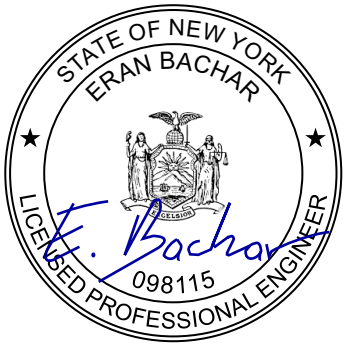
Metro-North Railroad
Upper Harlem Parking Improvements at Croton Falls
Package 2 – Surface Parking Lot
Contract No. 142486

Technical Specifications



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SECTION – 02 41 16

DEMOLITION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Section includes demolition and removal of the following:

1. Demolishing or relocating site utilities
2. Protection of adjacent structures

1.02 RELATED SECTIONS

A. Division 01 Specification Sections

B. Section 02 84 30 – Universal Waste and Miscellaneous Hazardous Materials

1.03 REFERENCES

A. American National Standards Institute (ANSI)

1. ANSI A10.6-2006 Safety Requirements for Demolition Operations

B. National Fire Protection Association (NFPA)

C. NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations

D. 2016 New York State Building Code Chapter 33: Safeguards During Construction

1.04 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Authority that may be encountered during building demolition remain Authority's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Engineer.

1.05 QUALITY ASSURANCE

A. Perform a level of Quality Control in conformance with the requirements of Section 01 43 00 – Quality Assurance.

B. Provide Quality Work Plan as required by Section 01 43 00 – Quality Assurance.

C. Professional Engineer performing the condition surveys, preparing the demolition plan and designing any temporary shoring that might be necessary during demolition shall have a license in the state of New York and shall have a minimum of five years' experience in demolition work.

D. Refrigerant Recovery Technician Qualifications: Certified by EPA approved certification program.

E. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

F. Standards: Comply with ANSI A10.6 and NFPA 241.

G. Comply with the requirements of the 2016 New York State Building Code Chapter

33: Safeguards During Construction.

H. Comply with the requirements of the 2016 New York State Building Code Chapter 33: Safeguards During Construction.

I. Pre-demolition Conference: Conduct conference at Project site.

1.06 SUBMITTALS

A. Provide copies of submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Qualification Data: For the following:

1. Professional Engineer

2. Refrigerant recovery technician: Evidence of EPA certification

C. Proposed Protection and Control Measures: Submit documentation or drawing that indicates the proposed measures for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate. Include measures for the following:

1. Environmental protection

2. Dust control

3. Noise control

D. Schedule of Demolition Activities: Indicate detailed sequence of demolition and removal work, with starting and ending dates for each activity, interruption of utility services, and locations of temporary protection.

E. Plan of demolition work prepared by professional engineer.

F. Pre-demolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, which might be misconstrued as damage caused by building demolition operations.

G. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

I. Recycled Records: Indicate receipt and acceptance of recycled material by the transfer facility or vendor licensed to accept material.

1.07 PROJECT CONDITIONS

A. Authority assumes no responsibility for buildings and structures to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Authority as far as practical.

B. Hazardous Materials: Hazardous materials are present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Division 2.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of demolition required.

B. Review Project Record Documents of existing construction provided by Authority. Authority does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Inventory and record the condition of items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to the Engineer.

3.02 PREPARATION

A. Refrigerant: Remove and store refrigerant according to 40 CFR 82 and regulations of authorities having jurisdiction.

B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities to be relocated.

1. Arrange to shut off indicated utilities with utility companies.

2. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

C. Removed and Salvaged Items: Comply with the following:

1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers.

3. Store items in secure area until reused

4. Transport items to storage area.

5. Protect items from damage during transport and storage.

D. Remove and dispose of debris and other materials.

3.03 PROTECTION

A. Existing Facilities: Protect adjacent walkways, driveway and the temporary parking area during demolition operations.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by the Engineer, items may be removed to a suitable, protected storage location during demolition and cleaned and reinstalled in their original locations after demolition operations are complete.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by the NYSBC and as

indicated. Comply with requirements in Division 1.

1. Protect existing site improvements, appurtenances, and landscaping to remain.
2. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
3. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.

3.04 ELECTRICAL DEMOLITION

A. Preparation

1. Inspection: Existing conditions and removals of electrical items are not completely detailed on the Contract Drawings. Survey the Work Site to determine full extent of the existing conditions including conditions that may affect the work, and make necessary changes as required based on the existing conditions. Include all such details in Shop Drawings. Obtain Engineer's acceptance of any changes before initiating them.
2. Protection: Provide temporary protection so that the existing structure is protected from damage or defacement. Provide temporary protection from damage for all remaining installations. Contractor shall be responsible for damage occurring to the existing structure or its contents because of the insufficiency of protection. Contractor shall make repairs or replacements as required and reviewed by the Engineer.
3. Verify that circuits are de-energized, locked out, and tagged prior to demolition and removal.

B. Procedure For Removal Of Equipment Previously Abandoned

1. Verify that "abandoned" wiring and equipment serve only abandoned facilities.
2. Remove electrical equipment, which was previously abandoned, as indicated on the Contract Drawings, or as specified, or if encountered within the work area.
3. Remove conduits and wiring. Conduits that are concealed in walls, floors, or ceilings not being removed, shall be cut flush with remaining structures surfaces and abandoned in place.
4. Remove fittings, supports, and accessories.
5. Legally dispose of unused removed equipment off-site.

C. Procedure For Demolition And Removal Of Equipment

1. Ensure that the circuits to be worked on have been de-energized.
2. Disconnect, demolish and remove electrical equipment including, but not limited to, lighting fixtures, wiring devices, and serving utilization equipment that has been removed, as indicated on the Contract Drawings, or as specified, or as required.
3. Disconnect electrical systems on or in walls, floors, and ceilings scheduled

for removal. Provide wiring and connections to maintain existing systems in service.

4. The lighting fixtures lamps and ballasts should be properly disposed unless otherwise informed by the Engineer.

5. Legally dispose of unused removed equipment off-site.

D. General Electrical Demolition

1. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the work, remove damaged portions and install new products of equal capacity, quality, and functionality at no additional cost to the owner. Report such damage to the Engineer.

2. Verification: Verify field measurements and circuiting indicated. Report any discrepancies to the Engineer.

3. Accessible Inactive Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

4. Buried and Concealed Work Abandoned in Place: Cut and remove buried raceway and wiring indicated to be abandoned in place, two inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish. Remove wiring and cables in their entirety or to locations indicated.

5. Switchovers: Disable system only to make switchovers and final connections. Minimize outage duration.

6. Patching and Sealing: Patch holes after removing items. Fire seal openings as indicated.

7. Tags: Tag all conduits and circuits to remain.

8. Disposal, Recovery and Recycling: Comply with all applicable EPA, DOT, OSHA, and other applicable regulations and ordinances, including handling, labeling, storage, and transportation requirements.

9. Legally dispose of unused removed material off-site.

3.05 EXPLOSIVE DEMOLITION

A. Explosives: Use of explosives is not permitted.

3.06 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.07 REPAIRS

A. Promptly repair damage to adjacent construction caused by building demolition operations.

B. Where repairs to existing surfaces are required, patch to produce surfaces suitable

for new materials.

C. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

3.08 RECYCLING DEMOLISHED MATERIALS

A. Separate recyclable demolished materials from other demolished materials to the maximum extent possible. Separate recyclable materials by type.

1. Provide containers or other storage method approved by the Engineer for controlling recyclable materials until they are removed from Project site.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3. Stockpile materials away from demolition area. Do not store within drip line of remaining trees.

4. Store components off the ground and protect from the weather.

5. Transport recyclable materials off Authority's property and legally dispose of them.

3.09 DISPOSAL OF DEMOLISHED MATERIALS

A. Except for items or materials to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Authority's property, remove demolished materials from Project site and legally dispose of them.

1. Do not allow demolished materials to accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Authority's property and legally dispose of them.

3.10 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations beg

3.11 SUBMITTAL APPROVALS

A. This table describes the action related to the Authority. Approval means approval by the Engineer.

B. This table is provided as a convenience to the Contractor, contract requirements are indicated in Part 1 of this Section.

Item No.	Paragraph No.	Submittal	Action
1	1.5B	Quality Work Plan	Approval
2	1.6B	Qualification Data	Approval
3	1.6C	Proposed Protection and Control Measures	Approval
4	1.6D	Schedule of Building Demolition Activities	Approval
5	1.6E	Plan of Demolition Work	Approval
6	1.6F	Pre-demolition Photographs or Videotape	Information
7	1.6G	Landfill Records	Information
8	1.6H	Statement of Refrigerant Recovery	Information
9	1.6I	Recycled Records	Information

END OF SECTION

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SECTION – 02 56 39

TEMPORARY TREE AND PLANT PROTECTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and other Division 01 Specification Sections, apply to the Work of this Section.

1.02 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.03 DEFINITIONS

A. Caliper Diameter at Breast Height (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape at a height 54 inches above the ground line for trees with caliper of 8 inches or greater as measured at a height of 12 inches above the ground.

B. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings. TPZ's are defined by the drip line of trees to remain or a minimum of 4 feet from the edge of the tree trunk. Where overlapping, TPZ's are defined by a shape that extends to the outermost boundaries of each grouping of trees indicated.

C. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

a. Tree-service firm's personnel and equipment needed to make progress and avoid delays.

b. Arborist's responsibilities.

c. Quality-control program.

d. Coordination of Work and equipment movement within and around the locations of protection zones.

e. Trenching by hand or with air spade within and around protection zones.

f. Field quality control.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of the following:

1. Organic Mulch: 1-quart volume of organic mulch; in sealed plastic bags

labeled with composition of materials by percentage of weight and source of mulch.

2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.

3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.

2. Location on site plan. Include unique identifier for each.

3. Reason for pruning.

4. Description of pruning to be performed.

5. Description of maintenance following pruning.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.

2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

3. Concurrence of initial condition on City property must be obtained from NYCDEP prior to start of work.

E. Quality-control program.

1.07 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA – minimum 10 years in-field experience.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the

arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

D. Tree pruning standards: Comply with ANSI A300, "Trees, Shrubs and Other Woody Plant Maintenance – Standard Practices", and the "Standards of Shade Trees", current edition, as published by National Arborist Association, The Meeting Place Mall, Route 101, PO Box 1494, Amherst, NH 03031-1094.

1.08 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. No entrance into tree protection zones on City property will be allowed.
2. Storage of construction materials, debris, or excavated material.
3. Moving or parking vehicles or equipment.
4. Foot traffic.
5. Erection of sheds or structures.
6. Impoundment of water.
7. Excavation or other digs unless otherwise indicated.
8. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
9. Spillage of construction materials hazardous to vegetation.
10. Felling of trees into tree protected areas.
11. Trenching operations.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

1.09 SEQUENCING AND SCHEDULING

A. Engineer/Owner shall review and approve tree protection devices installation prior to start of removals work.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Organic Mulch to be applied only on Metro-North Railroad property: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood bark or wood and bark chips.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural.

B. Anti-desiccant to be apllied only on Metro-North Railroad property: "Wilt-pruf NCF" anti-desiccant by Wilt-Pruf Products, Inc., "Cloud Cover" by Easy Gardener", or approved equal conforming to the following:

1. 100% organic and biodegradable, and not damaged by freezing.

C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements:

1. Tree Protection Fence, Wood Protection Zone Fencing: Within 15 feet of the limits of disturbance or as directed by NYCDEP on city property, the permittee shall install protective barriers made of 3/8-inch-thick plywood or other rigid material acceptable to NYCDEP around all trees greater than 4 inches in diameter to remain on site at completion of the work, including those adjacent to storage, staging or stockpiling areas. Barriers shall be adequately framed and anchored to the ground to withstand impacts from equipment. Barriers shall be at least 4 feet tall and 4 feet wide, or wide enough to completely shield the area to be protected from equipment entry. Barriers shall be placed on the operational side(s) of trees to remain, with trees centered behind them, and shall be located as far from trees to remain as possible. In no case shall barriers be located less than 4 feet away from the trunks of trees to remain.

a. Color: Natural, no staining.

2. Temporary Plastic Barrier Fence, Consisting of plastic safety mesh; secured to wood frame with uv-stable plastic bands or galvanized-steel or stainless-steel wire ties;

a. Height: 48 inches.

b. If the plastic safety mesh is not continuous, overlap 6 inches at joints

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with non-fading lettering and as follows:

1. Size and Text: 8-1/2 inches by 12 inches minimum. Text to read "Tree Protection Zone" or as directed by the Engineer.

2. Lettering: 1-inch-high minimum, black characters on white background.

3. Signage to be provided by Owner.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.02 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Flag each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious

materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.

1. Apply 2-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

2. No mulching or Anti-desiccants may occur or be used on New York City property.

3.03 ARBORIST

A. Supervise the installation and placement of landscape protection fencing.

B. Oversee the protection of trees throughout the course of the project.

C. Coordinate with Owner's Arborist throughout project duration. Notify Engineer/Owner immediately of any damage or root zone conflicts.

3.04 PROTECTION ZONES

A. No entrance into tree protection zones on City property will be allowed.

B. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

C. Maintenance of Protection-Zone Fencing: The contractor shall be responsible for the repair and replacement of any part of new or existing protective fencing throughout the duration of the project.

D. Where construction work is required within the branch spread of trees that are to remain, the work shall be performed under the direction of the Arborist.

E. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Engineer/Owner. Install one sign spaced approximately every 20 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.

F. Maintain protection zones free of weeds and trash.

G. Maintain protection-zone fencing and signage in good condition as acceptable to Engineer/Owner and remove when construction operations are complete, and equipment has been removed from the site.

1. No entrance into tree protection zones on City property will be allowed.

2. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.

3. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.05 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 31 20 00 – Earth Moving unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.06 ROOT PRUNING

A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches (38 mm) in diameter with a coating formulated for use on damaged plant tissues and that is acceptable to arborist. Cover with wet burlap and maintain moist.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Section 31 20 00 – Earth Moving.

B. Root Pruning at Edge of Protection Zone: Prune tree roots flush with the edge of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.07 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.

1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
    a. Type of Pruning: Cleaning where indicated.

B. Unless otherwise directed by arborist and acceptable to Engineer/Owner, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

3.08 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.09 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.10 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Engineer/Owner

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Owner. Replacement value of trees shall

be that which was established based on value in Arborist's report.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition or are damaged during construction operations that Owner determines are incapable of restoring to normal growth pattern.

1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 4 inches or smaller in caliper size.

2. Large Trees: Provide the number of replacement trees to reoccupy the crown space of the removed tree assuming a replacement tree spacing of 10 feet on center with a minimum of two new trees of 3-inch caliper size for each tree being replaced that measures more than 4 inches in caliper size.

a. Species: As selected by Engineer/Owner. In addition, any tree replacement species that occur on city property shall require the approval of NYCDEP.

b. If species is a non-native, NYCDEP will request replacements of a different species.

3. Plant and maintain new trees as specified in Section 32 93 00 – Plants.

C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch 4-inch Insert dimension uniform thickness to remain.

D. Soil Aeration: Where directed by Engineer or Owner, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

E. Post-Construction – Remove protective fencing, wood chips, debris and all surplus construction materials from site following construction, in a manner that will not damage tree preservation areas as directed by Owner.

3.11 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION

SECTION – 02 61 00

SAMPLING, TESTING, HANDLING, LOADING, REMOVAL AND DISPOSAL OF SOILS

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes requirements for the sampling, testing, loading, handling, on-site reuse, and off-site transport and disposal of soils. Requirements of this section apply to:

1. Soils to be excavated and re-used within the project limits or relocated from one Metro-North Railroad property / location to another; moved from one location to another that is not within the contiguous confines of the work site subject to the approval of Metro-North Railroad Department of Environmental Compliance and Services, and

2. Soils to be removed from Metro-North Railroad property and disposed of off-site at an appropriately permitted disposal facility subject to the approval of Metro-North Railroad Department of Environmental Compliance and Services.

B. The Contractor shall provide a qualified Environmental Professional (EP) to support the work required by this section.

C. The Contractor shall utilize transportation and disposal facilities from Metro-North Railroad's list of approved facilities. See Section 01 74 19 Appendix "Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories."

D. The Contractor must comply with all applicable Federal, State, County and Local regulations. The more restrictive law, rules and regulations will govern, including revisions to date of Contract.

E. It shall be known that terms in the singular may represent terms in the plural (i.e. laboratory / laboratories, facility / facilities, transporter / transporters).

1.02 RELATED SECTIONS

A. Section 01 35 43 Environmental Protection

B. Section 01 74 19 Construction Waste Management and Disposal

C. Section 31 20 00 Earth Moving

1.03 ABBREVIATIONS AND ACRONYMS

A.	ASP	Analytical Services Protocol
B.	ASTM	American Society for Testing and Materials
C.	BUD	Beneficial Use Determination
D.	C&D	Construction and Demolition
E.	CFR	Code of Federal Regulations
F.	ECL	Environmental Conservation Law
G.	ELAP	Environmental Laboratory Approval Program

H.	EP	Environmental Professional
I.	FSP	Field Sampling Plan
J.	SCR	Soils Characterization Report
K.	NYCRR	New York Codes, Rules and Regulations
L.	NYS	New York State
M.	NYSDEC	New York State Department of Environmental Conservation
N.	NYSDOH	New York State Department of Health
O.	PCBs	Polychlorinated Biphenyls
P.	PPB	Parts per Billion
Q.	PPM	Parts Per Million
R.	QA/QC	Quality Assurance/ Quality Control
S.	SCO	Soil Cleanup Objective
T.	SCL	Soil Cleanup Level
U.	SHP	Soil Handling Plan
V.	SHECP	Safety, Health and Environmental Control Plan
W.	SSCO	Supplemental Soil Cleanup Objectives
X.	TAL	Target Analyte List
Y.	TCL	Target Compound List
Z.	TPHC	Total Petroleum Hydrocarbon
AA.	WTS	Waste Technology Services

1.04 STANDARDS AND REGULATIONS

A. Protection of underground facilities shall be conducted in accordance with Metro-North Railroad's "Protection of Underground Metro-North Railroad Facilities", 16 NYCRR Part 753, and Dig Safely New York.

B. The Contractor must comply with all applicable rules and regulations, including but not limited to, the applicable provisions of the following regulatory agencies:

1. United States Department of Transportation
2. United States Environmental Protection Agency
3. Occupational Safety and Health Administration
4. New York State Department of Environmental Conservation
5. New York State Department of Health
6. New York State Department of Transportation
7. Metropolitan Transportation Authority

1.05 SUBMITTALS

A. General

1. The Contractor must prepare and submit for approval three (3) copies of the submittals required by this section. Submittals shall be transmitted to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer. Submittals shall be in accordance with the requirements of the general terms and conditions and the requirements of this Section.

2. Do not submit subsequent submittals until previous submittals are approved by Metro-North Railroad Department of Environmental Compliance and Services (i.e. approval of the Soil Handling Plan is contingent upon approval of the Field Sampling Report and the Field Sampling Summary and Soils Characterization Report).

3. See Section 1.6 Quality Assurance for submittal content / requirements.

B. Schedule

1. The Contractor must include the work required by this section in its anticipated schedule.

C. Environmental Professional (EP)

1. The Contractor shall identify and provide the credentials of the firm and/or individual serving in this capacity. See Section 1.6(B)

D. Field Sampling Plan (FSP)

1. Prepare a Field Sampling Plan (FSP) that prescribes the sampling and laboratory analyses to characterize soils for suitability for reuse on-site and/or off-site disposal. See Section 1.6(C) and (D).

E. Analytical Laboratories Certifications & Accreditations

1. Identify the analytical laboratory to be utilized and provide their accreditations and credentials for the analyses to be performed. See Section 1.6(E)

F. Soils Characterization Report (SCR)

1. Submit a Soils Characterization Report (SCR) within twenty-one (21) days of completion of the work outlined in the Field Sampling Plan (FSP) and receipt of laboratory analytical data. See Section 1.6(F)

G. Soil Handling Plan (SHP)

1. Submit a Soil Handling Plan (SHP) upon approval of the Soils Characterization Report (SCR). See Section 1.6(G)

H. Transporter Information

1. Identify the proposed transporter to be utilized for each of the soil classifications and provide their transporter permits and licenses for the soil classifications they will be hauling. See Sections 1.6(H), and 3.8.

2. The proposed transporter shall be from Metro-North Railroad's list of approved transporters. See Section 01 74 19 Appendix "Metro-North

Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories".

I. Disposal Facility Information

1. Identify the proposed disposal facility to be utilized for each of the soil classifications and provide their permits and licenses for the soil classifications they will be accepting. See Sections 1.6(I), and 3.8.

2. The proposed disposal facility shall be from Metro-North Railroad's list of approved disposal facilities. See 01 74 19 Appendix "Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories".

J. Waste Manifest Records, Shipment Records and Certificates of Disposal

1. Provide applicable waste manifest records, bills of lading, shipment records, scale tickets, and certificates of disposal for each truck and/or container load of soil taken off-site for disposal.

1.06 QUALITY ASSURANCE

A. Schedule

1. The Contractor must include the work required by this section in its schedule. The schedule shall include the time required for the preparation and review of the submittals by the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer, and actual performance of the work required by this section (i.e. field sampling, laboratory analysis, soils characterization/classification, soil excavation and placement, loading of soils for transport, backfill/re-use/placement, off site removal and disposal).

2. In order to prevent delays in the schedule, the Contractor must anticipate and allot time for the following in their schedule:

a. Preparation of the FSP (to be determined by the Contractor)

b. Review/approval of the FSP by the Metro-North Department of Environmental Compliance and Services and the Engineer

c. Implementation of the FSP, including collection of samples, and analysis of soil samples by the laboratory (to be determined by the Contractor)

3. Preparation of the SCR within twenty-one (21) days of completion of the work outlined in the Field Sampling Plan (FSP) and receipt of laboratory analytical data. See Section 1.6(F)

a. Review/approval of the SCR by the Metro-North Department of Environmental Compliance and Services and the Engineer

b. Preparation of the SHP (to be determined by the Contractor)

c. Review/approval of the SHP by the Metro-North Department of Environmental Compliance and Services and the Engineer

d. Implementation of the SHP, including re-use and/or loading, off-site

transport and disposal of soils (to be determined by the Contractor)

e. Receipt of waste manifest records, shipment records and certificates of disposal (to be determined by the Contractor)

B. Environmental Professional (EP)

1. The Contractor shall provide an individual to serve as the Environmental Professional (EP) and support the work required by this section. The Contractor shall submit a qualifications package on the firm and/or individual fulfilling this roll. At a minimum, the EP shall meet the following requirements:

a. The Environmental Professional possess sufficient specific education, training, and experience necessary to exercise professional judgment to develop opinions and conclusions regarding conditions indicative of releases or threatened releases on, at, in, or to a property, sufficient to meet the objectives and performance of the work required by this section.

b. The Environmental Professional must:

1) Hold a current Professional Engineer's or Professional Geologist's license and have the equivalent of three (3) years of full-time relevant experience; or

2) Be licensed or certified by the federal government or state to perform environmental assessments and have the equivalent of three (3) years of full-time relevant experience; or

3) Have a Baccalaureate or higher degree from an accredited institution of higher education in a discipline of engineering or science and the equivalent of five (5) years of full-time relevant experience; or

4) Demonstrate a minimum of ten (10) years of experience in performing similar work (i.e. developing field sampling strategies, soil sampling, interpretation of laboratory data/sample results, characterization of soils for disposal)

c. Relevant experience, as used in the definition of Environmental Professional in this section, means: participation in the performance of all appropriate inquiries, investigations, environmental site assessments, or other site investigations that may include environmental analyses, investigations, and remediation which involve the understanding of surface and subsurface environmental conditions and the processes used to evaluate these conditions and for which professional judgment was used to develop opinions regarding conditions indicative of releases or threatened releases to the subject property.

C. Field Sampling Plan (FSP)

1. The Contractor must conduct soil testing pursuant to a Field Sampling Plan (FSP) approved by Metro-North Railroad Department of Environmental Compliance and Services. The Contractor must submit a Field Sampling

Plan (FSP) meeting all requirements of this Section to the Metro-North Department of Environmental Compliance and Services and the Engineer for approval.

2. The resulting data shall be used to prepare a Soils Characterization Report (SCR) See Section 1.6(F) for purposes of classifying the soil types present at the site; determining whether reuse/backfilling of the soil is allowable; determining appropriate Personal Protective Equipment for those who will come in contact with the soil; and identifying what Metro-North-approved transporters and disposal sites will be used in connection with the proper transport and disposal of soils that cannot be backfilled/re-used on site. The Contractor is also required to prepare a Soil Handling Plan (SHP) based upon the information obtained during the preparation and execution of the FSP and SCR. See Section 1.6(G).

