TO PROSPECTIVE BIDDERS ON CONTRACT WTC 224.545. GREENWICH STREET CORRIDOR CONSTRUCTION**

The mandatory pre-bid conference and site tour is changed from Tuesday, June 9, 2009 to Friday, June 12, 2009. Start time and location remain the same.

The following changes are hereby made in the documents:

**I. INFORMATION FOR BIDDER**

**A. Article 2. PAPERS ACCOMPANYING PROPOSALS, Paragraph D.**

Each bid must be accompanied with the attached Analysis of Bid sheet.

**B. Article 10. QUESTIONS BY BIDDERS**

Questions by prospective bidders concerning the Contract may be addressed to Alvin Caesar at (212) 435- 5640 or by e-mail at [acaesar@panynj.gov](mailto:acaesar@panynj.gov).

**C. Article 18. PROTEST PROCEDURES**

Delete Article 18 in its entirety and replace with:

The information found in the following link is the sole administrative remedy for protesting procurement decisions:

[http://www.panynj.gov/DoingBusinessWith/contractors/pdfs/Protest\\_Procedures.pdf](http://www.panynj.gov/DoingBusinessWith/contractors/pdfs/Protest_Procedures.pdf)

**II. FORM OF CONTRACT, CHAPTER III, PROVISIONS RELATING TO TIME**

**A. Article 37. IDLE SALARIED MEN AND EQUIPMENT, fifteenth line.**

Insert "not to exceed amount of" in front of seven per cent (7%).

	<i>Answer</i>	Article 21 on Page 38 is the correct place to enter the lump sum bid amount.
4	<i>Question</i>	Please refer to your Specifications, page 38, # 21, General Agreement. Is this "another" place to enter our Bid? Please clarify.
	<i>Answer</i>	Article 21 on Page 38 is the correct place to enter the lump sum bid amount.

All other Terms and Conditions shall remain the same.

This communication should be initialed by you and annexed to your proposal upon submission.

In case any proposer fails to conform to these instructions, its proposal will nevertheless be construed as though this communication had been so physically annexed and initialed.

THE PORT AUTHORITY OF NY & NJ

*Mitchell Yonkler*  
 for MITCHELL YONKLER, MANAGER  
 CONSTRUCTION CONTRACT  
 SERVICES

PROPOSER'S FIRM NAME: TOTOR PERINI CORP.

INITIALED: *JMY*

DATE: 8/11/09

QUESTIONS CONCERNING THIS ADDENDUM MAY BE ADDRESSED TO MR ALVIN CAESAR, WHO CAN BE REACHED AT (212) 435-5640 OR ACAESAR@PANYNJ.GOV.

08-11-09P02:52 RCVD