3. The FSP must include, but is not limited to, the following:

   a. The testing program to be conducted for all soils in the areas to be excavated during construction (including all associated utility and support work). Identification of the proposed in-situ and/or stockpile samples per unit volume as required by Part 1.06D Soil Sampling and Testing of this Section. Where applicable, the FSP will divide areas into distinct in-situ or stockpiled segments, identifying the volume of soil or fill that each sample will represent. The FSP shall include methodology to complete sampling of in-situ or stockpiled soil to obtain a continuous vertical profile of the soil in order to allow for compositing of samples for proper classification.

   b. Description of sampling procedures and equipment to be used. Description of the method to be utilized to prevent mixing of soil if obvious changes in condition are encountered. Samples shall be placed in laboratory-clean sample containers provided by the analytical laboratory.

   c. The depths to which sampling will be conducted. The sampling depths shall be commensurate with the depth of soils to be encountered during excavation; as either required by the Contract, or by the anticipated depth of the substructure to be installed.

   d. The visual and olfactory inspection of all samples by the Environmental Professional (EP), when they are being collected in the field, to verify the presence or absence of petroleum and/or other such evidence of potential contamination.

   e. Identification of the sample container labeling and sample handling protocol. Immediately after sample collection, each sample container shall be properly sealed to ensure its integrity through receipt at the laboratory. Each sample container shall be labeled with a unique sample identification number just prior to, or immediately after, sample collection and sealing of the container. The sample identification number shall directly correlate to the attributes of that sample, including but not limited to, contract number, project description, project location, Contractor's name, sample location, sample depth, date and time of sampling, sample

inventory number as it correlates to sampling grid, and parameters to be analyzed. Sample attributes shall be recorded on a sampling data sheet and/or chain-of-custody form.

f. A scaled drawing or map of the site showing existing fixed landmarks and the proposed excavation limits. The drawing/map will contain specific sampling locations or proposed stockpiling sampling that will conform to the sampling frequency requirements set forth in Part 1.06 D. Soil Sampling and Testing.

g. A description of how the contractor will prevent the comingling/mixing of soil stockpiles after sampling. Stockpiles shall not be comingled/mixed unless allowed by the Environmental Professional and the SCR and approved by the Metro-North Railroad Department of Environmental Compliance and Services.

h. A discussion of the field notes that will be maintained by the Contractor during sampling and excavation to allow correlation of sample analysis results with the respective areas, stockpiles, or soil that the data represent, and to verify quantities of soil classification types to be disposed. The field notes made during the sampling shall at a minimum consist of:

1) Boring or probe logs from each sampling location sampled in that manner that will contain a continuous stratigraphic description of all soil to be encountered during excavation to the depth required by the contract or as required by the anticipated depth of the substructures. Each boring log will include a continuous description of soil including, but not limited to, color, odor, relative grain size distribution, soil composition (including, but not limited to, ash, slag (i.e., material remaining after smelting operations that is typically comprised of metal oxides and silicon dioxide or metal sulfides and elemental metals), organic-free silt, sand, gravel and clay), moisture content, cohesive properties, and relative density (ASTM 1586-D or equivalent), discoloration, sheen, or indication of obvious contamination.

2) The location of each sampling point identified via survey or GIS coordinates plotted on a scaled drawing or map. The sampling point shall be located in such a manner that return to that particular location is possible for future sampling if necessary (i.e. survey coordinates, GIS geo located).

3) Depth intervals for each sample

4) Sample type (grab sample or composite sample)

5) Any special notes which are included on the laboratory chain-of-custody forms

i. The chain-of-custody form that will accompany each set of one or more samples being submitted for laboratory testing. The chain-of-custody shall identify the samples and any special instructions to the laboratory. The chain-of-custody form shall be signed, with date

and time, at all changes in sample custody.

j. Identification of the analytical laboratory proposed to complete the laboratory analysis consistent with the requirements outlined in this Section.

k. Listing of all analyses to be performed, by sample, and a description of QA/QC samples that will be submitted (i.e. field blanks, spiked samples).

l. The proposed transporter(s) and disposal facility(ies) to be utilized for soils that cannot be backfilled/reused shall be from Metro-North Railroad's approved list. See Section 01 74 19 Appendix "Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories."

m. As an alternative, the FSP can identify Metro-North's on-call waste management firm (Waste Technology Services (WTS) as the entity to arrange for transport and disposal of the soil classification types involved in the project. If the approved disposal facility is/are not available when the disposal operations begin, the Contractor will be fully responsible for procuring a new Metro-North-approved disposal facility at no additional cost, and with no claims for delay. Any additional sampling, analysis, delay in approval, and labor involved in submitting new disposal facilities after the initial disposal facilities are accepted will be at the Contractor's expense.

4. Sampling shall not be conducted until the Metro-North Department of Environmental Compliance and Services and the Engineer has reviewed and formally approved the FSP in writing. The Metro-North Department of Environmental Compliance and Services will approve the FSP only if it clearly provides for the information to allow for the classification of all soil proposed for excavation in accordance with the definitions of soil classification stated in this Section. Any changes in protocol must be submitted by the Contractor for the review and approval of the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer prior to sampling.

5. The Contractor will be advised by the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer if there is a need for additional samples to be collected after reviewing the initial sampling data. Additional sampling ordered by the Metro-North Department of Environmental Compliance and Services and the Engineer to replace data that was deemed by the Metro-North Department of Environmental Compliance and Services and/or the Engineer to be unusable or unacceptable will be performed at the Contractor's expense, and the time delays and the work associated with submissions, approvals, sample collection, analysis, and data review of the additional samples, shall be the responsibility of the Contractor.

6. Additional samples outside those listed in the FSP, collected and sampled by the Contractor, for the Contractor's convenience and not ordered or approved by the Metro-North Department of Environmental Compliance

and Services and/or the Engineer, shall be at no additional cost to Metro-North.

D. Soil Sampling and Testing

1. The Contractor will be responsible for determining the actual required frequency of sample collection and analysis and the testing/analytical parameters that are necessary to satisfy the proposed disposal facilities.

2. The number and type (grab, composite) of soil samples to be collected for Total Concentrations testing will be based on the volume (e.g., cubic yards) of soil to be excavated and potentially re-used/disposed in relation to the requirements set forth in NYSDEC DER-10 Table 5.4(e)10 and NYSDEC CP-51 Table 4, table provided below for convenience. At a minimum, sampling frequency shall follow the table below. However, the actual frequency of samples to be collected and tested will be determined by the approved disposal facility or facilities.

3. Recommended Number of Soil Samples:

Recommended Number of Soil Samples for Soil Imported to or Exported from a Site			
Contaminant	VOC's [(a)]	SVOC's, Inorganics, PCB's, Pesticides	
Soil Quantity (cubic yards)	Discrete Samples	Composite	Discrete Samples/Composite
0-50	1	1	Each composite sample for analysis is created from 3-5 discrete samples from representative locations in the soil/fill
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1,000	7	2	
>1,000	Add an additional (2) VOC and (1) composite for each additional 1,000 cubic yards or consult with NYSDEC.[(b)]		
(a) VOC samples cannot be composited. Discrete samples must be taken to maximize the representativeness of the results			
(b) For example, a 3,000 cubic yard soil pile to be sampled and analyzed for VOCs would require 11 discrete representative samples. The same soil pile to be sampled for SVOCs, Inorganics, PCBs and Pesticides would require 4 composite samples with each composite sample consisting of 3-5 discrete samples.			

4. The Contractor shall have the soil samples analyzed by a qualified, appropriately accredited, and approved laboratory. Samples shall be analyzed for at least the parameters listed below. The Contractor is responsible for including any other specific analyses required by the disposal facility and State(s) of disposal.

a. Target Compound List (TCL) volatile organic compounds (Method 8260)

b. TCL semi-volatile organic compounds (Method 8270)

c. TCL pesticides (Method 8081)

d. Chlorinated herbicides (Method 8151)

e. Target Analyte List (TAL) metals (Method 6010/7470)

f. Cyanide (Method 9010)

g. Total Petroleum Hydrocarbons (TPH) (Method 8015)

h. Ignitability (Method 1010 or 40 CFR 173)

i. Corrosivity (Method 9045)

j. Reactivity (Chapter 7.3.2). The reactivity results shall be reported as Total Releasable Cyanide and Total Releasable Sulfide in mg/kg of soil.

k. Polychlorinated Biphenyls (Method 8082)

l. Full Toxicity Characteristic Leaching Procedure (TCLP) list volatile organic compounds, semi-volatile organic compounds, pesticides, herbicides and metals (Methods 1311, 8260, 8270, 8081, 8151, and 6010/7470).

m. Moisture

E. Analytical Laboratories

1. Identify the name and location of the analytical laboratory that will perform analyses/testing of samples for the purpose of soil classification meeting the requirements below. The laboratory shall be identified prior to or during preparation of the FSP.

2. York Analytical Laboratories of Stratford, Connecticut is an example of a facility that meets the project requirements.

3. Analytical laboratories shall retain current accreditation under the New York State Department of Health Environmental Laboratory Approval Program (ELAP) for each of the analytical methods and parameters for the soil analyses required. Additionally, the laboratory must retain the accreditations required by and acceptable to any state where material is proposed to be disposed. Submit copies of current accreditations under the New York State Department of Health Environmental Laboratory Approval Program (ELAP) and any others required by the disposal facilities for each of the analytical methods and parameters for the soil analyses required.

4. The laboratory must perform the analyses in accordance with methods presented in NYSDEC ASP, and if required by the Metro-North Railroad Department of Environmental Compliance and Services and/or the disposal site, report results as ASP Category B deliverables. In addition, other analyses not included in NYSDEC ASP, but required by the disposal facility and/or the host State, must conform to the requirements of that facility and/or the host State. The laboratory's current ELAP certifications shall be for the specific analytical methods required.

5. Sample holding times must comply with NYSDEC ASP holding time requirements. Various state agencies may have specific requirements relative to approved methods, sample holding times, and preservation techniques; the most stringent of these shall be used. All excess samples and extract shall be archived by the laboratory for six (6) months after collection. Disposal of excess soils and extracts shall be the responsibility

of the laboratory.

6. The laboratory shall simultaneously submit electronic copies of each data package to the Contractor, the Metro-North Railroad Department of Environmental Compliance and Services, and the Engineer. At a minimum, each analytical data package prepared by the laboratory shall include the following:

   a. Laboratory name and address

   b. Date of report

   c. Analytical results

   d. Non-conformance summary

   e. Laboratory batch spikes and duplicates, or other QA/QC checks

   f. Chain-of-custody forms

   g. Laboratory certification statement

   h. Laboratory credentials

F. Soils Characterization Report (SCR)

1. The Soils Characterization Report (SCR) shall summarize the field sampling conducted pursuant to the Field Sampling Plan (FSP), the laboratory analytical data, and characterize the soils for reuse and/or disposal. The Soils Characterization Report (SCR) shall include:

   a. All field notes, data from field instrumentation, visual observations and other project related information gathered during the sampling

   b. Legible copies of all boring logs

   c. All laboratory analytical data and corresponding chain-of-custody forms

   d. The location of each sampling point identified via survey or GIS coordinates plotted on a scaled drawing or map

   e. Summary tables comparing the analytical laboratory test results to NYSDEC Part 375 soil cleanup objectives (SCOs), NYSDEC CP-51 soil cleanup levels (SCLs), and NYSDEC Part 371 hazardous waste criteria, as applicable.

   f. Guidance on safety procedures (i.e. recommended safe work practices for persons coming into contact with the soils, personal protective equipment)

   g. Classification of soils at each location sampled, based on the definitions identified in Section 1.07 and as provided by the chosen disposal facilities

   h. Recommendations for re-use and/or disposal of soil generated during construction activities

   i. Summary comparison, in both tabular and graphical (site plan) format, of analytical results and classification criteria

j. The locations, in detail, of classified soil types, their depths, limits, and their in-situ or stockpiled quantities.

k. Classification from the Environmental Professional (EP) for specific grids, piles, or areas.

l. The proposed transporter and disposal facility to be utilized for soils that cannot be backfilled/reused. The proposed transporters and disposal facilities shall be from Metro-North Railroad's approved list. See 01 74 19 Appendix "Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories".

G. Soil Handling Plan (SHP)

1. The Soil Handling Plan (SHP) shall describe the procedures to be used to excavate, load, store/stockpile, maintain soils of differing characterizations separately, transport (on site and off site), quantify, and dispose of soils. The SHP shall describe the handling procedures for soils, including:

a. the locations, depths, and in-situ or stockpiled quantities of each of the soil classification types to be encountered/disturbed,

b. the areas and depths of excavation, and the soil classifications to be encountered,

c. a description of the excavation operation itself, the sequence of excavation, the type of equipment to be utilized, the manpower to support the operation,

d. transportation methods, both on-site and off-site,

e. the management of each soil classification type, how soils of differing characterizations will be maintained separately, means of preventing comingling/mixing of soils of differing characterizations

f. the procedure for stockpiling, appropriate stockpiling locations, and all associated details including siltation and erosion control

g. which soils will be backfilled/re-used on-site and where they are proposed for backfill/re-use

h. the disposal of soils that cannot be backfilled/re-used on-site, including estimated quantities, how they will be measured for payment (i.e. disposal facility scale tickets), and the proper documentation of soils for disposal at an approved facility.

2. No soils shall be removed from the site unless prior approval is obtained from the Metro-North Railroad Department of Environmental Compliance.

3. Should soil need to be removed from the site (e.g. soil contaminated beyond reuse limits, or excess soil that cannot be reused on site), the Contractor shall make appropriate provisions to account the for the amount of material to be removed (i.e. how many tons/cubic yards), the frequency of removal (i.e. how many transport vehicles per shift), the availability/ability of transporters to haul, the disposal facility's ability to accept, and the anticipated quantities at the anticipated frequencies. The inability of transporters to haul or the disposal facility's ability to accept soil from the

site shall not be grounds for delay.

4. The SHP shall describe the procedure to be implemented when, during excavation, it becomes evident that the soil being excavated is contaminated (e.g., olfactory or visual indication) and differs from surrounding soils, and how this material will be stockpiled and maintained separate from other soils not exhibiting similar characteristics.

5. If soil is to be excavated, stockpiled and then sampled for classification, then the SHP shall be submitted by the Contractor concurrently with its FSP. The approach of submitting the SHP at the same time as the FSP must be approved by the Metro-North Railroad Department of Environmental Compliance and Services prior to implementing the work. Once field sampling has begun, stockpiles shall not be added to or borrowed from, or commingled with other stockpiles, until the soils are classified, and a determination is made regarding their suitability for reuse. Upon completion of field sampling and receipt of laboratory analytical data, the Contractor's Environmental Professional shall prepare the SCR for use in determining soil/fill re-use and disposal options and provide it to the Metro-North Railroad Department of Environmental Compliance and Services.

6. The Contractor shall additionally address the following considerations:

    a. Personnel Safety. The Contractor will be responsible for the development and implementation of a Safety, Health and Environmental Control Plan (SHECP) that includes provisions for the protection of on-site workers and the public. It is anticipated that Level D personal protective equipment will be required, but the Contractor will be responsible for determining the level of personal protection required and complying with the OSHA standards and the approved Safety, Health and Environmental Control Plan (SHECP). If hazardous soils are encountered during construction-related work, the Contractor is to consult with the Metro-North Department of Environmental Compliance and Services with respect to approval of additional precautions to be developed and added to the SHECP.

    b. Environmental effects

    c. Prevention of transporter leaks on-site

    d. Vehicle decontamination verification prior to leaving the site

    e. Initial removal and stockpiling sequence

    f. Dust control, and monitoring if deemed necessary. The Contractor will be responsible for the development and implementation of a community air monitoring plan (CAMP) for the protection of the public health, and a SHECP for the protection of site workers, during ground intrusive activities. At a minimum this CAMP must comply with the provisions outlined in NYSDEC DER-10, Appendix 1A, 'Generic Community Air Monitoring Plan' and Appendix 1B 'Fugitive Dust and Particulate'.

H. Transporter Information

1. The Contractor shall utilize a transporter for soils that cannot be backfilled/reused from Metro-North Railroad's approved list. See 01 74 19 Appendix "Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories".

2. The Contractor must provide to Metro-North Railroad Department of Environmental Compliance and Services and the Engineer copies of all waste transporter licenses and permits including, but not limited to, NYSDEC 6 NYCRR Part 364 Waste Transporter Permits, hazardous waste transporter permits issued under 6 NYCRR Part 372.3, and any other state and local vehicle and waste hauling permits in the submittal. The Contractor may submit multiple Metro-North approved transporters for each soil classification type to anticipate changes in transporters, and/or final quantities for disposal.

3. The Transporter must comply with all pertinent Federal, State and Local regulations regarding the transport of soils.

I. Disposal Facility Information

1. The Contractor shall utilize a disposal facility from Metro-North Railroad's list of approved disposal facilities for soils that cannot be backfilled/reused. See 01 74 19 Appendix "Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories".

2. The Contractor must provide to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer the following information for each disposal facility:

   a. Copies of the current appropriate operating permits indicating a physical description of both the type of soils allowed and not allowed for final disposal.

   b. The maximum allowable concentrations of contaminants that can be accepted as indicated in NYSDEC 6 NYCRR Sub part 375. The facility will review data reports pertinent to the soil proposed for disposal and confirm that the soil complies with its existing permits.

   c. Analytical protocol requirements for sampling prior to accepting soil for disposal, including specific parameters, protocols, and minimum detection limits.

   d. The site-specific minimum sampling frequency, in samples per cubic yard of in-situ or stockpiled soil, and the facility's standard practices for determining classification of soil.

   e. Daily, annual, and project specific volume of each classification of soil that it is permitted to accept and a written indication as to the total and daily volume of soil that will be accepted from this project.

   f. Any state environmental agency sampling, analytical, or review requirements for soil being transported to a proposed disposal location outside of New York State.

g. A list of any violations, citations, and administrative complaints from federal, state, and local agencies.

J. Waste Manifest Records, Shipment Records and Certificates of Disposal

1. Provide waste manifests, bills of lading, shipment records and certificates of disposal for each truckload of soil removed from the site. Manifests and other documentation shall be properly prepared, filed, and distributed by the Contractor in accordance with regulatory requirements. Upon completion of disposal, the completed manifest, bill of lading, scale ticket from the disposal facility, and certificate of disposal shall be mailed, or hand delivered directly to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer.

2. At least two (2) weeks prior to proposed off-site disposal, submit the following to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer for approval.

a. Statutory Manifest Documents: A copy of the statutory manifest form and other documents that will be used in connection with the disposal of hazardous soils. Manifests and other documentation shall be properly prepared, filed, and distributed by the Contractor in accordance with regulatory requirements. The Contractor shall type in the name of the generator, transporter and disposal facility on each form. All other pertinent information shall be included on the manifest.

b. Bill of Lading/Record of Waste Transport and Disposal: A copy of the bill of lading / record of waste transport and disposal to be used to track the transportation and disposal of non-hazardous soils. See Appendix B Record of Waste Transport and Disposal. The Contractor may utilize the form provided in Appendix B or submit their own form to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer for approval. The bill of lading shall record the following for each truckload: the date, the transporter, the printed name and signature of the transporter's driver, the weight and volume of material on each truckload, the destination / receiving disposal facility, and an acknowledgement by the disposal facility that they have accepted the soil.

3. Scale tickets generated by the disposal facility scale operator identifying the transporter, the transport vehicle/container unique identification number, and its laden and un-laden weights shall be submitted by the Contractor to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer.

4. Certificates of Disposal: A Certificate or Documentation of Disposal along with each completed manifest shall be prepared by the disposal facility and mailed to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer once the soil has been properly treated and/or disposal is completed.

1.07 SOIL CLASSIFICATION

A. For the purposes of this Contract, the following soil classification shall apply. See Table 1.0 Soil Classification Summary

B. Hazardous Soil

1. Is soil as defined in 40 CFR Part 261 and New York State ECL Section 27-09 or 6 NYCRR Part 371, Identification and Listings of Hazardous Waste including soil containing concentrations that are Hazardous. This would also include soils contaminated with PCBs at or above 50 parts per million (ppm).

2. Hazardous soils must be disposed of at a disposal site that is permitted to accept hazardous waste. This soil is NOT suitable for backfill/re-use on site.

C. Non-Hazardous Petroleum-Contaminated Soil

1. Is soil that exhibits a distinct petroleum odor or contains visible petroleum product, or can be associated with a reportable spill, or contains petroleum constituents above NYSDEC Part 375 Soil Cleanup Objectives (SCOs) for protection of groundwater, as well as NYSDEC CP-51 Soil Cleanup Levels (SCLs).

2. Soils associated with a spill are to be handled separately in accordance with NYSDEC Technical Guidance Documents and Policies and direction provided by the Metro-North Railroad Department of Environmental Compliance and Services.

3. This soil is only suitable for recycling at a licensed, properly permitted, petroleum recycling facility and/or for disposal at an approved and properly permitted disposal facility that can accept non-hazardous petroleum-contaminated soil. This soil is NOT suitable for backfill/re-use on site.

D. Non-Hazardous PCB-Contaminated Soil

1. Is soil that contains less than the hazardous waste limit of 50 parts per million (ppm) of polychlorinated biphenyls (PCBs, on a dry weight basis) as referenced in 6 NYCRR Part 371.4(e).

2. Soil that contains greater than 1.0 ppm and less than 50.0 ppm PCBs must be disposed at an approved and properly permitted disposal facility that can accept non-hazardous PCB-contaminated soil.

3. Soil that contains less than or equal to 1.0 ppm PCBs is suitable for backfill/re-use on the Site as it meets the NYSDEC Part 375 soil cleanup objective of 1.0 ppm for PCBs, with any excess disposed at an approved and properly permitted disposal facility that can accept non-hazardous PCB-contaminated soil. Soil with a PCB level greater than 1.0 ppm is NOT suitable for backfill/re-use on site.

E. Non-Hazardous Soil/Fill

1. Is soil/fill that is non-hazardous, non-petroleum-contaminated, non-PCB-contaminated (i.e., containing PCB concentrations at or below 1 ppm) soil/fill generated by manufacturing or industrial processes as defined in NYSDEC NYCRR Part 360, Solid Waste Regulations Solid Waste

Management Facilities, 360-1.2 (b) (88).

2. Is soil/fill that contains >1% fouled and historic railroad ballast, ash, foundry sand or slag (i.e., material remaining after smelting operations that is typically comprised of metal oxides and silicon dioxide or metal sulfides and elemental metals), end or by-products of incineration or other forms of combustion, coal, coal dust, cinders, etc.

3. This soil/fill is suitable for backfill/re-use on-site, if approved by the Metro-North Railroad Department of Environmental Compliance and Services. Any excess soil/fill must be disposed at an approved and properly permitted disposal facility that can accept non-hazardous soil/fill.

F. Non-Hazardous C&D Soil/Fill

1. Is soil/fill that is non-hazardous, non-petroleum-contaminated non-PCB-contaminated (i.e., containing PCB concentrations at or below 1 ppm), soil/fill, as defined in NYSDEC Division of Solid and Hazardous Materials, 6 NYCRR Part 360, Solid Waste Management Facilities, 360-1.2 (b)(38).

2. Is soil/fill that contains <1% fouled and historic railroad ballast, ash, foundry sand or slag, end or by-products of incineration or other forms of combustion, coal, coal dust, cinders.

3. This soil/fill is suitable for backfill/re-use on site, if approved by the Metro-North Railroad Department of Environmental Compliance and Services. Any excess soil/fill must be disposed at an approved and properly permitted disposal facility that can accept non-hazardous C&D soil/fill.

NOTE: THE FOLLOWING TABLE/SOIL CLASSIFICATIONS SHALL BE USED TO DEVELOP THE UNIT PRICE SHEET FOR SOIL DISPOSAL

Table 1.0 - Soil Classification Summary

SOIL CLASSIFICATION	DESCRIPTION	SUITABILITY FOR REUSE
Hazardous	• Soils containing concentrations that are Hazardous as defined in 40 CFR Part 261 and New York State ECL Section 27-09 or 6 NYCRR Part 371, Identification and Listings of Hazardous Waste. • Soils containing PCBs at or above 50 parts per million (ppm).	**No** – must be disposed of at a disposal site that is permitted to accept hazardous waste
Non-Hazardous Petroleum Contaminated	• **Soils exhibiting a distinct petroleum odor or containing visible petroleum product.** • **Soils associated with a reportable spill.** • **Soils containing petroleum constituents exceeding NYSDEC Part 375 soil cleanup objectives (SCOs) for commercial use or protection of groundwater**	**No** – suitable for recycling at a licensed properly permitted petroleum recycling facility and/or for disposal at an approved and properly permitted disposal facility that can accept non-hazardous petroleum-contaminated soil

SOIL CLASSIFICATION	DESCRIPTION	SUITABILITY FOR REUSE
	• **Soils containing petroleum constituents exceeding NYSDEC CP-51 Soil Cleanup Levels (SCLs).**	
Non-Hazardous PCB Contaminated	• **Soils containing greater than 1.0 ppm and less than 50.0 ppm (>1.0 ppm and <50 ppm) PCBs (on a dry weight basis) as referenced in 6 NYCRR Part 371.4(e)**.	**> 1.0 ppm PCB's – No** - must be disposed of at an approved and properly permitted disposal facility that can accept hazardous PCB-contaminated soil. **< or = 1.0 ppm PCB's – Yes** – but any excess must be disposed of at an approved and properly permitted disposal facility that can accept non-hazardous PCB-contaminated soil.
Non-Hazardous Soil/Fill	• **Soil/fill that is non-hazardous, non-petroleum-contaminated, non-PCB-contaminated and is generated by manufacturing or industrial processes as defined in NYSDEC NYCRR Part 360, Solid Waste Regulations Solid Waste Management Facilities, 360-1.2 (b) (88).** • **Contains >1% fouled and historic railroad ballast, ash, foundry sand or slag, end or by-products of incineration or other forms of combustion, coal, coal dust, cinders, etc.).**	**Yes** – upon approval of the Metro-North Dept. of Environmental Compliance and Services. Any excess soil must be disposed of at an approved and properly permitted disposal facility that can accept non-hazardous soil/fill.
Non-Hazardous C&D Soil/Fill	• **Soil/fill that is non-hazardous, non-petroleum-contaminated, and non-PCB-contaminated, as defined in NYSDEC Division of Solid and Hazardous Materials, 6 NYCRR Part 360, Solid Waste Management Facilities, 360-1.2 (b)(38)** • **Contains ≤1% fouled and historic railroad ballast, ash, foundry sand or slag, end or by-products of incineration or other forms of combustion, coal, coal dust, cinders, etc.).**	**Yes** – upon approval of the Metro-North Dept. of Environmental Compliance and Services. Any excess must be disposed of at an approved and properly permitted disposal facility that can accept non-hazardous C&D soil/fill.

1.08 PERMITS

A. The Contractor must obtain and pay for all required permits, fees and inspections by authorities having jurisdiction for soil removal and disposal.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 GENERAL

A. The Contractor shall furnish all labor, equipment, materials, permits, and subcontracted services (e.g. Environmental Professional, field sampling, analytical laboratory, transporter, disposal facility), as necessary, to provide for the lawful reuse of excess soils on site, or removal and disposal of excess soils from the site in accordance with local, state and federal laws and regulations. The Contractor is responsible for all costs associated with the lawful transportation and disposal of soils by one or more of Metro-North Railroad's pre-approved waste transporters and disposal facilities.

B. Prior to conducting subsurface disturbance, borings, or excavation, the Contractor shall follow "Protection of Underground Metro-North Railroad Facilities" and 16 NYCRR Part 753.

C. Prepare the submittals required by this Section for approval by the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer. See Sections 1.05 and 1.06 for submittal requirements.

3.02 PREPARATION / INSPECTION

A. Pre-Work Inspection: Prior to the start of work, to verify existing conditions, the Contractor shall inspect and examine the areas where contract work is to be performed and soil disturbance will occur. This pre-assessment shall be used to assist in preparation of the required submittals.

B. Inspections During Work: The Contractor shall provide regular inspections of soil excavation and stockpile areas throughout the duration of the work. The Contractor shall correct conditions without impact to the completion of the Work. The Contractor will not be allowed to proceed until the unsatisfactory conditions have been corrected.

3.03 ENVIRONMENTAL PRECAUTIONS

A. To minimize risk to personnel, the Contractor shall limit access to the excavation areas to as few people as possible. During all excavation, the SHECP, SWP, and SHP shall be followed.

B. During excavation, the Contractor shall maintain grading and drainage of the site so that no stormwater runs from outside the excavation into the excavation. Rainwater falling directly into the excavation shall be allowed to percolate into the soil.

C. Transport vehicles must be cleaned prior to departure from the site to reduce the risk of losing soil and/or debris on public roads. Cleaning is to include, but not be limited to wheels, tires, and under carriages. The Contractor shall construct "knock off" pads at the exits from the construction / excavation areas as necessary to assist with vehicle cleaning.

D. All soils to be excavated must be sampled in-situ and/or moved directly to the stockpiling area for sampling in accordance with the FSP. All excavated soils are to be tested and classified prior to removal and/or loading into transport vehicles.

E. The Contractor shall identify, in detail, in the Soil handling Plan (SHP), the

procedures to avoid commingling of soils from different excavations, or soil that is removed after a classification sample is collected.

3.04 STOCKPILES OF EXCAVATED SOIL

A. On-site stockpiled soil shall not impact the work of any other Contractor. Following the Contractor's sampling, stockpile shall not be added to, moved or otherwise impacted by other soil that could affect the resulting classification of the soil.

B. Refer to specification Section for Environmental Protection. Stockpiles shall be constructed to isolate contaminated soil from the environment. Stockpiles shall be constructed to include:

1. A chemically resistant geo-membrane liner shall be placed on ground surfaces below stockpiles of soils determined unsuitable for reuse. Liners shall be scrim reinforced, having a minimum weight of 40 pounds per 1,000 SF, and a permeability coefficient less than 10-8cm/sec. The ground surface on which the membrane is to be placed shall be free of rocks greater than ½ inch in diameter and any other items that could damage the membrane.

2. A geo-membrane cover to control dust and to prevent precipitation from entering the stockpile. Scrim reinforced membranes shall have a minimum weight of 26 pounds per 1,000 SF. The cover shall be anchored to prevent it from being removed by wind. Stockpiles shall be covered during non-working hours and during periods of no construction activity.

C. The temporary storage of excavated soil in stockpiles shall comply with the dust monitoring and control requirements defined in the NYSDEC DER-10 Appendix 1B, "Fugitive Dust and Particulate Monitoring".

D. A berm shall surround each stockpile, a minimum of 12 inches in height. Vehicle access points shall also be bermed.

E. Provide and maintain siltation control measures (i.e. silt fencing, hay bales, mulch filled socks) around stockpiled soil.

F. No liquids shall be allowed to collect on stockpiles of excavated soil.

3.05 REUSE OF SOIL

A. The Contractor shall take all reasonable efforts to backfill/re-use as much soil on-site as possible. All opportunities must be explored to backfill/re-use excavated soils in compliance with NYSDEC requirements. The Contractor is to consult with the Metro-North Department of Environmental Compliance and Services with respect to backfill/re-use options. Refer to Table 1.0 – Soil Classification Summary.

B. Soils can be backfilled/re-used at the project site if:

1. they meet the geotechnical requirements of the Project, and,

2. they are classified as Non-Hazardous C&D Soil/Fill or Non-Hazardous Soil/Fill, and

3. the backfill/reuse location is approved by the Metro-North Department of Environmental Compliance and Services.

C. Soil that is not backfilled/re-used on the project site shall be disposed of in accordance with this specification by the Contractor.

3.06 EXCESS SOIL

A. Excess soils that cannot be reused on-site shall be disposed of by the Contractor in accordance with this Section. To assure soil is properly disposed of, no soil shall be removed from Metro-North property without prior written approval from the Metro-North Department of Environmental Compliance and Services.

B. The Contractor must NOT make any arrangements for disposal of soil without following the procedures identified in this specification. No soil is to be assumed 'clean' until it has been determined to be so by the Metro-North Railroad Department of Environmental Compliance and Services.

C. Soil is NOT to be offered for backfill/re-use off-site unless specific written permission is obtained from the Metro-North Railroad Department of Environmental Compliance and Services and if applicable, from the NYSDEC in the form of a Beneficial Use Determination (BUD).

3.07 BORROW SOIL / BORROW PIT TESTING FOR SOURCE APPROVAL

A. No fill soil can be accepted from an off-site source unless approved by the Metro-North Department of Environmental Compliance and Services. In such cases, the Contractor will be required to complete and execute a Clean Borrow Certification and the Metro-North Department of Environmental Compliance and Services reserves the right to require sampling and laboratory analysis to confirm that such fill is clean. Any such costs are to be borne by the Contractor at no expense to Metro-North.

B. For fill and backfill to be accepted from an off-site source, the soil is to be tested using approved methods which yield laboratory limits and meet the following criteria:

1. Contains no compounds or inorganic analytes at concentrations above the lower of 6 NYCRR 375-6.8(b) Unrestricted Use SCOs or Protection of Groundwater SCOs [unless a less restrictive option (e.g., Commercial Use) is approved by the Metro-North Railroad Department of Environmental Compliance and Services];

2. Contains no compounds or inorganic analytes above the lower of the NYSDEC CP-51: Soil Cleanup Guidance for Unrestricted Use and Protection of Groundwater Supplemental Soil Cleanup Objectives (SSCOs);

3. Meets NYSDEC pre-determined beneficial use determination (BUD) requirements referenced in 6 NYCRR 360-1.15(b);

4. Meets the project geotechnical requirements; and

5. Its use must be approved by the Metro-North Railroad Department of Environmental Compliance and Services prior to being brought on-site.

3.08 TRANSPORTERS AND TREATMENT, STORAGE AND DISPOSAL FACILITIES

A. Soils that require off-site disposal, or cannot be re-used on-site, shall be transported and disposed of in accordance with this Section.

B. The Contractor shall provide transport vehicles that comply with requirements for hauling soil and regulated materials as outlined in NYSDEC regulations (e.g., 6 NYCRR Part 360 and 364). The Contractor is responsible for vehicles having all

required permits and approvals.

C. The Contractor shall utilize one or more of the Metro-North Railroad audited and approved waste transporters and disposal facilities, or contract with Waste Technology Services (WTS) , as necessary, to transport and dispose of soils in compliance with all applicable regulatory requirements. See 01 74 19 Appendix "Metro-North Railroad Environmental Compliance & Services Approved Waste Management Consultants, Disposal Facilities, Transporters, and Laboratories" for waste transporters and disposal facilities that have been audited and approved by Metro-North Railroad.

D. The Contractor may choose to utilize more than one of the Metro-North Railroad approved transporter and disposal facilities. In this case, each facility must be in compliance with the above requirements, and each facility must have the ability to stabilize the soil (when deemed necessary) and dispose of the soil.

E. Should the Contractor choose to submit for use an alternate transporter or disposal facility that is not on the referenced approved list, the Contractor may elect to have an audit of the transporter or disposal facility conducted by Metro-North Railroad's on-call environmental consultant (currently Day Engineering, P.C.), at the Contractor's expense. Submittal of alternates must be initiated in the early stages of the project as to allow sufficient time for the audit to be conducted and completed before the Contractor begins using the alternate transporter or disposal facility. The Contractor shall not utilize the proposed alternate transporter or disposal facility until: 1) the audit is complete, 2) it has been submitted to the Metro-North Railroad Department of Environmental Compliance and Services for review, and 3) they have been approved for use by the Metro-North Railroad Department of Environmental Compliance and Services. The proposed transporters or disposal facilities are required to meet the same audit requirements as the entities already approved by Metro-North Railroad. The request and submittal of an alternate transporter or disposal facility for auditing does not guarantee that the entity will be approved for use by Metro-North Railroad. The Contractor is solely responsible for coordinating the audit with Metro-North Railroad's on-call environmental consultant (currently Day Engineering, P.C.), all costs incurred, and any resulting delays associated with the submittal and auditing process.

F. The Contractor is responsible for contacting transporters and disposal facilities to arrange for transport and disposal of the volumes and classifications of soils specific to the Project.

G. Transporters shall have current Part 364 - Waste Transporter Permits (or permits applicable for soil characterized). Note that each transporter has specific types of waste that they can transport under their transporter permits and may be limited in their permit as to what disposal sites they may transport to. It is the Contractor's responsibility to make sure that the transporter can transport to the selected disposal site(s).

H. If the approved disposal facility is/are not available when the disposal operations begin, the Contractor will be fully responsible for procuring a new approved disposal facility at no additional cost, and with no claims for delay. Any additional sampling, analysis, delay in approval, and labor involved in submitting new disposal facilities after the initial disposal facilities are accepted will be at the Contractor's expense.

I. The disposal facility must be able to treat and/or dispose of all of the soil removed from the site within the allotted Contract time. The ability of the facility to accept the soil should not limit the rate at which the Contractor can excavate and transport the soil. The Contractor is advised that as transporters and disposal facilities vary in the volume and classification of soils they can transport and dispose, that it cannot be assumed that all facilities can transport and dispose of all amounts and classifications of soils that may be encountered. It is the Contractor's responsibility to confirm that the disposal site(s) can take the classification(s) of soil that will be generated at the necessary volumes.

J. The Contractor may choose to streamline the transportation and disposal process by utilizing the services of Metro-North Railroad's on-call waste management firm:

1. Waste Technology Services (WTS) in Lewiston, NY – (716) 754-5400;

K. Should it choose to do so, the Contractor will be responsible for contracting directly with WTS and paying that firm directly. WTS' services include performance of the following tasks:

1. Waste identification/classification (including any required lab services).
2. Completion of all necessary waste approval shipping documentation (waste profiles, manifests, bills of lading, land disposal restriction forms, and labels).
3. Arranging for compliant transportation and disposal.
4. Scheduling with the transporters and disposal facilities.
5. When necessary, review of a site to assist in stockpiling and loading logistics.

3.09 WASTE MANIFEST RECORDS, SHIPMENT RECORDS AND CERTIFICATES OF DISPOSAL

A. Provide applicable waste manifest records, bills of lading, shipment records, scale tickets, and certificates of disposal for each truckload of soil removed from the site. Submit this documentation for each soil classification removed from the site for off-site disposal.

B. At least two (2) weeks prior to proposed off-site disposal, submit the following to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer for approval

1. A copy of the manifest form and other documents that will be used in connection with the disposal of hazardous soils.
2. A copy of the bill of lading form that will be used to track the movement of all identified soil classification types associated with the project.

C. Statutory Manifest Documents: The Contractor must comply with statutory manifest document requirements that are to be used in connection with the disposal of hazardous soils.

D. The Contractor is responsible for assuring that all transportation vehicles have the required manifests and/or bill of ladings necessary for transporting each truckload of soil for each soil classification type. Each manifest or bill of lading will be signed by the transporter and carried to the approved disposal facility. Prior to the

transport vehicle leaving the site, each manifest or bill of lading shall be signed by the Engineer, and a preliminary copy of each partially completed form shall be provided to the Engineer. The Engineer shall provide originals to the Metro-North Railroad Department of Environmental Compliance and Services and retain copies for their records.

E. All trucks shall be weighed upon their arrival to the disposal facility and weigh scale tickets shall be provided. Scale tickets generated by the disposal facility scale shall identify the transporter, the transport vehicle/container unique identification number, and its laden and un-laden weight. Scale tickets must be received back from all disposal sites and provided to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer.

F. Disposal Facility Records: The Contractor must comply with disposal facility record requirements. The disposal facility shall complete the waste manifest or bill of lading when the disposal facility accepts the waste. The disposal facility is to mail completed waste manifests to the appropriate regulatory agencies. A copy of the completed manifest or bill of lading, along with a copy of the scale ticket from the disposal facility, must be mailed or hand delivered directly to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer. A Certificate or Documentation of Disposal along with each completed manifest shall be prepared by the disposal facility and mailed to the Metro-North Railroad Department of Environmental Compliance and Services and the Engineer once the soil has been properly treated and/or disposal is completed.

3.10 METHOD OF MEASUREMENT

A. Refer to Measurement and Payment specification.

3.11 BASIS OF PAYMENT

A. Refer to Measurement and Payment specification.

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PROVIDE THE FOLLOWING ON STANDARD COMPANY LETTERHEAD

(INSERT DATE)

(INSERT COMPANY NAME HERE)

Re: *(INSERT CONTRACT NUMBER & DESCRIPTION)*

CLEAN FILL CERTIFICATION

The undersigned, *(INSERT NAME OF COMPANY OFFICER)*, hereby certifies that the material being brought by *(INSERT COMPANY NAME)*, onto Metro North Railroad property at *(DESCRIBE LOCATION WHERE FILL IS BEING PLACED)* is appropriate for general construction use under the applicable provisions of the Environmental Protection Agency and the New York State Department of Environmental Conservation.

The source of the material is: *(DESCRIBE SOURCE OF SUPPLY)*

The undersigned further certifies that there are no contaminants in the material that pose a threat to persons or to the environment, and that the undersigned has supplied all available test results for the material to Metro-North.

The undersigned agrees that should the appearance and/or odor of the material at any time present a concern to Metro-North, that the material will be removed promptly from Metro-North property or, in the alternative, if agreed to by Metro-North, sampling of the material, as specified by Metro-North, will be undertaken by the undersigned at the undersigned's expense and such sampling results will be provided to Metro-North. The material will remain stockpiled until sampling results have been received and reviewed by Metro-North, and it shall be Metro-North's unilateral determination as to whether delivery of the material may proceed.

CERTIFIED BY: *(INSERT SIGNATURE OF COMPANY OFFICER)*

OF *(INSERT COMPANY NAME)*

DATE: *(INSERT DATE)*

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LEAD-CONTAINING MATERIALS
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SECTION – 02 82 00

LEAD-CONTAINING MATERIALS SPECIFICATIONS

PART 1 – GENERAL

1.01 PROJECT OVERVIEW

A. The following specification is intended for use with a site-specific scope of work for any activity which will disturb lead containing coatings or materials on Metro-North Railroad property. Coating or material disturbance activities may result in occupational exposure to airborne lead particulate as described in 29 CFR 1926.62 Lead Exposure In Construction; Interim Final Rule. The requirements of the following specification shall apply to any and all construction activities known or suspected to result in worker exposure to airborne lead particulate, dust, or fume. Although not specifically covered under this specification, potential for personal or environmental exposure to harmful substances, including heavy metals other than lead, shall be considered when determining the best methods and procedures for executing the work.

B. All work resulting in the disturbance of lead containing coatings or other lead containing materials shall be conducted utilizing currently accepted lead abatement technologies and standards of practice in compliance with applicable regulations and Metro-North Railroad standards. The Contractor shall conduct all work in a manner which protects the health and safety of contract employees, Metro-North Railroad employees, Metro-North Railroad property, the surrounding community, the public, and the environment.

1.02 DEFINITIONS

A. **Action Level** – As set by 29 CFR 1910.1025, the level of exposure that triggers medical surveillance and selected other administrative and/or training controls for workers exposed to lead in general industry is 30 micrograms per cubic meter.

B. **Closed Abrasive Blast Cleaning** – The propulsion of abrasive particles against the surface to be de- leaded by means of compressed air or centrifugal wheels, the blasting action being contained within an enclosure creating a seal to the surface being de-leaded, and having vacuum capabilities for a simultaneous cleaning and blasting action.

C. **Competent Person Responsibilities** – In compliance with OSHA requirements, each Metro-North work site will have a competent person overseeing the work. The competent person will identify lead hazards, determine the strategy of exposure control, and ensure employees performing the work use personal protective equipment and hygiene facilities. The competent person will inspect the work regularly, make note of deficiencies and the corrective steps taken, ensure employees are using equipment properly and oversee maintenance of engineering controls and equipment.

D. **Compliance Program** – As per 29 CFR 1926. 62 (e); the employer's site-specific written program which describes engineering controls, work procedures and administrative controls which will serve to limit employees exposure to lead concentrations to, or below the Permissible Exposure Limit. The site specific plan describes hygiene facilities, housekeeping, personal protective equipment, respiratory protection, the scope of work, technology

considered to reduce exposures, a description of the activities which will disturb lead and potentially create exposures, identification of the competent person and his/her responsibilities, air monitoring data, etc. all relevant to the site specific scope of work and conditions.

E. **Construction Industry Standards** – As per 29 CFR 1926, "Safety and Health Regulations for Construction", the identification of OSHA standards developed for worker protection in the construction industry.

F. **Containment System** – The sealing of walls, floors and any entryways. Within the contained area there shall be a ventilation system of either forced or natural air imports and natural or mechanical exhaust. Air filtration systems may exist within the containment system. The purpose and design shall prohibit the emission of lead particulate from within the containment system to the ambient air.

G. **Contractor** – Any entity that has entered into contract with Metro-North Railroad.

H. **Critical Barrier** – The installation of flexible, sealed partitions, which prohibit the escape of particulate from the work area.

I. **Engineer** – The Resident Engineer, Project Engineer, Site Engineer, or Construction Manager, representing the best interest of Metro-North Railroad, and assigned to direct, manage, and oversee the execution of the work.

J. **Environmental Monitor** – The designated entity or third party, representing the best interest of Metro- North Railroad, responsible for overseeing the Contractor's compliance efforts.

K. **Hand Tool Cleaning** – Manual scraping, brushing or sanding of loose paint, rust and mill scale. Tools include chisels, knives, hammers, sandpaper and wire brushes.

L. **Hazardous Waste (LEAD)** – Debris containing 5 parts per million lead or greater when tested as per the Toxic Characteristic Leaching Procedure (TCLP). Lead is assigned the EPA Haz Waste #D008.

M. **HEPA – High Efficiency Particulate Air (Filter)** – Being, using, or containing a filter designed to remove 99.97% of airborne particles measuring 0.3 microns or greater in diameter passing through it.

N. **Histoplasma Capsulatum** – Fungus living in the environment, usually in association with large amounts of bird or bat droppings.

O. **Histoplasmosis** – a disease caused by the fungus Histoplasma Capsulatum.

P. **Isolation Barriers** – The construction of partitions, the placement of solid materials, and the plasticizing of apertures to seal off the work place from surrounding areas to contain and prohibit emissions.

Q. **Lead Health and Safety Plan (LHASP)** – Site Specific and meeting the requirements 29 CFR 1026.62 (e) for Site Specific Compliance Plan.

R. **Log Book** – A permanently bound book kept at the entrance to the work area. This book shall serve as a legal record of each work shifts' activity, profile of crewmembers, signatures of all persons visiting the work site, accidents/incidents and a daily sign-in and sign-out record for the crewmembers. Waste quantities generated, stored and released for transport

shall be recorded here on a daily basis. Emergency contact phone numbers shall be listed inside the front cover and a street map containing a highlighted route to the nearest hospital shall be kept with the book.

S. **Medical Surveillance Program** – For the purposes of this specification, detailed medical examinations and physician consultations for employees who have been exposed to lead above the action level of 30 micrograms per cubic meter of air for more than 30 days per year per 29 CFR 1926.62 (j),.

T. **Metro-North Railroad** – The Owner, Metro-North Railroad, or a designated entity or third party representing Metro-North Railroad.

U. **Movable Objects** – Any objects within the work area, which may be cleaned and removed prior to start of deleading.

V. **OSHA** – Acronym for Occupational Safety and Health Administration

W. **Open Abrasive Blast Cleaning** – Compressed air is used to propel abrasive particles against the surface being deleaded without the benefit of localized containment.

X. **Owner** – A person, firm, corporation, guardian, conservator, receiver, trustee, executor or other judicial officer, who, alone or jointly or severally with others, owns, holds, or controls the whole or any part of the freehold or leasehold title to any property, with or without accompanying actual possession of it, and shall include in addition to the holder of legal title, any vendee in possession of it, but may not include a mortgagee or an owner of a reversionary interest under a ground rent lease. In this instance, unless otherwise specified, the owner shall mean Metro-North Commuter Railroad.

Y. **Permissible Exposure Limit (PEL)** – A limit of exposure to a particular toxic material or harmful physical agent which is published and enforced by OSHA as a legal standard. This standard is typically based upon time weighted average (TWA) concentrations for a normal 8-hour workday over a 40-hour workweek. Per 29 CFR 1926.62, the PEL for workers exposed to lead in construction / general industry is 50 micrograms of lead per cubic meter of air, without regard to the use of respiratory protection.

Z. **Polyethylene** – Known commonly as plastic sheeting or poly, and having a conformance of 6 mil thickness, unless otherwise specified.

AA. **Power Tool Cleaning** – De-leading via the use of power operated impact tools. Power tools may include roto peens, disc sanders, needle guns, grinding wheels, brush blasters and similar equipment.

BB. **Pressure Washing** – Pressurized water, typically up to 4,000 psi, to clean surfaces.

CC. **Respirator Fit Test** – Qualitative and quantitative testing conducted to assure a respirator fits the employee properly and will function as intended.

DD. **Respiratory Protection Program** – As defined by 29 CFR 1910.134; the contractor's written program delineating employee training, storage, inspection and selection of respirators.

EE. **Solid Panels** – Building materials, which are impermeable to dust and may be used for construction of containments or for the purpose of encapsulation.

FF. **Tarpaulin** – A solid, flexible barrier impervious to dust.

GG. **Tent** – A flexible, sealed enclosure constructed for limited, localized quantities of de-leading.

HH. **Time Weighted Average (TWA)** – An employees' average airborne exposure to a particular toxin in over a given period of time, typically an eight-hour work shift of a 40-hour work week.

II. **Visible Emission** – Any emission of lead particulate or fume, which is detected by the human eye, without the aid of instrumentation.

JJ. **Water Jetting** – Pressurized water directed against the surface to be de-leaded at 20,000 pounds per square inch pressure (psi), or for ultra-high pressure at 20,000 to 40,000 psi.

KK. **Wet Abrasive Blast Cleaning** – Compressed air used to propel abrasives against a surface to be de- leaded. Water is injected into the abrasive stream and thereby significantly reduces dust generation.

LL. **Worker Decontamination Facility** – Appendage to the worksite containing a series of rooms, each segregated from the other by a series of air-locks and curtained doorways. A typical configuration of these rooms runs in a sequential series and includes three chambers; clean area, decontamination area (shower) and equipment room.

1.03 CONTRACT REQUIREMENTS

A. General

1. The Contractor is solely responsible for the occupational health and safety of the Contractor's employees. The Contractor shall conduct work utilizing all available methods and procedures to protect the health and safety of employees involved in the work, the surrounding community, the public, and to prevent environmental degradation.

2. The Contractor is hereby notified that lead exposure activities include the disturbance of lead containing materials, lead-containing coating removal and subsequent work on surfaces which have been abated of visible coatings. Therefore; these specifications apply to all lead exposure activities which may include but not be limited to coating removal, hot work, such as torch cutting, rivet busting, and use of mechanical or hand tool equipment on surfaces from which coatings have been removed.

3. The Contractor shall provide all labor, materials, equipment, services, certificates, variances, permits, and insurances necessary to execute the site-specific scope of work. The Contractor shall complete the work per the requirements set forth herein and at the direction of Metro-North Railroad, the Engineer, and the Environmental Monitor.

4. Work shall be conducted in compliance with 29 CFR 1926.62 Lead Exposure In Construction; Interim Final Rule, the requirements set forth in these specifications, Metro-North Railroad Operating Rules & Procedures, Society for Protective Coatings (SSPC) Guidelines, all applicable standards and local, state and federal regulations. The Contractor shall conduct the work in accordance with direction provided

by Metro-North Railroad or their representative, the Project Engineer, Project Management, the Environmental Monitor, and any agency having jurisdiction over the work.

5. The Contractor shall comply with the requirements of this specification and all applicable Federal, State, and Local laws, codes, and regulations, including but not limited to the regulations of the United States Environmental Protection Agency (USEPA), United States Department of Transportation (USDOT) Occupational Safety and Health Administration (OSHA), New York State Department of Environmental Conservation (NYS DEC), New York State Department of Health (NYS DOH), and the New York State Department of Labor (NYS DOL), and the New York City Department of Environmental Protection (NYC DEP), AASHTO, ACI, ANSI, DOT, NEMA, UL. The referenced regulations, standards and codes shall be of the latest revision, in effect at the time of execution of the work. Recommendations or suggestions contained within referenced regulations, codes and standards promoting employee health and safety or the overall quality of the work shall be deemed mandatory.

6. Reference to specific regulations, standards, codes, or other items in this specification which are of specific interest to Metro-North Railroad in no way relieves the Contractor of the requirement to comply with all applicable legal requirements, nor should it be construed that Metro-North Railroad, the USEPA, USDOT, NYSDEC, NYSDOH, NYSDOL, NYCDEP, or other Federal, State and City regulators are only interested in these items. Compliance with this specification does not relieve the Contractor of the obligation to comply with other applicable requirements.

7. The Contractor shall comply with all applicable laws, codes and regulations even if they are not specifically referenced herein. Failure to reference a particular code, standard, or regulation within this specification, does not relieve the Contractor from compliance with or conducting work in accordance with all applicable codes, standards, and/or regulations.

8. If an applicable law, code or regulation is more restrictive than the requirements of this specification; the Contractor shall follow the more restrictive requirements. In event of conflict between codes, regulations, standards, contract documents or specifications, the more restrictive requirements shall apply as interpreted by Metro-North Railroad. Metro-North Railroad's decision regarding applicability of the provisions applied independently or as supplemented, modified or voided, shall be final.

9. For estimating and bidding purposes, the Contractor shall assume the more restrictive method will prevail and shall prepare the bid price to reflect the more restrictive method.

10. It is the responsibility of the Contractor to ensure that all Subcontractors are familiarized with the requirements of this specification.

B. Owner's Representatives

1. The Contractor shall adhere to the requirements of this specification, any regulatory agency inspecting the work, managing agents, project managers, project engineers, or any other entities or individuals representing Metro-North Railroad.

2. Metro-North Railroad may engage the services of third parties to provide air monitoring and/or oversee work conducted by the Contractor. The Project Engineer and Environmental Monitor shall serve as representatives of Metro-North Railroad, serving the best interest of Metro-North Railroad. The Engineer and the Environmental Monitor shall report to Metro-North Railroad on matters pertaining to the work being performed and the Contractor's conformance with these specifications and regulatory requirements. Metro-North Railroad authorizes the Project Engineer and the Environmental Monitor to have free access to the work site and all work areas for the performance of duties.

3. The Contractor is hereby notified that the Engineer or the Environmental Monitor has the jurisdiction to stop the Contractor's work if he/she witnesses or observes an instance of substantial non-conformance with these specifications, the contract documents, and/or a situation that may adversely affect the health, safety, and/or wellbeing of the contractor's workforce, Metro-North Railroad's employees, Metro-North Railroad's property, the general public, and/or the environment. Work may be stopped for instances including but not limited to, non-conformance with contract documents or specifications, unsafe work practices, employee misuse or non-use of appropriate personal protective equipment, releases or emissions resulting from the work, use of materials or equipment other than those submitted and approved for use, work not meeting the satisfaction or standard of quality of Metro-North Railroad or the Engineer. The Contractor shall not resume work until corrective measures have been implemented meeting the satisfaction of Metro-North Railroad, the Engineer, and the Environmental Monitor.

C. Use of Subcontractors

1. The Contractor shall submit required submittals for each proposed lead abatement or demolition Subcontractor to Metro-North Railroad Office of System Safety Department for review and approval prior to using any subcontractor(s) to perform any of the specified work.

2. Subcontractors shall be required to perform work in compliance with these specifications and applicable regulations and standards.

1.04 SUBMITTALS

A. General

1. Certain lead specific submittals will be required prior to the start of any work. The Contractor shall make these and any other required submittals in conformance with Part 3 of these specifications in advance of the work, allowing sufficient time for review and revision. In addition to the submittals required herein, the Contractor is hereby given notice

that the Contractor's Corporate Health and Safety Plan, Respiratory Protection Plan, Personal Protective Equipment (PPE) Plan and Hazardous Communication Program as well as scope specific submittals other are mandatory submittals as required by these Specifications and will be reviewed separately. The Metro North Lead Projects Submittal Outline & Checklist is attached.

B. Project – Site Specific

1. Lead Health and Safety Plan (LHASP)
2. Site Specific Work Plan & OSHA Compliance Program
3. Waste Management Plan (As per Section 02 74 19: Construction Waste Management and Disposal)
4. Worker Submittals

C. Requirements

1. The foregoing is a summary of submittals to be provided by the Contractor and applicable sub- contractors to Metro-North Railroad for review. Metro-North Railroad expects for each submittal to be complete upon submission. Metro North reserves the right to request additional submittals from the Contractor as deemed necessary.
2. Information regarding all equipment and materials to be used for the performance of the work must be submitted for Metro-North Railroad's review and approval prior to use. This shall include, at a minimum, product and technical data sheets, specification sheets, material/equipment cut sheets, samples of materials, and design drawings. Submittals shall be of sufficient detail to satisfy Metro- North Railroad's requirements.
3. The Contractor shall maintain all product and equipment data sheets and instructions at the project site.
4. The Contractor shall submit evidence of one or more individuals that have completed the SSPC C3 Competent Person/Lead Supervisor Training. The person directly responsible for the on-site supervision of the work force shall have C3 certification and shall be present on site during all lead exposure related activities.
5. At the direction of Metro-North Railroad, the Contractor shall provide additional preconstruction or post construction photos and/or photos of damages resulting from the Contractor's operations.

D. Site Specific Lead Health & Safety Plan

1. A Lead Health and Safety Plan (LHASP) shall be prepared for the work covered under this specification. This plan shall discuss the occupational health and safety aspects relevant to the construction activities to be undertaken by the Contractor.
2. The LHASP shall address the specific components of this specification and shall be reviewed by the Contractor's Certified Industrial Hygienist (CIH) prior to submission for review by Metro-North Railroad. The plan shall conform to all applicable laws, codes, rules, and regulations.

3. The LHASP shall incorporate by reference, but not be limited to, the following:

   a. OSHA 29 CFR 1910 and 29 CFR 1926, including, but not limited to 29 CFR 1926.21, 1926.62 and 1926.103.

   b. National Institute of Occupational Safety and Health (NIOSH) Pocket Guide

   c. National Institute of Occupational Safety and Health (NIOSH) Manual of Analytical Methods

   d. American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Values

   e. OSHA Sampling and Analytical Methods

4. The LHASP shall, at a minimum, address the following:

   a. The Contractor's policy concerning employee health and safety, A description of how the policy applies to the project including site specific information so that the plan reflects the actual site conditions and scope of work,

   b. A statement of the Contractor's understanding of the Contractor's responsibility to maintain employee health and safety and enforce implemented health and safety procedures,

   c. Responsibilities for site control, management, supervision, and enforcement of health and safety procedures shall be detailed in the plan. The Contractor shall designate an individual who will be responsible for employee health and safety and has the background and authority to know what constitutes safe practices and direct their implementation at the site,

   d. The Contractor's procedures for the protection of Contractor's employees, and employees of Metro-North Railroad, the Engineer, and Metro-North Railroad's representatives shall be detailed in the plan,

   e. The Contractor's policy and procedures for environmental protection including, prevention of air, water, and soil contamination shall be provided in site-specific detail,

   f. The Contractor shall give a description of any special provisions made for safety and health procedures for specific work requirements such as scaffolding, trenching, blasting, torch cutting, fall protection, welding, hoists, cranes, maintenance and protection of traffic, confined space entry,

   g. The plan shall review the Contractor's program for maintaining and revising the health and safety plan as needed to reflect site conditions and procedures and reassessing, re- evaluating the plan on a set schedule or as needed to maintain accuracy and applicability to the work,

   h. The plan shall include a statement regarding the review, revision, and approval of the plan by the Contractor's American Board of

Industrial Hygiene, Certified Industrial Hygienist (CIH),

i. General requirements for emergency planning and contingency plans with a contact list and emergency phone numbers shall be provided,

j. Directions, maps and addresses of nearby health care facilities, fire departments and police departments shall be provided,

k. Reference to the Contractor's other written programs including the Respiratory Protection Plan and Personal Protective Equipment (PPE) Programs including selection and usage specifications, Hazardous Communication Program, and Site Specific Lead Health & Safety Compliance Program shall be incorporated in the plan,

l. A statement of conformance and methods of conformance to the plan by the Contractor, subcontractors, and site visitors shall be included in the LHASP,

m. The LHASP shall detail methods of onsite communication, the lines of communication, and establishment of an emergency contact list,

n. General requirements and the definition of the Work Zone and methods of limiting unauthorized access shall be detailed in the plan,

o. A description of the provisions that will be made for first aid and emergency medical assistance, including equipment available at the site, its accessibility for use by all, and a procedure for replacement of expended first aid materials shall be cited,

p. The plan shall provide a statement that treatment of an injured worker shall not be delayed for the reason of decontamination,

q. Procedures for reporting accidents, injuries, and incidents shall be included in the plan,

r. A description of the site specific medical surveillance program shall be included,

s. EPA's recommended "Levels of Protection" including descriptions and usage requirements shall be included,

t. Industrial hygiene practices including employee Right-To-Know and usage and availability of MSDS,

u. Details of personal exposure monitoring procedures, including a description of the tasks to be monitored, the analytes, equipment, calibration and usage requirements and reporting methods,

v. The Contractor's plan for providing sanitary facilities and clean, potable drinking water,

w. Procedures for employee hygiene and decontamination,

x. The use of safety gear including but not limited to personal protective equipment including eye protection, hearing protection, hard hats, safety shoes, respirators, protective clothing, harnesses, fall protection, fall arrest, gloves and safety belts,

y. Safe electrical procedures, including adequate lighting of work areas, maintenance of temporary circuits, use of insulated tools, ground fault circuit interruption (GFCI), lockout/tag out procedures,

z. Documentation of experience, training and certifications of the Contractor's employees, including personnel responsible for overseeing and enforcing on site safety and health procedures, the competent person, the industrial hygienist, and the American Board of Industrial Hygiene (ABIH) certified industrial hygienist,

aa. Description of the Contractor's plan for regularly scheduled safety meetings and other periodic training to ensure safe work practices, including OSHA required annual refresher training,

bb. A description of housekeeping procedures,

cc. A description of emergency egress and fire escape routes, and that each egress shall be clearly identified and not be blocked or locked,

dd. A description of means implemented for fire protection and prevention including providing fire extinguishers at the site, having scheduled fire drills, and training,

ee. Safe working practices for hot and cold environments,

ff. The Contractor's procedures for the use of powder actuated tools including compliance with New York City Fire Department Regulations by individuals retaining a Certificate of Fitness, as applicable.

E. Site Specific Work Plan & OSHA Compliance Program

1. The Contractor shall submit a detailed Site Specific Work Plan and OSHA Compliance Program (Program) per the requirements of these specifications and 29 CFR 1926.62 (e). The Program shall be site specific to the particular project being undertaken and shall describe in detail the means, methods and procedures for execution of the work and protecting employees, the surrounding community, and the environment from lead exposure during performance of the work. The program shall include a detailed discussion of the sequence of work. This shall include a description of all project related activities, from commencement through completion, providing the sequence of work attached to a work schedule or timeline estimating the anticipated duration of each task.

2. Subcontractors may be required to provide submittals separate from those provided by the Contractor.

3. The Site Specific Work Plan & OSHA Compliance Program shall be prepared in accordance with 29 CFR 1926.62 paragraph (e), which shall be carried out by all employees involved in operations which disturb or remove lead containing materials.

F. The program shall describe the methods, procedures, processes, equipment and materials that will be implemented to reduce or eliminate employee exposure to airborne lead particulate concentration.

G. At a minimum, the program shall address respiratory protection that is in full compliance with 29 CFR 1910.134, an emergency plan of action, methods of exposure assessment, signs to be posted in work areas, protective clothing, engineering and administrative controls, hygiene facilities and practices, decontamination, housekeeping, medical surveillance, training and other items to satisfy OSHA standards as required.

H. The program shall be specific to the scope of work and the site conditions.

I. A listing of the contents of the program in accordance with 29 CFR 1926.62 paragraph (e) follows. The following list is provided only as a guide to assist the Contractor in reviewing the program and is not intended to represent the full contents of a complete compliance program.

1. A summary of the project scope of work including methods of abatement and components affected by the work,

2. A list of all individuals on the work crew. The list should include employee names, employee numbers, certification and/or training identification numbers. In addition, the employee's job description and a brief description of each employee's responsibilities shall be provided,

3. A description of each work activity which may result in employee exposure to airborne lead particulate,

4. A description of the specific engineering controls and work practices which will be implemented to reduce employee exposure as required under 29 CFR 1926.62 paragraph (e)(5) and Appendix B to the standard,

5. A listing of the specific equipment and materials to be utilized on the project, including catalogue cut sheets, product data sheets, product information, product specifications, manufacturer instructions and recommendations for use, Material Safety Data Sheets, and any other information pertinent to the functioning and use of the product,

6. A description of maintenance practices which ensure the proper functioning of equipment used to reduce airborne lead particulate concentrations and employee exposure,

7. A description of the administrative controls implemented to reduce employee exposure to airborne lead particulate including a discussion of the procedures, schedule, record keeping, of employee and/or task rotation that will be utilized,

8. A description of the technology considered to reduce employee exposure below the Permissible Exposure Limit (PEL),

9. A description of the respiratory protection to be utilized on the project,

including catalogue cut sheets, product data sheets, specifications, assigned protection factors and recommendations for use. The Contractor shall indicate which respirator will be utilized by employees for each specific task which may result in employee exposure,

10. A description of the personal protective equipment (PPE) to be utilized on the project, including catalogue cut sheets, product data sheets, specifications and recommendations for use. The Contractor is hereby notified that with regard to disposable coveralls; the use of spun bound polypropylene garments is prohibited.

11. All personal exposure monitoring data compiled during the course of the project shall be maintained at the project site from the onset of the project through project completion. It is the responsibility of the Contractor to ensure that exposure assessment data is collected in accordance with OSHA and NIOSH recommendations for personal exposure assessment and is representative of the actual exposure incurred by the employee(s). The Contractor shall conduct the initial exposure assessments in accordance with 29 CFR 1926.62 paragraph (d). Furthermore, the Contractor shall conduct the initial exposure assessment requirement under 29 CFR 1926.62 paragraph (d) for a minimum of three (3) or more work shifts. The initial exposure assessment data shall be representative of the highest exposure incurred by an employee conducting each potential lead exposure task. During the course of the project, should there be a change of personnel, work practices, types of equipment, processes, or other factor that may affect exposure rates, the initial exposure assessment shall be repeated. Following the initial exposure assessment period, the schedule of personal exposure assessments shall comply with 29 CFR 1926.62 paragraph (d). Personal exposure assessments shall be conducted over the entire work shift. The Contractor is hereby notified that Metro- North Railroad does not accept historical data in lieu of conducting personal exposure assessments.

12. A description of the schedule for inspections for the work site, equipment, and materials to be made by the competent person shall be provided. In accordance with the requirements of 29 CFR 1926.62, Metro-North Railroad requires that the designated competent person be physically on site during all lead related work activities. The Contractor shall include a sample of the inspection checklist or compliance report to be completed by the competent person and shall describe the frequency of inspections.

13. A description of the housekeeping procedures that will be implemented at the work site to maintain surfaces as free as practicable from accumulations of lead.

14. A description of the personal hygiene facilities which will be provided and the hygiene practices to be followed by employees. In addition to the requirements of 29 CFR 1926.62, the Contractor shall provide complete decontamination facilities on projects involving tasks that are known or suspected of resulting in employee exposure to airborne lead particulate in excess of the Permissible Exposure Limit (PEL). The

Contractor shall describe in detail the operation, maintenance, and cleaning of facilities and provide manufacturer catalogue cut sheets, product data sheets, instructions and recommendations for use.

15. A description of the implementation schedule of the program on the project.

16. The compliance program shall include a statement in accordance with 29 CFR 1926.62 paragraph (e)(2)(v) that the program will be reviewed and revised as necessary at six (6) month intervals.

17. The compliance program shall include a statement the program will be available on the work site and available at all times for review by employees, the competent person, OSHA, Metro-North Railroad, the Environmental Monitor, and any other entity affected by the work.

J. Site Specific Waste Management Plan

1. The Contractor shall provide a written Waste Management Plan as per Section 02 74 19: Construction Waste Management and Disposal, which addresses the proper collection, handling and storage of all waste. Waste includes paint waste, potentially contaminated materials, containment materials, personal protective equipment, construction debris, scrap steel, spent solvents, and any other hazardous or non-hazardous wastes generated during the project.

2. Unless otherwise directed, only hazardous and non-hazardous waste generated directly from lead remediation activities will be transported and disposed of by Metro-North Railroad's contracted waste disposal company. Metro-North Railroad shall contract, separately, the transportation and disposal of all hazardous and non-hazardous waste. The contractor shall provide drums for debris generated.

3. The following information shall be included in the Waste Management Plan:

   a. The Contractor shall provide the procedures that will be followed for the collection, site handling, storage, packaging and labeling of the waste.

   b. If solvents are designated for reuse rather than disposal, the Contractor shall provide a solvent handling plan which includes the procedures that will be followed to control and track the solvents while on site, and between the work site and the final destination.

   c. The Contractor shall provide a detailed Emergency Response and Contingency Plan which addresses worker training and the notification, clean up, and reporting in the event of a spill per these specifications. The Contractor shall comply with the requirements for implementation of the Emergency Response and Contingency Plan in the event of releases which may impact the public or the environment.

K. Transporter Information

1. Hazardous Waste Transporters

a. Metro-North Railroad shall be responsible for the transportation of hazardous wastes. Transportation of hazardous wastes is excluded from the Contractor's scope of work.

b. The Contractor shall assist with coordination of the transportation of hazardous wastes with Metro-North Railroad and Metro-North Railroad's representatives designated to arrange for the transportation of hazardous wastes. Coordination efforts shall include assistance with the inventory and scheduling for delivery and pick-up of roll-off containers and/or pick-up of drummed wastes. Contractor in all related cases shall ensure ready access to drums and other containers scheduled for pick-up and disposal.

L. Non-Hazardous Waste Transporters

1. The Contractor shall submit the name, address, qualifications, and experience of each proposed hauler of construction debris, scrap steel, and filtered, non-hazardous wastewater.

2. The Contractor shall provide the following information pertaining to the facility:

a. Any violation of any legal requirement in the last five (5) years relating to the protection of the environment, and describe any such notice of violation and status;

b. Any notification of any claim pertaining to investigation or remediation of any hazardous substance at the facility or;

c. Any request for information or other inquiry from a governmental entity or private party relating to the release or potential release of any hazardous substances at the facility.

M. Scrap Steel

1. The Contractor shall identify the entity proposed for handling scrap steel for disposal and the method(s) of disposal that will be used. The Contractor shall provide the entity written notification that the steel is coated with lead containing paint. The Contractor shall provide a letter (attached at the end of section 3) from the entity indicating that it will accept the scrap steel coated with lead paint, is authorized to accept the scrap steel under the laws of the state of residence; has the required capability to assure that scrap steel coated with paint which contains lead and other heavy metals is re-smelted; and will ensure that the steel is destroyed in accordance with the provisions of this specification.

2. The Contractor shall provide Metro-North Railroad with the original letter signed by a legally authorized representative of the entity or facility.

N. Wastewater

1. The environmental monitor will periodically collect samples of waste water. Laboratory analysis of the waste water will determine the classification of the water as hazardous or non- hazardous.

2. The Contractor shall provide drums for waste water collection and storage

prior to disposal.

3. Non- hazardous waste water shall be disposed of by the Contractor in accordance with applicable local, state and federal regulations.

4. A firm separately contracted by Metro-North Railroad shall transport and dispose of waste water classified as hazardous. Transportation of hazardous wastes, including waste water, is excluded from the Contractor's scope of work.

O. Worker Submittals

1. Certificate of Lead Awareness Training, (1926.62 (l) (2)) for each worker – Within one year of project date.

2. Lead Physical Examinations (29 CFR 1926.62 (j) (3)) for each worker – Within one year of project date.

3. Analytical results of blood analysis consisting of Blood Lead Levels and Zinc Protoporphyrin testing must be performed within 15 days of project start date,

4. Respirator Fit Tests, for each worker – Within one year of project date.

5. Medical Clearance to wear Respiratory Protection for each worker – Within one year of project date.

6. Current SSPC, C 3 / C 5 Certification for Competent Person.

P. Site Specific Containment Plan

1. The Contractor shall provide a Containment Plan for review and approval by Metro-North Railroad. The Containment Plan shall include containment working drawings, design calculations, and other information requested for review and approval by Metro-North Railroad prior to requisition of the containment system(s). The contents of the Containment Plan shall include, but not be limited to:

2. Detailed drawings stamped by a Professional Engineer licensed in the State of New York. The Professional Engineer must analyze the containment system for the effects of wind forces on the structure as well as the containment system itself and all other imposed loads. The containment system shall not induce a load on the structure which will affect the structural integrity of the structure.

3. Data, calculations, and assumptions used for the design of the containment and ventilation system and the imposed loads on the existing structure, signed by a Professional Engineer licensed in the State of New York.

4. The plan and procedures for staging, installing, moving, and removing the containment.

5. The methods and locations of attachment to the structure.

6. The methods of access that will be provided to work areas inside containment, locations of safety lines, and locations of emergency containment entryways and exits shall also be included.

7. Procedures for cleaning, securing, monitoring and removing the containment and/or protecting materials used to construct the containment at the end of each day and/or in the case of expected inclement weather during work shut downs.

8. Plans for maintaining sufficient lighting inside containment during all work operations, including inspection, and for maintaining the navigational lighting (if applicable) during the work. Procedures for maintaining sufficient exterior lighting to ensure compliance with the restrictions on emissions and releases set forth in this specification, and to the extent that lighting is necessary for nighttime operations, when applicable.

9. Procedures and methods for communicating between equipment operators and workers inside containment, including the responsible foreman and Metro-North Railroad, the Engineer, or the Environmental Monitor, to provide for immediate shut-down of blasting equipment during abrasive blasting operations when necessary, and to communicate any corrective measures which need to be undertaken.

10. Plans and procedures for the collection and removal of waste and debris from within the containment.

11. Technical data sheets, specification sheets, material samples, and any other information needed to thoroughly describe the containment plan and materials proposed for use.

12. Containment drawings including detail sketches of all seams and seals, and ventilation design(s) for proper ventilation and negative pressure, including calculations and assumptions. All drawings and designs shall be in sufficient detail to allow for the proper review by Metro-North Railroad, and shall comply with the requirements of this specification.

13. Samples of containment materials and sealants, and actual methods of sealing, shall be submitted for review.

14. A statement that the Contractor will shut down operations, adjust work practices, modify containment and take other steps as necessary to comply with the results of the monitoring and the assessments of visible emissions as directed by Metro-North Railroad and/or the Environmental Monitor.

15. A written program for the observation of visible emissions during project activities, and inspections for releases or spills of dust and debris that may become deposited on surrounding equipment, property, soil, water, and sediment. Include the frequency and methods of observation and inspection that will be made, areas or work activities that will be observed, and the frequency and nature of clean up that will be undertaken. Include the name(s) and qualifications of the personnel conducting the observations and inspections, and the methods and equipment that will be used for cleanup activities.

16. A written program for visual inspection of the ground, soil, equipment, structure and other surfaces prior to commencement of the project, continuously during the project, and upon completion of the project to

ensure that the ground, soil, equipment, structure and other surfaces are not and have not been affected by project activities. Include clean-up procedures that will be followed.

17. A written program identifying the procedures and methods that will be used to conduct daily and final visual cleanliness inspections and evaluations and final clean up upon completion of the project shall be submitted to Metro-North Railroad by the Contractor. These inspections are conducted to assure that the area and surrounding equipment, property, structures, ground, soil, water, sediment, and other surfaces have been properly cleaned and are free of visible paint dust and debris, abrasives, or other contaminated debris in compliance with this specification.

18. The Contractor shall identify the solutions, detergents, solvents, etc. proposed for the cleaning of surfaces and equipment when wet wiping or washing is employed.

Q. Site Specific Cleaning, Surface Preparation & Re-Coating Plan

1. The Contractor shall provide detailed, written procedures on intended methods of cleaning, surface preparation, and coating application. The Contractor shall include a description of all equipment and materials, including the equipment manufacturers' catalogue cuts, technical data sheets, specifications and instructions.

2. The Contractor shall identify the level of containment, methods of protection, or work isolation procedures that will be followed to protect surrounding structures, equipment, and property from exposure to all cleaning methods as well as those methods which will provide protection from exposure to paint, overspray, solvent materials, and general paint debris.

3. The Contractor shall describe the proposed method of chloride and ferrous salt removal.

4. The Contractor shall identify the name and chemical composition of detergents or solutions that will be used for cleaning the existing coating or for the removal of mildew. MSDS and product literature shall be submittal to Metro-North Railroad for review and approval prior to use.

5. The Contractor shall identify the type, brand name, and size of the abrasive proposed for use, if applicable. The contractor is hereby notified that only recyclable abrasive blast media and systems are approved for use on Metro-North Railroad property.

6. The contractor shall include procedures to be followed for cleaning of the primer coat prior to field painting as finish coat when specified as part of the scope of work.

7. The Contractor shall identify the coating materials to be applied and include the manufacturer's name, product names, and product numbers. Product data sheets, VOC levels, MSDS, and written application instructions including mixing requirements, specified thinners, and thinner amounts (see Coating Product Submittals) shall be provided to Metro-North Railroad for review. Metro-North Railroad reserves the right to specify the coating products to be used by the

Contractor.

8. In the event of conflict between the manufacturer's technical data, specifications, or usage instructions and the requirements of this specification, the Contractor shall comply with the requirements of this specification unless the requirements of the manufacturer are more restrictive. In these cases, the Contractor shall advise Metro-North Railroad of any discrepancies in writing, and comply with Metro- North Railroad's written instruction with respect thereto.

9. The Contractor shall identify the procedures and methods of testing to be utilized to monitor the surface preparation and painting work, utilizing industry standard methods, including but not limited to compressed air cleanliness, ambient conditions, surface temperature, abrasive size and use, surface profile, degree of cleanliness, wet and dry film thickness or adhesion.

R. Project Notifications

1. The Contractor shall provide formal written notification to all local, state and/or federal agencies as required by law or as directed by the Engineer or Metro-North Railroad. The contents of the agency notification(s) shall be submitted to Metro-North Railroad for review fifteen (15) days prior to the deadline for submittal to a specified agency.

2. The Contractor shall provide written notification to adjacent contractors informing them of the potential for exposure to lead. In the event notification is required, the Contractor shall submit the notification to Metro-North Railroad for review prior to submittal to the effected Contractor(s).

3. Should the Contractor launder personal protective clothing, the contractor shall notify the laundry and provide information on bags or containers of contaminated protective clothing and equipment as required by 29 CFR 1926.62 (g)(2)(vii)(B). The Contractor shall provide a sample of the notification to Metro-North Railroad prior to use.

S. Project Close-Out Submittals

1. Upon completion of the work, and prior to release of final payment, the Contractor shall submit the following information to Metro-North Railroad.

2. All filings, permits, variances, approvals, etc. granted to the Contractor by authorities or agencies to complete the work.

3. A complete copy of the Contractor's job log and the competent person's log.

4. All personal exposure monitoring data, including laboratory analytical data, compiled throughout the project.

5. Reports signed by a Certified Industrial Hygienist summarizing all blood testing results.

6. The Contractor shall provide copies of all documentation pertaining to

the disposal of all hazardous and non-hazardous waste generated during the work, including but not limited to, a written log of the type and quantity of waste that was generated and removed from the project site, executed waste manifests/waste shipment records (if applicable), bills of lading, waste shipment records.

1.05 RELATED SECTIONS

A. Section 02 74 19: Construction Waste Management

1.06 REFERENCES

A. General

1. Reference of a particular code, regulation or standard shall apply to the work with the same authority as if it were included word for word in the specifications. Work shall conform to the applicable provisions of reference documents cited directly in the specifications and shall also conform to all codes, standards and specifications, or part thereof, cited in reference documents stipulated in the specifications. Unless otherwise noted, the latest editions and revisions of the referenced codes standards, specifications and other reference documents in effect during execution of the work shall govern.

2. Failure to reference a particular code, standard, or regulation within this specification, does not relieve the Contractor from compliance with or conducting work in accordance with applicable codes, standards, or regulations.

B. Regulations

1. Administrative Code of the City of New York

a. Section 1403, Part III of Chapter 57

b. Section 16, NYC Department of Sanitation Regulations

1.07 CODES, RULES AND REGULATIONS OF THE STATE OF NEW YORK (NYCRR)

1. Title 6, Chapter III, Subchapter B, Air Resources Part 211.2, Air Pollution

2. Parts 256 – 257, Ambient Air Quality Standards

3. Title 6, Chapter IV, Subchapter B, Solid and Hazardous Waste Laws Part 364, Waste Transporter Permits

4. Part 370, Hazardous Waste Management

5. Part 371, Identification and Listing of Hazardous Wastes

6. Part 372, Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities

7. Part 373, Treatment, Storage, and Disposal Facilities

8. Parts 595-597, New York Rules of Releases, Registration, and Listing of Hazardous Substances Title 6, Chapter X, New York State Pollutant Discharge of Water Resources Elimination System New York State Department of Environmental Conservation 6 NYCRR Subparts 371-376.

1.08 CODE OF FEDERAL REGULATIONS (CFR)

A. 29 CFR 1926, Occupational Safety and Health Regulations for the Construction Industry 29 CFR 1926.28 Personal Protective Equipment

B. 29 CFR 1926.33 Access to Employees Exposure and Medical Records 29 CFR 1926.51, Sanitation

C. 29 CFR 1926.55, Gases, Vapors, Fumes, Dusts, and Mists 29 CFR 1926.59 Hazard Communication

D. 29 CFR 1926.62 Lead Exposure in Construction; Interim Final Rule Vol. 58, No. 84 29 CFR 1926.103 Respiratory Protection

E. 29 CFR 1910.134 Respiratory Protection

F. 29 CFR 1910.132 General Requirements for Personal Protective Equipment 29 CFR 1910.133 Eye and Face Protection

G. 40 CFR 50, National Primary and Secondary Ambient Air Quality Standards 40 CFR 58, Ambient Air Quality Surveillance

H. 40 CFR 60, App A, Method 9, Visual Determination of the Opacity of Emissions from Stationary Sources 40 CFR 60, App. A, Method 22, Visual Determination of Fugitive Emissions from Material

I. Sources and Smoke Emissions from Fires

J. 40 CFR 61, Subpart A General Provisions (Hazardous Air Pollutants Listing)

K. 40 CFR 61,152 Standard for Waste Manufacturing, Demolition, Renovation, Spraying and Fabricating Operations.

L. 40 CFR 241 Guidelines for the Land Disposal of Solid Wastes 40 CFR 257 Criteria for Classification of Solid Waste

M. 40 CFR 261 Identification and Listing of Hazardous Wastes

N. 40 CFR 261, Appendix II EPA, Toxicity Characteristic Leaching Procedure 40 CFR 262 Standards Applicable to Generators of Hazardous Waste

O. 40 CFR 263 Standards Applicable to Transporters of Hazardous Waste

P. 40 CFR 264 Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities

Q. 40 CFR 265 Interim Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities

R. 40 CFR 265, Subpart C, Preparedness and Prevention

S. 40 CFR 265, Subpart D, Contingency Plan and Emergency Procedures 40 CFR 265.16 Personnel Training

T. 40 CFR 268 Land Disposal Restrictions

U. 40 CFR 302, Designation, Reportable Quantities and Notification 40 CFR 355, Emergency Planning and Notification

V. 40 CFR 71-179, Transportation of Hazardous Materials Regulations

W. Testing Methodologies

1. Below is a partial list of test methods that may be used for verifying compliance to the specifications and/or manufacturer's technical data sheets. Other test methods not listed below may be required at Metro-North Railroad's discretion.

1.09 FEDERAL TEST METHOD STANDARD NO. 141 "PAINT, VARNISH LACQUER AND RELATED MATERIALS: SAMPLING AND TESTING"

A. Federal Test Method 141 4091 Coarse particles and skins in oil base paints & pastes

B. Federal Test Method 141 6252 Self-lifting test

C. Federal Test Method 141 4053 Non-volatile vehicle

1.10 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A. ASTM-D-3925 Sampling for inspection

B. ASTM-D-1210 Fineness of grind

C. ASTM-D-2244 Color

D. ASTM-D-1640 Drying time

E. ASTM-D-523 Gloss

F. ASTM-D-563 Phthalic anhydride content in Resins

G. ASTM-D-2698 Pigment content

H. ASTM-D-2369 Solids by weight

I. ASTM-D-2697 Solids by volume

J. ASTM-D-4400 Sag resistance (mils)

K. ASTM-D-1849 Skinning

L. ASTM-D-562 Viscosity

M. ASTM-D-1475 Weight per gallon

N. ASTM-D-2369 VOC Content

O. ASTM-D-1400 Standard Test Method for Non-Destructive Measurement of Dry Film Thickness of Non-Conductive Coatings Applied to a Non-ferrous Metal Base

P. ASTM-D-3359 Standard Test Methods for Measuring Adhesion by Tape Test

Q. ASTM-D-4138 Standard Test Method for Measurement of Dry Paint Thickness of Protective Coating Systems by Destructive Means

R. ASTM-D-4285 Standard Test Method for Indicating Oil or Water in Compressed Air

S. ASTM-D-4414 Standard Practice for Measurement of Wet Film Thickness by Notch Gages

T. ASTM-D-4417 Standard Test Methods for field Measurement of Surface Profile of Blast Cleaned Steel

U. ASTM-D-4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

V. ASTM-D-4752 Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub

1.11 EPA METHODS

A. EP/600/R-94/038b, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods, Section 2.8 (Lead) and 2.11 (PM-10).

B. SW 846 Test Methods for Evaluating Solid Waste – Physical/Chemical Methods Method 3050, Acid Digestion of Sediment, Sludge, and Soils

C. Method 1311 Toxicity Characteristic Leaching Procedure (TCLP)

1.12 NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH AND SAFETY (NIOSH)

A. NIOSH Manual of Analytical Methods NIOSH Method 7082, Lead

1.13 OTHER

A. American Industrial Hygiene Association (AIHA)

B. Environmental Lead Proficiency Analytical Testing Program (ELPAT) Proficiency Analytical Testing Program (PAT)

1.14 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) PUBLICATIONS

A. Z88.2-1980 Practices for Respiratory Protection

B. Z87.1 Eye Protection

1.15 SOCIETY FOR PROTECTIVE COATINGS (SSPC)

A. SSPC Painting Manual-Good Painting Practice-Volume 1

B. SSPC Painting Manual-Systems and Specifications-Volume 2 (Eighth Edition) SSPC-PA 2 Measurement of Dry Film Thickness with Magnetic Gages

C. SSPC-VIS 1 Visual Standard for Abrasive Blast Cleaned Steel

D. SSPC-VIS 3 Visual Standard for Hand and Power Tool Cleaned Steel

E. SSPC Guide 6 Guide for Containing Debris Generated During Paint Removal Operations (revised 12/01/1997)

F. SSPC Guide 7 Guide for the Disposal of Lead-Contaminated Surface Preparation Debris

G. Industrial Lead Paint Removal Handbook, 2nd Edition, Volume I (SSPC 93-02) Project Design, Industrial Lead Paint Removal Handbook, Volume II (SSPC 94-18)

H. Industrial Lead Paint Abatement: Practical Techniques for Complying With Regulations (SSPC 94-02)

END OF PART 1

PART 2 – PRODUCTS

2.01 EQUIPMENT SPECIFIC TO LEAD ABATEMENT/SURFACE PREPARATION

A. All power tools shall be equipped with commercially available HEPA filtered local exhaust ventilation. Power tools equipped with dust collection shall be attached to HEPA filter equipped vacuums capable of providing the vacuum and airflow recommended by the tool manufacturer.

B. The Contractor shall deliver equipment to the project site in clean, working condition.

C. Equipment having HEPA filters shall be delivered to the work site with new primary and secondary filters installed prior. Removal and replacement of use filter elements after arrival to the project site is prohibited.

D. All ventilation and vacuum equipment having HEPA filtration shall be delivered to the job site with new filter media. Filtration media may be replaced on site during the course of the project, as required to maintain proper functioning of equipment and adequate filtration of exhaust air. On-site filter replacement shall be conducted within containment enclosures having operating engineering controls in place to control airborne particulate.

E. Prior to removal from the work site, the Contractor shall clean all equipment, unused materials, and other non-disposable items to be removed from the work site. Cleaning shall be accomplished via HEPA vacuuming and wet cleaning.

F. Vacuum equipment shall be equipped with HEPA filtration. Vacuum equipment shall be sized and suited to the specific type of planned usage.

G. Collection / filter bags shall be removed from all HEPA vacuums utilized on the project prior to removal from the project site. Gross debris remaining in HEPA vacuum canisters or collection tanks shall be removed via another HEPA vacuum.

H. As applicable, air filtration devices (AFDs) equipped with HEPA filters shall be provided.

I. Unless otherwise directed, used filter elements shall be disposed of as hazardous waste.

J. Prior to removal from the contained work area or project site, the inlets and outlets of dust collectors, ventilation ducts, HEPA vacuums, air filtration devices, and other contaminated equipment shall be sealed to prevent the escape of any debris remaining within the equipment.

END OF PART 2

PART 3 – EXECUTION

3.01 LEAD HEALTH & SAFETY

A. Airborne Dust & Particulate Control

1. The Contractor shall implement engineering controls to minimize the generation of airborne particulate.
2. Dust control measures may include wetting of surfaces, the use of HEPA filter equipped mechanical ventilation, or other methods approved by Metro-North Railroad.
3. In accordance with 29 CFR 1926.62 paragraph (e), the Contractor shall implement work practices and engineering controls to reduce employee exposure to lead particulate as the primary means of protecting employees from exposure to lead particulate.
4. The Contractor shall immediately cease work should equipment crucial to maintaining employee health and safety become defective or not be functioning properly.
5. The following work practices/methods are prohibited:
   a. Dry sweeping / broom use
   b. Un-contained, open abrasive blasting,
   c. Un-contained use of compressed air to blow down or remove dust from surfaces,
   d. Use of power tools not equipped with HEPA filter equipped local exhaust ventilation.
   e. Use of heat guns or open flame to remove coatings.

B. Health & Safety Requirements

1. Competent Person
   a. The Contractor shall provide a competent person responsible to perform the duties required by 29 CFR 1926.62. The competent person shall be present on site during all lead related activities. The designated competent person shall be responsible for examination and evaluation of equipment utilized to minimize worker exposure, employee work practices, and personal protective equipment. Other responsibilities shall include, but are not limited to:
      1) Maintain a permanently bound daily entry job log, signed by all individuals who enter and leave the site. The log shall record the Contractor, the specific work area, name and signature of the person, Metro-North Railroad's contract number and the type of respiratory protection utilized by the worker. The daily entry logbook shall be available for inspection by Metro-North Railroad throughout the project.
      2) Maintaining a project inspection log recording daily events, work progress and unusual events during the course of

the work. This log shall remain on-site and be made available to Metro-North Railroad upon request.

b. The competent person shall have successfully completed the Society for Protective Coatings (SSPC) C-3 Supervisor/Competent Person Training For De- leading of Industrial Structures.

2. Certified Industrial Hygienist

a. The Contractor shall retain the services of a Certified Industrial Hygienist (CIH) holding current certification by the American Board of Industrial Hygiene (ABIH) with at least one (1) year experience on hazardous waste operations. The certified industrial hygienist shall be involved in the preparation of all health and safety related submittals and shall review and approve the Contractor's submittals prior to submission to Metro-North Railroad. The Contractor shall arrange for inspections of the project site by the CIH. At a minimum, site inspections shall be conducted by the CIH during the initial phases of the lead related tasks.

3.02 WORK AREA SEGREGATION & PREPARATION

A. Work Area Segregation & Preparation

1. The Contractor shall establish the perimeter boundaries of the work zone. The perimeter of an active work area shall be demarcated by "caution tape" and lead hazard signs consistent with 29 CFR 1926.62 paragraph (m). The work zone shall include the entire area utilized by the Contractor to perform the work. If site conditions allow, an additional exclusion zone extending twenty-five (25) feet from the perimeter of the work zone shall be established. The exclusion zone shall be demarcated by "caution tape" and lead hazard signs consistent with 29 CFR 1926.62 paragraph (m).

2. Lead hazard signs consistent with 29 CFR 1926.62 paragraph (m) shall be posted in accordance with OSHA requirements and at all points of entry to the work zone(s), containment(s), and the decontamination facility. Signs utilized outdoors and exposed to the weather elements shall be weatherproof or otherwise protected from damage and fading. The Contractor shall maintain or replace signs as needed to maintain effectiveness throughout the work.

3. The Contractor shall install temporary fencing enclosing the work zone, or exclusion zone, preventing access of unauthorized personnel. The Contractor shall maintain the fencing as needed to maintain its integrity throughout the work.

4. Access to the work area shall be restricted to Metro-North Railroad, the Contractor, Contract personnel, and other authorized personnel who have donned the appropriate personal protective equipment, have received the appropriate training in respiratory protection and lead exposure hazards, and are familiar with the decontamination procedures specified herein.

5. The Contractor shall request approval from Metro-North Railroad for any person not directly involved in the project, to enter the work area. Only upon Metro-North Railroad's approval shall such persons be allowed to enter the work zone.

B. Requirements For The Establishment of Exclusion Zones

1. The Contractor shall establish regulated areas, or exclusion zones, around areas or activities which may produce airborne emissions of lead in excess of the applicable Action Level.

2. Based upon observations and/or air monitoring conducted by the Environmental Monitor, Metro-North Railroad may require the Contractor to expand the exclusion zones beyond initial boundaries.

3. The Contractor shall provide the Environmental Monitor with a list of workers daily to ensure that all workers who enter the regulated area have had the proper training, blood analysis and medical examinations, and are wearing the required protective clothing and equipment.

4. The Contractor shall prohibit eating, drinking, smoking, and chewing tobacco products in any area where the exposures exceed the Action Level.

C. Signs

1. The Contractor shall post caution signs around the regulated area. Signs must be posted to adequately inform employees of the potential exposure to lead and the need for personal protective equipment. Signs are to be clearly visible during all hours, cleaned as necessary, and positioned as to be easily visible from all routinely used approaches to the lead work area. Signs shall be in compliance with the requirements of 29 CFR 1926.62.

2. The Contractor shall use signs that are a minimum of 8 1/2 inches by 11 inches in size with black block lettering on a white, yellow, or orange background. Signs shall display the following message:

WARNING LEAD
WORK AREA

POISON

NO EATING OR
SMOKING

3.03 SPECIFIC LEAD ABATEMENT METHODOLOGIES & PROCEDURES

A. Available Lead Abatement Methodologies

1. The Contractor shall employ one or a combination of lead abatement methods to satisfy Metro- North Railroad's requirements depending on the project specific scope of work. Metro-North Railroad reserves the right to accept or reject specific lead abatement methodologies based upon the health and safety, and environmental risks posed to employees performing the work, adjacent occupants, communities, and the public, the

Contractor's experience with performing a specific method, the potential quantities and types of waste resulting from the method, the noise, fumes, and/or odors associated with the specific method, and any other concerns.

2. The following are the currently available and accepted methods of abating lead painted surfaces:

B. Removal of paint from components or building materials:

1. Paint removal shall be known as the complete removal of all visible paint from the substrate. Paint removal may be accomplished utilizing one or a combination of available methods, such as, chemical stripping, power tool cleaning utilizing mechanical surface preparation tools equipped with HEPA filtered local exhaust ventilation, contained abrasive blast cleaning, wet abrasive blast cleaning, or other suitable means submitted by the Contractor and approved for use by Metro-North Railroad.

C. Removal and replacement of components or building materials having lead containing paints, in their entirety:

1. Removal and replacement of lead painted components or building materials shall include the removal of lead based painted components or building materials in their entirety and replacement with similar non-lead based painted components of equal or greater quality. Metro-North Railroad reserves the right to accept or reject replacement materials based upon comparative quality and durability, aesthetic nature and physical attributes, form and function, and the overall suitability of the product for its intended use.

D. Encapsulation of lead based painted surfaces:

1. Encapsulation of lead based painted components or building materials shall include the covering of a lead based painted surface with a coating product, which is applied in a liquid state and then cures to provide a protective film over the underlying lead based painted surface.

E. Enclosure of lead based painted surfaces:

1. Enclosure of lead based painted components or building materials shall include the covering of a lead based painted surface with a rigid building material creating a physical barrier between the underlying lead based painted surface and the area in which the component is located. Enclosure typically involves encasement of a lead based painted surface with gypsum board, paneling, metal sheeting, etc.

F. Surface Preparation & Paint Removal

1. The Contractor may utilize a combination of surface preparation methods described in this specification or otherwise approved by Metro-North Railroad.

2. The Contractor shall not perform any work which requires the disturbance of a lead containing material without the prior authorization of Metro-North Railroad.

3. The Contractor shall perform a demonstration of the cleaning method for

Metro-North Railroad to demonstrate the effectiveness of the proposed method of surface preparation.

4. Prior to torch cutting, open flame burning, rivet/bolt busting, or other impact or abrasive related work which may cause lead particulate releases, all visible paint within six (6) inches of the area of disturbance shall be removed, as technologically feasible.

5. All paint chips, paint removal material, and any other debris generated in the cleaning process shall be contained, captured, collected and disposed of in accordance with the provisions set forth in this specification.

G. Abatement of Lead - Containing Paint – Interior Locations

1. Prior to the start of work, all movable objects shall be removed from the work area. All movable objects remaining within the work area at the start of the project shall be considered contaminated unless otherwise determined by Metro-North Railroad. Prior to removal from the work area, and at the direction of Metro-North Railroad, potentially contaminated movable objects shall either be cleaned via approved methods outlined in this specification or methods proposed by the Contractor and approved by Metro-North Railroad or discarded. Upon completion of cleaning, movable objects shall be removed from the work area, and stored in non-contaminated areas outside of the boundaries of the work area. Objects remaining in the work area shall be isolated from the remainder of the work area. At the direction of Metro- North Railroad, the Contractor shall construct a rigid, sealed, enclosure surrounding the items as necessary to protect items from damage during the work.

2. Interior lead-containing paint abatement, including demolition and surface preparation of lead based painted surfaces, shall be contained. Containment for interior lead abatement will require the installation of critical barriers. At a minimum, containment barriers shall be constructed of two (2) layers of six (6) mil poly sheeting. Reinforced poly shall be used to protect floor surfaces.

3. Containment shall prevent the migration of particulate to areas or locations outside the work area. Should an entire area, room, etc. be the work area, containment barriers may be limited to doors, windows, ducts, registers, grilles, or other penetrations to the work area. Critical barriers shall be installed as necessary to isolate components not included in the scope of work.

4. The entry to the work area shall be equipped with an airlock entryway. The airlock entryway shall have a minimum of four (4) feet between airlock flap doors and shall have dimensions large enough to allow for the passage of all movable objects to be removed from the work area, and all materials, tools, equipment necessary to complete the work. The airlock shall be cleaned regularly and walk-off mats shall be installed in the airlock to prevent tracking of dust outside of the work area.

5. In the event the space contains heating, ventilation and air conditioning (HVAC) equipment, the following procedures shall be followed.

a. If the HVAC system supplies only the active work area and no other areas adjacent to the work area, the HVAC system shall be blanked at the system's entrance to the work area.

b. If HVAC equipment runs through the work area supplying occupied areas adjacent to, but outside of the boundaries of the work area, the HVAC system shall remain in operation but be completely sealed.

c. Supply diffusers and return grilles, shall be cleaned and sealed. All seams in the ducting systems shall be cleaned and sealed. The exterior of the ducts running through the work area shall be cleaned as part of the final cleaning, prior to project completion.

6. Electrical, mechanical and other non-moveable equipment within the work area shall be framed out with solid, load bearing barriers of 3/8" thickness or greater. Equipment which must remain operational during the work shall be segregated with a solid rigid barrier and isolated from the work area. Equipment shall be ventilated via a flex duct system brought from outside of the work area.

7. Unless otherwise directed, light fixtures shall remain in place and be securely wrapped with a single layer of 6 mil poly.

8. Mechanical ventilation shall be implemented as an engineering control to reduce employee exposures to airborne particulate during the work. A sufficient quantity of HEPA filter equipped air filtration devices shall be installed to provide a minimum of twelve (12) air changes per hour in the active work area during surface preparation, demolition, or other disturbance of lead containing materials. Air filtration devices shall be located as far as possible from the entry/egress to the work area(s), or other locations of make-up air, to create a cross draft through the work area. Air filtration devices shall be exhausted outside of the work area.

9. The Contractor shall implement additional engineering controls and good work practices such as wetting or misting of surfaces and/or localized exhaust ventilation as necessary to minimize the generation of airborne particulate throughout the work.

H. Cleaning Methods & Procedures

1. General

a. Cleaning of surfaces shall be accomplished via HEPA filter equipped vacuums, and wet wiping,. The Contractor shall identify the specific methods proposed for the cleaning of surfaces and the equipment to be utilized.

2. HEPA Vacuuming

a. HEPA vacuuming shall be utilized to remove, recover, and collect debris. Dry brushing, wiping, sweeping, blowing via compressed air, or other methods resulting in the generation of airborne particulate are prohibited. The vacuum equipment shall be properly sized to the specific task being employed. Recovery of spent abrasive blast media shall be conducted utilizing

industrial grade vacuum equipment.

b. HEPA vacuum attachments shall be manufactured by, or approved for use by, the HEPA vacuum manufacturer.

The Contractor's site supervisor shall be responsible for the proper operation and maintenance of vacuum equipment and shall review the proper use of equipment and attachments with the work force.

3. Wet Cleaning Procedures

a. Wet wiping of surfaces shall be conducted using detergent approved by Metro-North Railroad prior to use.

b. The surface shall be deemed "clean" when visible surface contamination can no longer be removed from the surface. No visible detergent residue or streaking from contamination shall remain on the surface.

c. Unless otherwise directed, upon completion of wet wiping, all surfaces shall be rinsed with clean water.

d. All wastewater generated during wet wiping shall be handled in accordance with the waste handling section of these specifications.

e. Care shall be taken to avoid excessive accumulation or pooling of water within work areas. Accumulated water shall be extracted via wet/dry HEPA vacuums or absorbed with sponges or towels.

f. The Contractor shall install dehumidification equipment as necessary to lower the moisture content of building materials to acceptable levels prior to coating application.

g. Surfaces shall be allowed to thoroughly dry prior to application of coatings.

4. Cleaning Carpeted Surfaces

a. Carpet specified for removal shall have visible paint debris removed via HEPA vacuuming. Carpet shall be removed after area work area preparation / isolation has been accomplished.

b. Carpet specified to remain shall be HEPA vacuumed utilizing HEPA vacuums designed for carpeted floor surfaces and having a power head with rotating agitator or beater brush. No exceptions to this requirement will be made.

c. Commercial cleaning of carpet may be implemented upon prior approval from Metro-North Railroad.

5. Cleaning Concrete and Other Rough Surfaces

a. Upon approval of Metro-North Railroad, the Contractor may utilize commercially available equipment specifically designed to pressure wash and recover water simultaneously for cleaning concrete or similar rough surfaces.

I. Demolition of Lead-containing Components

1. Prior to demolition of materials coated with lead containing coating, all loose, peeling, non- adhering paint shall be removed from the components specified for demolition. Paint removal shall meet the requirements of an SSPC SP2 Hand Tool Cleaning.

2. The Contractor shall implement engineering controls and good work practices to reduce the generation of airborne lead particulate. Surfaces shall be wetted prior and during surface preparation and demolition. Mechanical ventilation equipped with HEPA filtration shall be utilized to ventilate the work area.

3. Disposal requirements for lead based painted building components shall be determined via laboratory analysis of representative samples of the waste stream via EPA Methods 1311/6010 (TCLP Lead).

J. Demolition / Dismantling of Steel Components Having Lead Containing Paint

1. Steel repair, replacement, reinforcement, or rehabilitation involving the disturbance of coatings shall be conducted as described in this section and in accordance with 29 CFR 1926.62, 29 CFR Subpart J Welding and Cutting, and specifically 1926.353 Ventilation & Protection: Welding, Cutting, and Heating and 1926.354 Welding, Cutting, and Heating in Way of Preservative Coatings.

2. Prior to demolition of coated steel components, all loose, peeling, non-adhering paint shall be removed from the components specified for demolition. Paint removal shall meet the requirements of an SSPC SP2 Hand Tool Cleaning.

3. At a minimum, existing coatings within six (6) inches of each location at which disturbance will occur shall be removed prior to disturbance. “Disturbance” includes rivet busting, thermal cutting, welding, grinding, or other methods known to result in worker exposure to lead. Use of sheering methods in substitution of “hot methods” is recommended as an alternative method.

4. If the component is double sided and both faces are painted, paint within six (6) inches of each location at which disturbance will occur, shall be removed from both sides of the component.

5. All visible coatings, shall be removed exposing the underlying steel substrate.

K. Thermal Cutting, Torch Cutting, Burning, Welding & Other “Hot” Work

1. Steel repair, replacement, reinforcement, or rehabilitation involving the disturbance of coatings shall be conducted as described in this section and in accordance with 29 CFR 1926.62, 29 CFR Subpart J Welding and Cutting, and specifically 1926.353 Ventilation & Protection: Welding, Cutting, and Heating and 1926.354 Welding, Cutting, and Heating in Way of Preservative Coatings.

2. At a minimum, existing coatings within six (6) inches of each location at which disturbance will occur shall be removed prior to disturbance. “Disturbance” includes rivet busting, thermal cutting, welding, grinding

without HEPA filtered local exhaust ventilation, or other methods known to result in the generation of airborne particulate or suspected to result in worker exposure.

3. If the component is double sided and both faces are painted, paint within six (6) inches of each location at which disturbance will occur, shall be removed from both sides of the component. “Cut lines” require six inches on either side of cut for a total of 12 inches abated at the cut line point.

4. All visible coatings shall be removed exposing the underlying steel substrate.

5. The Contractor may accomplish removal of coatings utilizing one or a combination of the following methods:

   a. Use of sheering methods as an alternative method to reduce exposure to airborne contaminants is recommended.

   b. The use of chemical stripping agents containing methylene chloride is prohibited.

   c. Power tool cleaning with HEPA filtered attachment, resulting in an SSPC SP3/SP11 degree of cleanliness, may be utilized.

   d. Alternative methods submitted by the Contractor and approved by Metro-North Railroad may be utilized.

6. Employees performing “hot work” shall retain current city and state certifications applicable to performance of the work.

7. Upon completion of coating removal via the requirements in this specification, the Contractor shall implement the additional controls specified below.

8. Demolition of steel components via thermal cutting, torch cutting, burning shall be accomplished utilizing “demolition torches” having a three (3) foot lance length or greater.

9. The Contractor shall implement the following combined engineering controls during thermal cutting, torch cutting, burning, welding, & other “hot work”.

   a. Local exhaust ventilation equipped with HEPA filtration to locally “capture” metal fume at the point of generation

   b. Mechanical ventilation to disperse metal fume within the employee’s work zone.

10. Employees performing thermal cutting, torch cutting, burning, welding, & other “hot work”, after lead containing coating removal, shall use personal protective equipment suitable to the specific task to be completed. Personal protective equipment shall include but not be limited to, respiratory protection having an Assigned Protection Factor (APF) of fifty (50) times the Permissible Exposure Limit until personal exposure monitoring data demonstrates otherwise.

11. Hygiene facilities compliant with 29 CFR 1926.62 shall be provided.

Until exposure assessments are completed, complete decontamination facilities equipped with showers shall be provided. At no time shall the respiratory protection for employees performing thermal cutting, torch cutting, burning, welding, & other "hot work", after lead containing coating removal, be downgraded below an Assigned Protection Factor (APF) of ten (10) times the Permissible Exposure Limit.

3.04 CONTAINMENT

A. Containment General

1. The degree of containment required shall be consistent with the needs of the site-specific work scope. The Contractor shall utilize SSPC Guide 6 in determining containment design requirements. The Contractor is responsible for consulting Metro-North Railroad in determining specific information on the structural limitations of the structure to be worked and the structural requirements for the containment itself. Unless otherwise directed, containments within or adjacent to the rail traffic envelope shall be capable of withstanding a one hundred (100) mile per hour wind loading and a minimum load carrying capacity of two hundred pounds per square foot (200 lbs/ft^2).

B. Containment Components

1. Materials: All containment materials and materials used for sealing of the containment shall be resistant to water, chemicals, and the anticipated exposure/weathering and shall be able to perform as intended when exposed to such elements. Rigid containment materials consist of solid panels of plywood, aluminum, rigid metal, plastic, fiberglass, composites, or similar materials. Flexible materials consist of screens, tarps, drapes, plastic sheeting, or similar materials. Fire resistant materials shall be used for containments, as applicable.

2. Support structure: Rigid support structures may consist of scaffolding and framing to which the containment materials are affixed or similar types of materials and configurations. Flexible support structures will be constructed of cables, chains, or similar systems to which the containment materials are affixed.

3. Joints: Approved joint sealing methods include tape, caulk, Velcro, zippers, clamps, or other similar material capable of forming a continuous, impenetrable seal. The use of overlapping containment materials (1 foot minimum overlap) to achieve fully sealed joints is acceptable only when emissions of dust and debris are adequately controlled.

4. Airlock Entryway: Re-sealable door entryways shall include the use of flexible or rigid doors capable of being repeatedly opened and resealed. Approved sealing methods include zippers, Velcro, clamps, or similar fasteners.

C. Lighting

1. The Contractor shall maintain all warning beacons and other warning lighting on the structure throughout the work .

2. Flexible containment materials shall consist of a light transmissive material which allow natural light into the containment during daytime hours and artificial light during nighttime hours.

3. Lighting within work areas and containments shall meet the requirements of SSPC-Guide 12 Guide for Illumination of Industrial Painting Projects. In strict accordance with SSPC

   Guide-12, lighting intensity on the steel surface, by natural or artificial means, shall be maintained at a minimum of 200 foot candles, throughout surface preparation, painting, and inspection. The Contractor shall supply a portable light meter to verify compliance with this specification.

4. The Contractor shall provide adequate artificial lighting for all methods of cleaning, paint application, and inspection work. The use of blast nozzle mounted lighting is recommended to supplement general containment lighting. The Contractor shall not solely rely upon blast nozzle mounted lighting for illumination.

5. Exterior lighting shall be sufficient to allow for visible assessment of emissions from all sides of the containment and environmental control equipment. All exterior sides of the containment and filtration equipment shall be sufficiently illuminated to allow for visual assessment of emissions during nighttime hours.

6. Lighting deemed insufficient by Metro-North Railroad or their representatives shall be grounds for work stoppage until remedial action is taken and the work area is sufficiently illuminated.

D. Ventilation

1. Ventilation: Local exhaust ventilation or mechanical ventilation shall be implemented to the degree compatible with the method of surface preparation employed.

   a. Local Exhaust Ventilation

      1) The Contractor shall provide suitable local exhaust ventilation for use with shrouded power tools and/or during “hot work”. Local exhaust ventilation equipment shall discharge air through a HEPA filter. Local exhaust ventilation equipment shall be adequately sized to accommodate the operation. The hose connecting the ventilation equipment to the tool shall be properly sized and the length maintained to distances allowing for adequate exhaust ventilation at the point of use.

      2) The Contractor shall provide filtration of the exhaust air with a filtration efficiency of 0.3 microns or better, in order to prevent airborne particulate from being exhausted into the surrounding air.

   b. Mechanical Ventilation

      1) The Contractor shall provide mechanical ventilation of Class 1A containment(s) as necessary to provide adequate ventilation based upon containment size. A

minimum average cross draft velocity of 120 feet per minute and/or average downdraft velocity of 70 feet per minute shall be maintained during blasting and cleaning operations.

2) When mechanical ventilation systems are used, the Contractor shall provide filtration of the exhaust air with a filtration efficiency of 0.5 microns or better.

3) The Contractor shall verify negative pressure through instrument monitoring to achieve a minimum of 0.03 in. (7.5 mm) water column (W.C.) relative to ambient conditions, or through visual assessments for the concave appearance of the containment enclosure.

4) Work areas shall be adequately ventilated during use of solvent borne materials in accordance with the MSDS of products utilized. In the event ventilation cannot be maintained as recommended on the MSDS, the Contractor shall provide employees with suitable respiratory protection equipment.

E. Pre-Work Inspection & Construction Verification

1. Containment Construction Certification

a. Upon completion of installation of the containment system and prior to the start of surface preparation activities, the Contractor shall conduct an inspection of the containment system as built and certify that the containment system has been assembled as shown on the approved, signed and sealed engineered drawings. The certification shall be submitted to Metro-North.

b. If the containment is not constructed in accordance with the design drawings, the Contractor's design engineer shall issue supplemental calculations for the new design for review and approval in accordance with the original submittal requirements. After supplemental calculations have been reviewed and approved by Metro-North Railroad, the Contractor shall conduct a new containment inspection and certify that the containment system has been assembled as shown by the supplemental calculations. This certification shall be submitted to Metro-North Railroad.

2. Pre-Surface Preparation Inspection

a. The Contractor shall notify Metro-North Railroad two (2) days in advance of the intended date of completion of erection/installation of the containment system. Upon completion of containment installation, Metro-North Railroad, the Engineer, and the environmental monitor shall conduct a "Pre-Surface Preparation Inspection" verifying containment construction meets the requirements of the specification and is constructed per the approved containment plan. Sealing, ventilation, and illumination, among other design parameters, will be investigated. Should the

containment fail to meet the specified requirements, the Contractor shall take all necessary actions to correct discrepancies or deficiencies. Additional "Pre-Surface Preparation Inspections" shall be conducted as necessary until conformance to the specifications and containment plan submittals is achieved.

F. Routine Cleaning & Maintenance

1. Preventative Measures & Daily Routine Cleaning

a. The Contractor shall prevent dust, solvents, paint, paint chips, and debris from being released or spilled into the soil, water, sediment, or storm sewers.

b. The Contractor shall replace worn or damaged materials and/or equipment as necessary or as directed by Metro-North Railroad to maintain the integrity of environmental controls and protection. This shall include replacement of worn or damaged containment tarpaulins as necessary to maintain their effectiveness.

c. The Contractor shall conduct work site clean-up during and after the project, including the removal of pre-existing litter or debris the distance of two times the height of the containment in all directions surrounding the containment.

2. Cleaning & Securing Containment

a. The Contractor shall clean and secure the containment materials and equipment at the following times: the end of each work shift, prior to relocation or moving to another point along the structure, when the containment will be unmanned, and when inclement weather is forecast.

b. Cleaning shall be accomplished via vacuums equipped with HEPA filtration.

c. The Contractor shall clean all loose debris from within the containment and containment materials and equipment to the extent that dust or debris is not dislodged, by physical contact and to prevent emissions during moving of the containment or non-working hours.

d. The Contractor shall clean all containment materials and equipment prior to moving or removing materials and equipment from the site.

e. The Contractor shall thoroughly HEPA vacuum, wet wipe, or otherwise decontaminate reusable items until all loose surface dust and debris have been removed. Items requiring cleaning include, but are not limited to, paint removal and ventilation equipment, containment materials, ground covers, scaffolding, work platforms, fasteners, etc.

f. If adequate cleaning is not possible, the Contractor shall treat the materials as a separate waste stream and containerize for testing and disposal in conformance with this specification.

g. When the containment is unmanned and/or inclement weather is forecast, the Contractor shall shut down operations, perform cleanup as required herein and secure the containment and equipment as a safeguard against winds or inclement weather.

h. The Contractor shall coordinate all containment cleaning and securing activities described herein with Metro-North Railroad.

3. Containment Maintenance During Inclement Weather or Non-Working Hours

a. The Contractor shall assign personnel to inspect and secure the containment, platform, and its components during inclement weather conditions and non-working hours. Non-working hours include all times when the containment is unmanned,

b. including without limitation weekends, holidays and other extended shut down periods.

c. During extended shut down periods the Contractor shall inspect the containment, scaffold, work platform, and other related components at least one (1) time per week for damage and/or defects.

d. At all times, during working and non-working hours, the Contractor shall correct any potentially unsafe condition, including but not limited to repairing any deficiencies and/or defects, securing any torn or loose containment components and removing any excessive loadings to safeguard the structure, surrounding property, and the general public.

G. Final Cleaning & Clearance

1. The Contractor shall undertake a final, thorough inspection and cleanup of the project site and surrounding area within two (2) days of completion of project activities.

2. After all Contractor equipment and materials have been removed, the Contractor shall conduct a visual inspection of the project site, which includes all areas used as staging and equipment yards, storage and decontamination areas, waste storage, and all surrounding areas and surfaces located within two times the height of the structure in all directions. If project debris is observed beyond two times the height of the structure, the limits of the inspection shall be increased, as directed by Metro-North Railroad.

3. The Contractor shall thoroughly inspect the area and surfaces for the presence of visible debris and waste. This includes, but is not limited to, lead dust, spent abrasives or other paint removal media, paint chips, solvents, materials of construction, fuel, and other litter. In the areas and surfaces subject to inspection, the Contractor shall clean up and remove debris and wastes to the satisfaction of Metro-North Railroad even if the debris and waste are a pre-existing condition.

4. Cleaning will include manually removing paint chips, by HEPA vacuuming, and/or wet wiping or washing, as directed by Metro-North

Railroad.

5. Clean the surrounding water with the use of approved materials and equipment including but not limited to water booms and/or boats with skimmers, as directed by Metro-North Railroad.

3.05 ENVIRONMENTAL MONITORING

A. Clearance Inspections Final Report

1. The Contractor shall prepare a report presenting the results of the inspections conducted to verify the final cleanliness of the project site, surrounding property, waterways, equipment, buildings, and structures within one (1) week of the inspection performed in accordance with this specification.

2. The Contractor shall include a summary of any problems or releases that occurred during the project, and the cleanup and corrective action measures that were taken to resolve the problem.

B. Visible Emissions & Releases

1. The Contractor is required to perform his own assessments of visible emissions in addition to those performed by the environmental monitor.

2. The Contractor shall conduct assessments of visible emissions as required by this specification to account for all locations where emissions of lead dust might be generated, including but not limited to, the containment, dust collection and abrasive recovery equipment, and waste containerizing areas.

3. The Contractor shall conduct observations and corrections of visible emissions on an ongoing basis.

4. In addition to maintaining the required written documentation, the Contractor shall verbally communicate the results to Metro-North Railroad on a daily basis.

5. The Contractor shall immediately cease operations and undertake corrective action to control emissions if there is a failure of mechanical ventilation or inability to maintain continuous negative pressure and/or any emissions regardless of time, duration or opacity.

6. When visible emissions or other releases are observed, in addition to cleaning the debris, the Contractor shall take the initiative to change work practices, modify the containment, or take other appropriate corrective action to prevent similar releases from occurring in the future.

C. Reporting/Documenting Visible Emissions and Releases

1. The Contractor shall report the results of the daily assessments of visible emissions and releases in a report form approved by Metro-North Railroad. At a minimum, the visible emission observation form shall include information such as the Contract number, Contractor's name, work location, date of observations, location and duration of emission, outline of the visible emission criteria, notification to Metro-North Railroad, corrective actions taken, and signature block for the observer.

2. The Contractor shall document all cases where work has been halted due to visible emissions or releases, the resulting cleanup activities performed, the reason or explanation for the emission or release, and the corrective action taken to avoid a reoccurrence. The written report shall be provided to Metro-North Railroad within forty-eight (48) hours of the occurrence.

3. The Contractor shall summarize the individual reports and the corrective action taken and provide the combined information to the environmental monitor and Metro-North Railroad each month. The Contractor shall cooperate with the environmental monitor in the preparation of any reports for Metro-North Railroad.

D. General

1. Metro-North Railroad has contracted the services of a third party environmental monitor to conduct assessments of emissions and releases into the environment including air, soil and water.

2. The Contractor shall comply with the requirements for assessment of visible emissions, releases, and ambient air monitoring throughout the work.

3. The Contractor shall coordinate all monitoring activities with the environmental monitor, and cooperate with the assessments and results of the testing and inspection performed by the environmental monitor.

4. The Contractor shall comply with any directions given by the Engineer or the environmental monitor, including shut down of operations when emissions or releases violate the requirements of this specification. The Contractor shall undertake all necessary corrective action to control emissions and clean up the area.

3.06 WASTE HANDLING

A. Submittals

1. Waste Management Plan

a. The Contractor shall provide a written Waste Management Plan. The Waste Management Plan shall address the proper collection, handling, storage, and disposal of all waste. The Waste Management Plan required under this specification is for the protection of workers, the public and the environment. The requirements of the Waste Management Plan are outlined in the Submittals section of this specification.

2. Close-Out Submittals

a. The Contractor shall provide copies of all documentation pertaining to the disposal of all hazardous and non-hazardous waste generated during the work, including but not limited to, a written log of the type and quantity of waste that was generated and removed from the project site, executed waste manifests/waste shipment records (if applicable), bills of lading, waste shipment records.

B. Waste Handling Requirements

1. General

a. The Contractor is responsible for all labor, materials, equipment, services, and costs associated with the proper and compliant collection, handling, separation, containerization, and storage of solid, liquid, hazardous, non-hazardous, industrial, and municipal wastes generated throughout the course of the work in accordance with all applicable Federal, State and Local laws, codes, rules and regulations. Waste handling shall be conducted in accordance with 40 CFR Part 261, Part 262, and Part 268, and applicable state and local regulations.

b. Unless otherwise directed, Metro-North Railroad shall be responsible for the lawful transportation and disposal of all hazardous and non-hazardous industrial wastes. The Contractor is responsible for the disposal of all non-hazardous, non-industrial, and municipal waste streams.

c. The Contractor is solely responsible for obtaining any and all permits, certificates, variances, etc. required for onsite waste storage.

d. The Contractor shall arrange for the transportation and disposal of all waste with Metro-North Railroad and Metro-North Railroad's representatives as specified in this specification.

e. Under no circumstances shall wastes or contaminated debris be allowed to remain in the work area upon conclusion of the work shift. At a minimum, the Contractor shall collect and store the waste at the end of each working day in USDOT- approved storage drums or containers such that no waste is left exposed overnight.

f. When cleaning paint chips and dust, the Contractor shall use vacuuming equipment equipped with HEPA filters, or other means that will effectively remove the dust and debris without re-dispersing lead laden particulate into the air.

g. The Contractor shall recover all waste products generated during the work, including but not limited to containment materials, rags, tapes, sealants, disposable personal protective equipment, filters, paint debris, paint cans, wastewater, etc. The contractor shall provide containers for the collection, storage and disposal of all waste. Containers shall mean drums, bags or other required containers.

h. The Contractor shall train all personnel in the proper handling of hazardous waste in accordance with 40 CFR 265.16 and 6 NYCRR 373. Include procedures in the Waste Management Plan that will be followed in the event of a release or spill, including required notifications and methods to be used for cleanup. Maintain all training records on-site.

i. The use of additives to render the waste non-hazardous is

prohibited.

j. All wastes generated by the Contractor during the work are the property of Metro- North Railroad. Metro-North Railroad shall be known and listed as the primary generator of regulated wastes. The Contractor shall be known as the co-generator of regulated wastes for this project. The Contractor as co-generator is legally and contractually responsible for the proper collection, handling, and storage of waste.

k. The Contractor shall not discharge any waste, potentially contaminated material, or hazardous or regulated material, solid or liquid, into the natural environment. At no time shall the Contractor discharge any liquid effluent, including wastewater, "gray water", sewage, solvent borne materials, fuels, etc. into the natural environment.

l. Wastewater containing contaminants unable to be properly handled and treated by the wastewater treatment facility shall not be discharged into the sanitary sewer system.

m. Liquid wastes not acceptable to the sanitary sewer system shall be containerized and disposed of in accordance with applicable regulations.

n. If soil remediation is required as a result of the Contractor's activities, the Contractor shall place the soil into separate containers, and assume all costs for its testing, storage and disposal.

o. Improper handling and storage of waste may result in the immediate shut down of the project until appropriate corrective action is completed.

2. Separation of Waste Streams

a. In an effort to minimize the quantity of hazardous wastes generated in compliance with EPA and RCRA requirements, the Contractor shall separate wastes into differing waste streams based upon their general type and composition. Wastes shall be separated into the following waste streams:

1) General construction debris and other non-contaminated debris (such as cardboard boxes from materials and supplies brought to the site, containers, empty cans, etc.

2) Paint debris, paint chips, paint dust, respirator cartridges, filters from air filtration devices and HEPA vacuums

3) Painted demolition debris

4) Disposable personal protective equipment

5) Containment sheeting and materials

6) Cleaning devices

7) Liquid paint residues

8) Solvents and/or paint thinners

9) Painted scrap steel components

10) Painted demolition debris

11) Filtered wastewater

12) Any other potentially hazardous or regulated wastes generated during the work shall be segregated into separate waste streams, containerized separately in approved storage containers, and properly stored in approved locations.

3. Characterization & Classification of Wastes

a. Historically, based upon the sampling and testing of wastes generated on previous paint removal projects, lead paint wastes are characterized as hazardous based upon lead toxicity. However; the Contractor shall not assume any potentially contaminated waste, with the exception of paint debris, paint chips, paint dust, respirator cartridges, filters from air filtration devices and HEPA vacuums, is hazardous. Testing of each potentially contaminated waste stream shall be conducted by the environmental monitor to satisfy the requirements of the law, as well as that of the transporter and the disposal facility. Testing shall be conducted in accordance with 40 CFR 261, Appendix II, Method 1311 Toxicity Characteristic Leaching Procedure (TCLP).

b. Metro-North Railroad is responsible for all costs associated with laboratory analysis for the characterization of wastes.

c. The Environmental Monitor shall conduct sampling of the various waste streams and report the laboratory results to the Contractor. The Environmental Monitor is responsible for the collection of representative samples of each of the potentially contaminated waste streams and submission of such to an accredited laboratory for analysis via the EPA Toxicity Characteristic Leaching Procedure in order to confirm the classification of the waste as hazardous and non-hazardous. Upon receipt of Toxicity Characteristic Leaching Procedure data, arrangements for the disposal of wastes in accordance with the results of the testing shall be made with Metro-North Railroad or Metro-North Railroad's representative. If the nature of the waste stream initially tested remains constant additional classification is not required for subsequent shipments unless otherwise directed by Metro-North Railroad or Metro-North Railroad's representative, or required by federal, state or local laws, codes or regulations, or the waste recycling or disposal facility. Should the nature of a waste stream change after the initial testing, additional representative samples shall be collected and analyzed to re-characterize the waste stream.

d. The Contractor is hereby notified that hazardous substances other than heavy metals may be present in the waste,

characterizing it as Hazardous Waste as defined in 40 CFR 261

e. Solvents designated for disposal shall be characterized as hazardous waste because their ignitable and toxic properties. Solvents that will be used for a purpose other than disposal shall not be classified as waste, and shall be handled in accordance with the Contractor's approved solvent handling plan. The Contractor shall provide written documentation of the tracking of these solvents while on site and during transportation, including proof of receipt at the final destination.

f. Chemical paint strippers typically contain solvents and/or highly alkaline materials. Waste containing chemical paint strippers shall be characterized appropriately based upon their constituents.

4. Containerization

a. Containerization and packaging of wastes shall be conducted in accordance with 49 CFR Part 172, Part 173, and Part 178 and other applicable sections of the Department of Transportation (DOT) regulations.

b. The Contractor shall maintain an adequate supply of clear plastic bags for the containerization of lead contaminated debris. The waste bags for lead debris shall be clear, polyethylene plastic, having a six (6) mil thickness or greater. Black or opaque bags are prohibited from use, unless specified by Metro-North Railroad. Pre-printed asbestos waste bags are prohibited from use for containerization of lead debris.

c. All potentially hazardous wastes shall be deposited and sealed in appropriate containers or roll off containers concurrent with waste generation.

d. Separate waste streams shall be containerized separately.

e. The Contractor shall cover all containers immediately upon filling and confirm that all lids are attached except when filling and that all required labels are affixed and remain intact and legible. Waste containers shall be properly and securely fastened and sealed upon being filled to capacity.

f. Two (2) methods of waste containerization and transportation are acceptable to Metro-North Railroad; 1) bulk disposal via roll-off style waste containers or 2) drum disposal, utilizing 1A1 or 1A2 approved containers. The Contractor may utilize a combination of such containerization and transportation methods.

g. The Contractor shall supply waste containers meeting the requirements of the Department of Transportation 1A1/1A2 designation, or other containers approved by Metro-North Railroad for the disposal of lead contaminated debris. Waste containers shall comply with the requirements of 40 CFR 262.30-262.32 and 49 CFR Part 172 and Subpart F. 1A1 or 1A2

approved drums shall be new or reconditioned and suitable for the containerization and disposal of hazardous lead waste. Use containers that are resistant to rust and corrosion (painted, if constructed of steel), that have tight fitting lids or covers, and which are water resistant and leak proof.

h. The Contractor shall maintain all containers in good operating condition with all lids and closing mechanisms intact and operational to prevent the escape of debris, spilling of the contents, or access by unauthorized personnel and observe all labeling requirements.

i. The Contractor shall inspect the drums or containers for corrosion, legible labels, proper covers, ground protection, and leaks on a weekly basis and record the results of all the inspections in a log book.

j. Drums for liquid wastes shall have permanently sealed lids with bung openings.

k. Drums for solid wastes shall have removable lids with the appropriate fitting bolted clasps. Spring lever clasps shall not be utilized.

l. Roll off containers shall be lined with bladders provided by the waste transporter or polyethylene sheeting having a nominal thickness of six (6) mils.

m. No container shall be filled to a capacity exceeding the maximum dry volume capacity marked on the container. No container shall be filled to a capacity that will result in a payload weight exceeding the transportation vehicle's safe operating parameters or Department of Transportation (DOT) regulations pertaining to gross vehicle weight. If overfilled containers cause delays during pick-up, remediate the situation at no additional cost to Metro-North Railroad.

n. The Contractor shall provide all containers for non-hazardous waste, including filtered wastewater. Use containers that are free of loose debris when brought on- site. Wastewater shall be containerized in USDOT approved polyethylene drums having sealed lids with bung openings.

o. The Contractor shall provide all containers for liquid paint residues and spent solvents, whether the liquid paint residue or solvent is designated for reuse, or for disposal as a hazardous waste. Liquid paint residues and solvents shall be containerized in USDOT approved steel drums having sealed lids with bung openings. Spent solvents and liquid paint residues shall not be mixed with spent abrasives, paint debris, water, or other waste.

5. Labeling & Identification

a. The Contractor shall immediately label all containers of hazardous waste in accordance with 40 CFR 262, and 49 CFR

171-179 and 6 NYCRR 372. All waste containers shall be properly labeled. Under no circumstances shall containerized debris be stored without proper labeling.

b. All materials shall be labeled and shall conform and comply with the Contractor's Hazardous Communication Program as per 29 CFR 1910.1200 and 1926.059 as well as all applicable state "Right To Know" legislation.

c. The accumulation start date on each container shall be the start date of hazardous waste accumulation. the environmental monitor shall enter it using permanent marking material.

d. A label describing the contents of each container shall be affixed to the outside of the container.

e. Unless otherwise directed, all labeling, marking, and placards shall be the responsibility of the Contractor and shall be done under the supervision of Metro- North Railroad, the Engineer, and the environmental monitor. This work shall be completed to Metro-North Railroad's, The Engineer's, and the environmental monitor's satisfaction prior to the filling or transportation of any particular container.

f. All label markings shall be permanent, printed in English, displayed on a background of contrasting color unobscured by other labels, or attachments. Labeling shall be located away from other markings that could substantially reduce its effectiveness.

g. The contracted waste transporter shall provide all required labels.

h. Upon receipt of results of characterization analyses (TCLP), labels shall be changed to reflect the characterization of the waste. If characterized as hazardous waste, complete the absent information upon receipt of the testing results. Include the following minimum information on the labels:

1) "Hazardous Waste. Federal law prohibits improper disposal. If found, contact the nearest police, or public safety authority, or the US Environmental Protection Agency."

2) Proper DOT Shipping Name (e.g., RQ Hazardous Waste Solid, N.O.S. 9, NA 3077, PG III)

3) Manifest Document No (when manifest is prepared; prior to shipping)

4) Generator Name, Address, EPA ID Number, and Contract Number.

5) Date of Accumulation (First day waste placed into container)

6) EPA Waste Number

C. The Contractor shall enter the above information using permanent marking

material, printed in English, and displayed on a background of contrasting color unobscured by other labels or attachments. Locate labeling away from other markings that could substantially reduce its effectiveness.

D. The Contractor shall complete the labeling, marking, and placarding activities under the observation of Metro-North Railroad or their designee, prior to storing or transporting any container or roll-off.

1. Storage

a. The Contractor shall maintain a secure temporary waste storage/holding area on site as required by the work. The waste storage area shall be a securable, lockable enclosure segregated from access by unauthorized personnel. The Contractor shall determine a suitable location for temporary on site storage of wastes generated throughout the project. The Contractor shall submit the proposed waste storage location to Metro-North Railroad for approval. Waste shall be stored only in areas approved by Metro-North Railroad. The design and location of the waste storage area shall be submitted by the Contractor in the waste management plan.

b. The Contractor shall store non-hazardous waste separately from hazardous waste. Hazardous and non-hazardous waste shall not be mixed and stored together unless approved in advance in writing by Metro-North Railroad.

c. The Contractor shall locate all hazardous waste containers on protected ground (e.g., covered with impermeable tarps) and in a secure area with signs around the perimeter. The Contractor shall adequately shield and/or protect the surrounding area when transferring and/or conveying hazardous waste from one container to another to prevent any dispersion. The storage location(s) must be approved by Metro-North Railroad in advance.

d. Containers shall be elevated from ground surfaces via pallets or other approved means.

e. Arrange containers in the storage area for easy accessibility. Stage the containers together in lots no greater than two rows of five containers each. Maintain a minimum lane clearance of thirty-six (36) inches between each lot of ten containers.

2. Transportation & Disposal

a. Unless otherwise specified in the Contract Documents, transportation and disposal of wastes shall be conducted under separate contract by Metro-North Railroad.

b. Unless otherwise specified in the Contract Documents, Metro-North Railroad shall be responsible for the transportation and disposal of hazardous wastes. Transportation and disposal of hazardous wastes is excluded from the Contractor's scope of work.

c. Unless otherwise specified in the Contract Documents, under no circumstances shall the Contractor remove or transport potentially hazardous wastes from the project site without the prior approval and permission of Metro-North Railroad.

d. The Contractor shall be responsible for coordinating the transportation of hazardous wastes with Metro-North Railroad and Metro-North Railroad's representatives responsible for arranging for the transportation of hazardous wastes.

e. When the transporter arrives to load the waste, the on-site representative may be required to sign the manifest "As Agent For Metro-North Railroad" with their signature. The "Generator" copies of waste manifests, bills of lading, etc. shall be retained and submitted to the Metro-North Railroad Department of Environmental Compliance & Services within three (3) business days.

3. Non-Hazardous Wastes & General Refuse

a. The Contractor shall properly transport, and dispose of all non-hazardous, non- industrial waste and general refuse. The Contractor shall make provisions for the removal of all non-regulated, general garbage generated as a result of his work. The Contractor shall provide their own trash dumpster(s) for the removal of all non- regulated debris and shall not use Metro-North Railroad's containers without the prior approval of Metro-North Railroad. The Contractor shall not site any roll-off containers / dumpsters on Metro-North Railroad's property without the prior approval of Metro-North Railroad.

b. The Contractor shall comply with NYC Department of Sanitation regulations as applicable.

c. The Contractor shall provide a suitable rubbish container device, properly maintained and serviced, replaced as required and protected from access by the public by fencing as approved by Metro-North Railroad.

d. The Contractor shall provide daily trash collection and cleanup of the project area and shall dispose of all discarded debris, and the like in a manner approved by Metro-North Railroad.

e. Contractor shall sweep up and gather together daily all his own rubbish and place same in containers. Wood crates and similar matter shall be broken up, securely tied into bundles and stacked alongside rubbish containers or in locations as approved by Metro-North Railroad.

f. The Contractor shall provide Metro-North Railroad with bills of lading for all non- hazardous wastes removed from the project site.

4. Special Requirements for Recycled Steel Abrasives

a. When recycled steel abrasives are used, the Contractor shall

collect, handle, store, transport, and dispose of the steel abrasive/paint waste as hazardous waste, regardless of the results of the characterization analyses.

5. Special Requirements for Recycling Scrap Steel Coated With Lead Containing Paint

   a. Scrap steel coated with lead containing paint shall not be classified as hazardous waste if the steel is sent to a recycling facility approved by Metro-North Railroad. If the lead based painted steel is not recycled, the material shall classified as hazardous or non-hazardous based upon TCLP analysis of the paint itself.

   b. The Contractor shall make arrangements with a scrap metal dealer for the removal and recycling of scrap steel coated with lead containing paint. The Contractor may utilize a scrap dealer under contract with Metro-North Railroad, or may utilize other dealers approved by Metro-North Railroad. If the scrap steel is not recycled, the Contractor shall dispose of such in the same manner as other solid wastes containing lead.

   c. The Contractor shall utilize lined roll-off containers for the on-site accumulation and storage of all demolished scrap steel coated with lead containing paint.

   d. The Contractor shall provide the scrap metal dealer with a written notification that the steel to be received is coated with lead containing paint. A copy of the written notification shall be provided to Metro-North Railroad or his designee prior to shipping the steel. (See example at end of this section)

   e. The Contractor shall provide Metro-North Railroad with written confirmation from the scrap dealer, at the time it is received, stating that the coated steel will be recycled and will be properly destroyed within sixty (60) days of removal from the site.

6. Wastewater Handling & Disposal

   a. The Contractor shall provide containers for the collection and retention of all wastewater, including but not limited to, water used for hygiene purposes, laundering of clothing if done on site, surface preparation by means of power washing or water jetting, and cleanup activities. Filtered wastewater shall be containerized in polyethylene drums or an approved equal. Steel drums are not permitted for containerization of wastewater.

   b. All wastewater generated through pressure washing, the decontamination facility or manual washing shall be filtered through a filtration system capable of removing visible paint chips, particulate, heavy metals and suspended solids prior to placing it into storage containers. Filter the water until the water is not classified as hazardous and will be permissible to dispose of as described below.

   c. Prior to disposal, the environmental monitor shall collect

samples of filtered, containerized wastewater for analysis to determine lead concentrations. Upon receipt of analytical data demonstrating lead concentrations less than the local discharge limit for the municipality in which the work is being conducted, wastewater may be discharged into the sanitary sewer system, if approved by the local publicly owned treatment works (POTW).

d. The Contractor shall make disposal arrangements with the local publicly owned treatment works (POTW), sanitation company, or other appropriate permitted facility and provide Metro-North Railroad with documentation signed by an official of the facility stating that the facility will accept the waste, and that the levels of any lead or other metals remaining in the water are acceptable. If the facility allows the filtered water to be placed into the sanitary sewer system, include such authorization in the letter.

7. Recordkeeping & Logging of Generated Wastes

a. The Contractor shall maintain inventory by location of waste type collected, quantity, dates stored and dates released to waste hauler. This inventory shall be maintained on site and made readily available to Metro-North Railroad. This inventory shall be kept as part of the Contractor's log book.

b. The Contractor shall cooperate with Metro-North Railroad, the Engineer, and the environmental monitor in record keeping of waste stored and released for disposal.

c. The Contractor shall retain copies of all waste logs, manifests, bills of lading, written notifications and approvals, and all other documentation pertaining to the transportation and disposal of hazardous and non-hazardous waste generated during the work. Copies of the documentation shall be provided to Metro-North Railroad as part of the project closeout submittals.

3.07 ENVIRONMENTAL PROTECTION

A. The Contractor shall adhere to the applicable federal, state and local laws and regulations pertaining to the protection of the environment. For the duration of the project, the Contractor shall comply with all applicable federal, state, city, and local laws, regulations, and ordinances pertaining to environmental protection, including all applicable New York State Department of Environmental Conservation (NYSDEC) and New York City Department of Environmental Protection (NYCDEP) requirements.

B. The Contractor shall be familiar with the specific requirements of environmental protection laws, regulations, and ordinances. It is the responsibility of the Contractor to ensure that its subcontractors, vendors, and suppliers comply with applicable requirements.

C. Environmental protection considerations shall include, but are not limited to, the following:

1. Protection of Existing Natural Features and Vegetation

2. Air & Water Pollution

3. Hazardous materials &toxic substances
4. Lead containing particulates such as dust and fumes
5. Dust Control
6. Noise Abatement
7. Erosion and sedimentation control
8. Light Pollution
    a. The Contractor shall execute the work in a manner which prevents releases of environmentally degrading substances such as petroleum-based products, volatile organic compounds, and hazardous materials into the environment.

D. Environmental Remediation Resulting From Contractor's Operations

1. Should the Contractor's work result in the release of a lead containing material, hazardous material, or other regulated material during performance of the work, the Contractor shall take all actions necessary to remediate the condition. All remedial actions shall be conducted per the direction of Metro-North Railroad or those serving as representatives of Metro-North Railroad, the Coast Guard, and federal and state agencies. Remedial actions shall be completed meeting the satisfaction of Metro-North Railroad, the Coast Guard, and federal and state agencies.
2. Remedial actions may include and are not limited to, complete removal and replacement of soil/ballast, facilities, equipment, furnishings, or other materials as deemed necessary by Metro-North Railroad to return the site to pre-existing or better conditions.
3. The Contractor is hereby notified that in the event the Contractor fails to remediate the condition within a schedule acceptable to Metro-North Railroad or to the degree acceptable to Metro-North Railroad, Metro-North Railroad may remediate the condition with its own or other contracted forces. Metro-North Railroad shall deduct the cost of the remediation work from any moneys due the Contractor from Metro-North Railroad per the conditions of the MTA Metro-North Railroad General conditions and Contract governing this scope of work.

    (NOTE: THE CONTRACTOR GENERATING THE SCRAP SHALL COMPLETE THE FOLLOWING AND SUBMIT IT TO THE SCRAP YARD/RECYCLER. METRO-NORTH RAILROAD SHALL BE PROVIDED A COPY OF THE SIGNED ACKNOWLEDGEMENT.)

    Click here to enter DATE.

    a. Click here to enter NAME & ADDRESS OF SCRAP DEALER.

3.08 RE: NOTIFICATION OF LEAD CONTAINING MATERIAL

Dear Sir/Madam:

Metro-North Railroad's policy requires us to provide you written notification that the material you will receive contains Lead. The scrap material(s) you are receiving from the Metro-North Commuter Railroad Company Click here to enter CONTRACT NUMBER, PROJECT DESCRIPTION, & ADDRESS contains Lead. These materials consist of Click here to enter DESCRIPTION OF MATERIAL. Testing has determined that the materials you will be accepting have Lead containing paint on them.

Kindly acknowledge receipt of this written notification by completing the section below and returning the original to my attention.

Regards,

Insert Name

3.09 ACKNOWLEDGEMENT OF RECEIPT OF LEAD CONTAINING MATERIAL

A. The entity identified below acknowledges receipt of the lead containing material identified above. We will insure that appropriate precautions/procedures are followed in accordance with the requirements of all regulatory agencies having jurisdiction related to lead containing materials.

Company Name:	Click here to enter text.	Phone:	Click here to enter text.
Address:	Click here to enter text.		
Officer's Name (Print):	Click here to enter text.		
Officer's Title:	Click here to enter text.		April 1, 2018

END OF SECTION

SECTION – 02 84 30

UNIVERSAL WASTE AND MISCELLANEOUS HAZARDOUS MATERIALS

PART 1 – GENERAL

1.01 SECTION INCLUDES:

A. This section describes the handling, segregation, packaging, labeling, transport, and disposal of Hazardous Substances and Universal Wastes generated by demolition and or renovation activities. These wastes, classified by the EPA under the Hazardous Waste Management System (40 CFR Parts 260 through 279), require specialized handling, packaging, labeling, shipment, and ultimately recycling or disposal at an approved facility.

1. Universal Wastes: as defined by the Environmental Protection Agency (EPA) and various state departments. Materials that are classified as hazardous wastes but are exempt from hazardous waste regulations provided, they are collected for recycling. This includes but not limited to:

   a. High Intensity Discharge (HID) Bulbs

   b. Fluorescent light bulbs

   c. PCB containing ballasts

   d. Used batteries

   e. Mercury-containing equipment

   f. Used thermostats

2. Hazardous Waste: as defined by the EPA and various state departments. This generally includes wastes that are ignitable, corrosive, reactive, toxic, or listed by state/federal agencies. This includes but not limited to:

   a. Lead Paint (see alternate Specifications)

   b. Asbestos

3. Protection of the environmental requirements as per Section 01 35 43, including but not limited to, Dust and Air Monitoring Controls, Noise Control, Management and disposal of debris and other environmentally regulated materials, Spill Prevention and Response, Sediment and Erosion Control.

   a. The Contractor must protect and preserve public and private property within and adjacent to the work site and use every precaution to prevent damage, injury, pollution or destruction. Precautions should be made to protect trees and other plants that are to remain.

   b. The Contractor is responsible to conduct a survey and provide a report of all the universal and hazardous waste. The report is to be submitted to the Engineer for review prior to the start of the project.

   c. High intensity discharge bulbs, fluorescent light bulbs and PCB containing light ballasts. These bulbs may contain mercury, PCB, lead and metals. All spent or discarded light bulbs (a.k.a. waste

lamps) and light ballasts from this project shall be collected by the Contractor, handled, transported, and recycled or disposed of in accordance with 40 CFR 273.13 & 273 requirements for universal waste concerning waste lamps.

1.02 RELATED SECTIONS

A. Section 01 35 43 Environmental Protection

B. Section 01 74 19 Construction Waste Management and Disposal

C. Section 02 61 00 Sampling, Testing, Handling, Loading, Removal and Disposal of Soils

D. Section 31 20 00 Earth Moving

1.03 CODES AND REGULATIONS

A. The Contractor is to comply with all applicable Federal, State, laws, ordinances and regulations pertaining to environmental protection to include but not limited to the programs in the New York State Department of Environmental Conservation (DEC) Division of Environmental Remediation (DER) and Commissioner Policies (CP). This is to include the management, hauling and disposal of hazardous and universal waste.

B. The Contractor is to take full responsibility and liability for the compliance with all applicable Federal, State, and local regulations pertaining to hazardous waste management and disposal.

C. Federal Requirements which govern the management, hauling and disposal of hazardous waste include but are not limited to the following:

1. DOT: U.S. Department of Transportation, including, but not limited to:

   a. Hazardous Substances Title 49, Part 171 and 172 of the Code of Federal Regulations

   b. Hazardous Materials Regulations

   c. General Awareness and Training Requirements for Handlers, Loaders and Drivers Titles 49, Parts 171-180 of the Code of Federal Regulations

   d. Hazardous Materials Regulations Editorial and Technical Revisions Title 49, Parts 171-180 of the Code of Federal Regulations.

2. Handling and transport of universal waste is to be in accordance with 40 CFR 273. The Contractor is to minimize the amount of hazardous waste and look for areas to reduced and prevent items that are hazardous waste from being disposed in a landfill. A plan to reduce the amount of universal waste and reduce material is to be submitted to the Engineer for approval.

3. 40 CFR 260 Hazardous Waste Management System

D. EPA: U.S. Environmental Protection Agency, including but not limited to Management of Hazardous Wastes, Resource Conservation and Recovery Act (RCRA), Title 40, Parts 260-268 of the Code of Federal Regulations

E. OSHA: Occupational Safety and Health Administration including, but not limited to OSHA General Industry Safety and Health Standards (29 CFR 1910) and OSHA

Construction Industry Standards (29 CFR 1926).

F. State Requirements: State requirements which govern the management, hauling and disposal of hazardous waste include but are not limited to the following, New York State Department of Environmental Conservation (NYSDEC), Hazardous Waste; Title 6, NYCRR, Sections 364, 371, 372, and 373.

1.04 SUBMITTALS

A. All plans and programs and surveys are to be submitted within thirty (30) calendar days after receipt of Notice of Award, the Contractor shall submit a Plan(s) to the Engineer for approval. The plan should detail all measures and procedures to be under taken by the Contractor 30 days prior to starting construction activities.

B. Provide the following submittals to the Engineer approval prior to the start of Work:

1. Submit a Health and Safety Plan and Spill Prevention Plan, Dust Control Plan and Noise Surveys per Section 01 35 43 – Environmental Protection.
2. Submit the name of the waste hauler (s) as listed in Section 02 61 00 along with a copy of state and local license and permits for waste hauling.
3. U.S. EPA Identification Number of waste hauler.
4. Name and address of waste disposal facility where waste materials are to be disposed including:
    a. Contact person and telephone number.
    b. Copy of state license and permit.
    c. Disposal facility permits.
5. Copy of Uniform Hazardous Waste Manifest form or Bill of Lading as appropriate.
6. Copy of EPA “Notice of Hazardous Waste activity” form.
7. Copy of forms required by state and local agencies.
8. Provide copies of sample data taken in accordance with Section 02 61 00
9. Provide sample of disposal label to be used.
10. Type of personal protective equipment and work procedures to be used.

C. During Work, submit to the Engineer copies of all executed manifests, disposal site receipts or certificates of destruction.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Disposal Bags: Provide 0.15mm (6-mil) thick leak-tight polyethylene bags.

B. DOT Hazardous Waste Disposal Drums: Provide DOT 17-H Open –Top Drums (55 gallon) in accordance with DOT regulations title 49 CFR Parts 173, 178, and 179.

C. DOT Hazardous Waste Labels: in accordance with DOT regulations Title 49 CFR Parts 173, 178, and 179.

2.02 LIGHT FIXTURES

A. Lighting is to include but not be limited to mercury bulbs, switch components, PCB-containing light fixtures & ballast, fluorescent, incandescent, high pressure light bulbs, high intensity discharge bulb.

B. Removal Procedures: Remove bulb, switch or component by manufacturer's standard installation, removal procedure, or in such a manner as to not damage the bulb, switch or component. Follow waste containerizing and labeling procedures.

2.03 BATTERIES

A. Batteries that are not hazardous at the time of disposal need not be managed as Universal Waste. Non-hazardous batteries include alkaline, carbon zinc, chloride zinc (commonly labeled heavy duty), nickel metal hydride (NiMH), zinc air, and lithium batteries that are nine volts or less and higher voltage lithium batteries that have been discharged to less than one volt. These batteries are to be recycled.

B. The term "battery" also includes intact, unbroken batteries from which the electrolyte has been removed (40 CFR 260.10 and 273.9). In relation to the concept of universal wastes, this term includes all batteries except (40 CFR 273.2(b)):

1. Spent lead acid batteries that are managed under 40 CFR 266, Subpart G (reclamation of spent lead acid batteries that are recyclable), batteries as defined above that are not yet wastes under 40 CFR 261, including those that do not meet the criteria for waste generation (see definition of Waste Battery), and batteries as defined above that are not hazardous waste. A battery is a hazardous waste if it exhibits one or more of the characteristics identified in 40 CFR 261, Subpart C.

2.04 MERCURY CONTAINING EQUIPMENT

A. A device or part of a device or part of a device (including thermostats but excluding batteries and lamps) that contains elemental mercury integral to its function (40 CFR 260.10 and 273.9).

B. The requirements of 40 CFR 273 do not apply to persons managing the following mercury-containing equipment (40 CFR 273.4(b)):

1. Mercury-containing equipment that is not yet a waste under 40 CFR 261.

2. Mercury-containing equipment that is not a hazardous waste. Mercury-containing equipment is a hazardous waste if it exhibits one or more of the characteristics identified in 40 CFR 261, subpart C, or is listed in 40 CFR 261, subpart D.

3. Equipment and devices from which the mercury-containing components have been removed.

2.05 HAZARDOUS WASTE PACKAGING AND LABELING

A. Segregate And Package Each Waste Type as follows:

1. Package switches, components in DOT 17-H Open-Top Drums with Polyethylene disposal Bag liners.

2. Fill liner bags with only one type of waste (e.g.: mercury or PCB waste, etc.), then neck liner bags down into DOT 17-H Open-Top Drum and seal

with duct tape.

3. Install gasket on lid, apply lock ring, and seal.

B. Universal Waste

1. Apply Waste Label to drum side.

2. Enter appropriate DOT Shipping Data, for example:

3. PCB Waste – "Waste PCB Light Ballasts" – RQ, Polychlorinated Biphenyls Mixture, 9, UN2315, PG III

4. Adjacent to each label, enter the date indicating when waste was first placed in each drum.

C. Sealed and Labeled Containers: maintain all containers in a continuously sealed condition after they have been sealed.

1. Do not reopen sealed containers.

2. Do not place additional waste in sealed containers.

2.06 TEMPORARY STORAGE

A. See Section 3.02 for Handling of Waste.

B. Partially filled containers of waste may be stored at the work site for intermittent packaging provided that:

1. Each container is properly labeled when it is first placed in service;

2. Each container remains closed at all times except when compatible waste types are added.

C. When moved within the site, each container remains within the geographic boundaries of the facility without moving or crossing public access highways.

D. Immediately seal containers of waste as each container is filled. Remove containers of waste from the work site within 45 days from start of accumulation. All containers are to be marked with the start date of accumulation.

E. Continuously maintain custody of all hazardous material generated at the work site including security, short-term storage, transportation and disposition until custody is transferred to an approved disposal site or recycling center. Document continuous chain-of custody and waste manifest.

PART 3 – EXECUTION

3.01 GENERAL

A. Do not mix potentially hazardous waste streams. Where feasible, separate each type of waste from other types of hazardous wastes, from asbestos waste and from construction waste. Hazardous waste is defined in 40 CFR Part 261, New York State ECL Section 27-09 or 6 NYCRR Part 371 (Identification and Listing of Hazardous Waste). See Section 01 74 19.

B. Segregate, package, label, transport and dispose of Waste in accordance with DOT, EPA, State and Local regulations.

C. The following hazardous wastes that are managed under the universal waste requirements of 40 CFR 273 (40 CFR 260.10 and 273.9):

1. Batteries as described in 40 CFR 273.2 (see definition of Battery)
2. Pesticides as described in 40 CFR 273.3 (see definition of Pesticides)
3. Mercury-containing equipment as described in 40 CFR 273.4 (see definition of Mercury-Containing Equipment)
4. Lamps as described in 40 CFR 273.5 (see definition of Lamp).

3.02 HANDLING OF WASTE

A. Hazardous and dangerous waste generated within the job site shall not be moved except in accordance with Federal and State regulations. If the presence of hazardous waste is confirmed, the Metro-North Department of Environmental Compliance and Services shall be advised promptly.

B. In no event shall hazardous waste remain on the site for more than 60 days from generation. All hazardous materials and or waste are to be stored in compatible and regulated storage containers/drums, provide the MSDS to the Engineer. All materials are to placard and stored in accordance with State and Federal regulations.

C. Off-site disposal facilities must be approved by the Engineer as listed in Section 02 61 00 prior to disposal. Testing and sampling of materials and waste are to be done in accordance with Section 02 61 00.

D. Signed Originals of Weight Tickets/Bill-of-Lading and/or Waste Profile Sheets; Waste Manifests (for Hazardous Waste) are to be turned over to the Engineer after making copies of each following each waste shipment. Copies of the Chain of Custody are to be given to the Engineer in accordance with Section 02 61 00.

E. Employee training shall ensure that all employees are thoroughly familiar with proper waste handling and emergency procedures, relative to their responsibilities during normal operations and emergencies and to the type of waste they are handling.

1. Documentation when a universal waste in storage was first accumulated shall be provided. This is to be done by dating and labeling the waste with the date of the earliest accumulation that can document the length of time the universal waste has been accumulated.
2. Maintenance of an inventory system on-site that identifies the earliest date that any universal waste in a group of universal waste items or a group of containers of universal waste became a waste was received.
3. Any waste developed from the work that exhibits one or more characteristics of hazardous waste, that are not specifically identified by EPA and DEC as Universal Waste, must be handled accordingly and not as a universal waste. See the Hazardous Waste Disposal Specification for those wastes.

F. Off-Site Shipment of Universal Waste

1. Off-Site shipments shall meet the requirements for offsite shipments and is prohibited from sending or taking universal waste to a place other than a designated universal waste handler or a universal waste destination facility.

END OF SECTION

SECTION – 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Requirements for providing the concrete formwork for construction of all concrete structures set forth on the Contract Drawings and in the Specifications.

1.02 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and other Division 01 Specification Sections, apply to the Work of this Section.

1.03 CITED STANDARDS

A. American Concrete Institute (ACI):

1. ACI 347, Guide to Formwork for Concrete.
2. ACI 318/318R, Building Code Requirements for Structural Concrete and Commentary.

B. APA-The Engineered Wood Association (APA):

1. APA Panel Handbook & Grade Glossary.

C. Southern Pine Inspection Bureau (SPIB):

1. SPIB Standard Grading Rules for Southern Pine Lumber.

D. U. S. Government:

1. U.S. Department of Commerce (DOC):
   a. Technology Administration, National Institute of Standards and Technology (NIST):
      1) DOC Voluntary Product Standards:
         a) PS-1, Construction and Industrial Plywood.
         b) PS-20, American Softwood Lumber Standard.

E. Western Wood Products Association (WWPA):

1. WWPA Western Lumber Grading Rules ‘98.

1.04 QUALITY CONTROL

A. Certifications:

1. Submit certification that material is acceptable for structures processing or storing potable water.

1.05 SUBMITTALS

A. Prior to the start of the work of this Section, submit the following information for approval in accordance with the Submittal Procedures in SGR 1, Section 1.03:

1. Product Data and current specifications for the following:

a. Form coating materials.

b. Form ties.

2. Quality Assurance/Control Submittals:

a. Certificates:

1) Certification that material is acceptable for structures processing or storing potable water.

1.06 GENERAL DESIGN AND FABRICATION REQUIREMENTS

A. Design the formwork and falsework in accordance with ACI 347 and the following:

1. Include assumed values of live load, dead load, weight of moving equipment operated on the formwork, temporary construction material, foundation pressures, stresses, lateral stability, and such other factors pertinent to safety of the structure during construction in the design.

2. Design the formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent construction.

3. Earth forms are not permitted.

B. Design the formwork to ensure that the tolerances indicated are held, and factors pertinent to the safety of personnel during construction are included.

C. Structural components including slabs subject to traffic loading shall be designed by a qualified Professional Engineer licensed in New York State and all submittals shall be signed and stamped by same.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Framing, Sheathing, Struts, Braces, and Shoring for Forms: Provide framing, sheathing, struts, braces, and shoring for the forms made from lumber conforming to WWPA Grading Rules or SPIB Grading Rules.

B. Rough Structural and Dimension Lumber: Provide lumber of allowable species, surfaced on four sides as applicable, and grade stamped with the appropriate WWPA or SPIB stamp indicating product compliance with PS-20-94.

C. Form Sheathing and Panels: Provide Exterior Type B-B Plywood Class I and II for form sheathing and panels that conforms to U.S. Product Standard PS-1-95, and that is not less than 5/8 inch thick.

1. On surfaces not exposed to view, only use Class II plywood.

D. Metal Forms:

1. Steel forms of a pre-engineered standard design, conforming to the concrete sections indicated on the Contract Drawings, may be used in lieu of wood forms.

2. Do not use stay-in-place metal forms.

E. Form Ties:

1. Provide factory-fabricated, adjustable-length, removable or snap-off metal form ties conforming to ACI 347.

a. Do not fabricate wire ties, flat bands, or form ties on the Site.

2. Removable Ties:

a. For ties that are designed to be completely removed, taper the ties over their full length that passes through the concrete.

1) For liquid containment structures, install tapered ties so the large end of the taper is on the liquid side of the concrete wall.

2) In building foundation walls, install tapered ties so the large end of the taper is on the ground side of the concrete wall.

b. Do not use removable type ties that leave holes larger than one inch.

c. Do not use removable type ties to construct liquid-retaining concrete structures.

3. Snap-off Metal Ties:

a. Provide snap-off metal ties with ends that break at least 1 1/2 inches from the face of the wall.

4. Do not use wood spacers.

5. To construct liquid-retaining structures and structures designed to exclude groundwater, use ties designed to prevent seepage or flow of water along the embedded tie.

6. Submit Product Data and current specifications for the form tie materials.

F. Form Coatings:

1. Provide commercial formulation form-coating compounds that do not bond with, stain, or affect concrete surfaces.

a. Provide form-coating compounds that do not impair subsequent treatment of concrete surfaces requiring bond or adhesion, or impede the wetting of surfaces to be cured with water or curing compounds.

2. For surfaces designed to be in contact with potable water, do not use coating material that will add taste, odor, or toxic effects to the water.

3. Submit Product Data and current specifications for the form coating materials.

4. Fuel shall not be used as a form release agent.

2.02 SOURCE QUALITY CONTROL

A. Provide lumber free of material defects that would deform the finished concrete product.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Prior to placement of concrete, inspect the forms to verify the accuracy of their alignment and for cleanliness.

3.02 PREPARATION

A. Apply form coatings in accordance with the coating manufacturer's specifications.

B. Do not allow excess form coating material to accumulate in the forms.

C. Do not allow form coatings to come in contact with construction joints and reinforcing steel.

3.03 ERECTION

A. Construct the forms in accordance with ACI 347 and to the required dimensions; and erect them plumb, straight, mortar tight, and paste tight where appearance is important.

1. Fabricate forms for easy removal without hammering or prying against concrete surfaces.

2. Form intersecting planes to provide true, clean-cut corners with the concrete not exposed to the edge grain of plywood.

3. Securely brace and shore the forms to prevent displacement, bowing, pillowing, and to safely support the imposed concrete load.

4. Provide offsets, keyways, recesses, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and such other features as required.

B. Build into the forms items such as inserts, anchors, miscellaneous metal items, and other embedded items indicated on the Contract Drawings; or otherwise secure these items in the forms.

1. Accurately place and securely support items to be built into forms.

C. Openings:

1. Provide temporary openings where the interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, or for placement of concrete.

a. Locate temporary openings on forms in locations as inconspicuous as possible consistent with the requirements of the work.

b. Provide openings in concrete formwork of the correct size and in the proper location to accommodate other items and operations of construction work passing through the forms.

2. Securely brace and set temporary openings tightly to forms to prevent the loss of concrete mortar.

D. Wet wooden forms sufficiently to prevent the joints from opening prior to the concrete placement.

3.04 SITE TOLERANCES

A. Set and maintain concrete forms within allowable tolerance limits stated in ACI 347.

3.05 FORM REMOVAL

A. If the atmospheric temperature at the site has been continuously above 50 degrees Fahrenheit from the time of the placement, remove the forms at the earliest

practical time within the limits set forth in this Paragraph, and maintain wet curing without delay.

1. Forms for walls and other vertical faces may be carefully removed 24 hours after the last portion of concrete in the section involved has been placed, provided the concrete has sufficiently hardened to preclude damage resulting from form removal, and provided these members are not subjected to loads for a period of 14 days.

2. Maintain horizontal forms in place for a minimum of 14 days or until the concrete, as determined by job-cured cylinders, has attained a compressive strength of 3000 psi.

3. If a water-reducing retarder is used in the concrete mix, the normal time period for removing forms may need to be increased.

B. If the atmospheric temperature at the site drops below 50 degrees Fahrenheit, leave all forms in place for at least five (5) days regardless of the temperature within protective coverings or enclosures.

C. Remove forms in accordance with ACI 347 without damaging the concrete and in a manner that ensures complete safety and serviceability of the structure.

1. Do not cut form ties back from the face of the concrete.

2. Concrete containing slag ground granulated blast furnace slag tends to develop strength slower than a concrete containing 100 percent Portland cement, so forms for such concrete may need to be left in place longer.

D. Do not remove supporting forms or shoring until the members have acquired sufficient strength to safely support their weight and the anticipated construction loads without distortion or excessive deflection.

3.06 RE-INSTALLATION

A. Forms may be re-used, only if they meet the same requirements as new forms with respect to their effect on placed concrete appearance and structural stability.

B. Reusing concrete forms may not cause delays or changes in the concrete placement schedule when compared to the concrete placement schedule that is made possible by using all new forms in the case of wood forms, or by having available the total number of forms required in the case of metal forms.

3.07 FIELD QUALITY CONTROL

A. Notify the Engineer upon removal of a concrete placement’s forms so that a review of the newly stripped surfaces may be made before patching takes place.

B. Examine concrete surfaces following removal of forms to verify that they do not contain residual form coating that will interfere with other materials or coatings to be applied.

1. If detrimental form coating is found, use approved methods to remove it prior to applying other materials or coatings.

3.08 PROTECTION

A. Protect formwork materials before, during, and after erection to ensure acceptable finished concrete work.

B. The Engineer's consent to remove forms does not relieve the Contractor of the responsibility for the safety of the work.

C. Protect in-place materials and the work of other trades during concrete work.

END OF SECTION

SECTION – 03 20 00

CONCRETE REINFORCING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Requirements for furnishing and installing reinforcement for concrete structures.

1.02 REFERENCED SECTIONS

A. Division 01 Specification Sections

B. Section 03 10 00 – Concrete Forming and Accessories.

C. Section 03 30 00 – Cast-In-Place Concrete.

1.03 CITED STANDARDS

A. American Concrete Institute (ACI):

1. ACI 315, Details and Detailing of Concrete Reinforcement.
2. ACI 318, Building Code Requirements for Structural Concrete.

B. American Society for Testing and Materials (ASTM):

1. ASTM A 82, Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A 185, Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
3. ASTM A 496, Specification for Steel Wire, Deformed, for Concrete Reinforcement.
4. ASTM A 615/A615M, Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
5. ASTM A 663/A663M, Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
6. ASTM A767 / A767M, Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

C. Concrete Reinforcing Steel Institute (CRSI):

1. CRSI Manual of Standard Practice.

1.04 QUALITY CONTROL

A. Certifications:

1. Submit certification that material meets specified requirements.

1.05 SUBMITTALS

A. Prior to the start of the work of this Section, submit the following information to the Engineer for approval in accordance with the requirements of Section 01 33 00 – Submittal Procedures:

1. Product Data

a. Submit the manufacturer's descriptive product data and current specification for each product specified herein, include installation instructions.

1) Reinforcing steel.

2) Rebar splicing coupler.

3) Slab joint dowel bars.

4) Deformed bar anchors.

2. Shop Drawings

a. Prepare Shop Drawings of concrete reinforcement in accordance with ACI 315.

b. Provide drawings showing all fabrication dimensions and locations for placing reinforcement and bar supports; indicate bending diagrams, splicing and lap of rods, shapes, dimensions and details of bar reinforcing and accessories.

3. Test Reports

a. Submit copies of test reports showing the results of tests conducted in accordance with the American Society for Testing and Materials Specifications listed in Paragraph 7.02B.

b. Test Requirements may be waived, if certified copies of mill test reports that show compliance with specified requirements are provided.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage of Materials:

1. Store concrete reinforcing materials in a manner that prevents excessive rusting and fouling with dirt, grease, and other bond-breaking coatings.

B. Identify bundles of reinforcing steel with tags wired to the reinforcing steel.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Reinforcing Steel:

1. Reinforcement Bars: Provide deformed steel reinforcement bars in accordance with the requirements of ASTM A 615/A615M, Grade 60.

2. Wire: Provide wire in accordance with the requirements of ASTM A 82.

3. Welded Wire Fabric: Provide welded wire fabric in accordance with the requirements of ASTM A 185.

a. Galvanized: Provide galvanized reinforcing steel conforming to the requirements of A 767/A 767M, Class I zinc coated, hot-dip galvanized and chromate wash treated after fabrication and bending in cast-in- place concrete only.

b. Metal Accessories: Provide metal accessories in accordance with the requirements of the CRSI Manual of Standard Practice.

B. Rebar Splicing Coupler:

1. Use a rebar splicing coupler only where one is shown on the Contract Drawings or where approved by the Engineer.

2. Provide a two-piece dowel bar splicer system manufactured from ASTM A 615/A615M Grade 60 deformed rebar, and consisting of a rebar externally-threaded on the splice end, or “dowel-in”, which can be threaded into an internally-threaded hole in a “dowel bar splicer” factory- forged onto the end of the mating rebar and equipped with an integral nailing flange plate.

3. The strength of the completed splice must exceed the tensile strength requirements of ACI 318.

4. Where “dowel bar splicers” are provided for mating with “dowel-ins” to be installed later, install the coupler manufacturer’s plastic internal coupler protectors in the “dowel bar splicers”.

5. Provide solid plastic sleeves placed over the “dowel-in” ends to protect the threading from damage, contamination, and rust.

6. Acceptable Manufacturers:

a. Dayton/Richmond Concrete Accessories, www.daytonrichmond.com.

b. Approved equal.

C. Slab Joint Dowel Bars:

1. To transfer shear forces at slab joints, provide plain round dowel bars conforming to requirements of ASTM A 663/A663M, Grade 70, 75, or 80; and which are not burred, roughened, or deformed out-of-round so that slippage is not hindered.

2. Coat the slab joint dowel bars with curing compound conforming to the requirements specified in Section 03 30 00, Cast-In-Place Concrete, to render the surface of the bars bondless.

D. Deformed Bar Anchors:

1. Provide deformed anchors conforming to the requirements of ASTM A 496 with a minimum yield strength of 50 ksi and a minimum ultimate tensile strength of 61 ksi.

a. Provide low carbon steel anchors with the following composition:

1) Carbon: 0.23 percent, maximum.

2) Manganese: 0.90 percent, maximum.

3) Phosphorus: 0.040 percent, maximum.

4) Sulfur: 0.050 percent, maximum.

b. Provide flux-filled deformed bar anchor similar to Nelson Stud Welding, Inc. Type D2L.

2. Acceptable Manufacturers:

a. Nelson Stud Welding, Inc., www.nelsonstud.com.

b. Approved equal.

2.02 FABRICATION

A. Fabricate reinforcement to the dimensions indicated on the Contract Drawings and within the tolerances given in ACI 315.

B. Bend steel reinforcement using the cold bending method.

1. Do not use bars with kinks or bends not indicated on the Contract Drawings.

2. Fabricate bar shapes in a manner that will not injure the material or lessen the member strength.

3. Use either a hand- or power-operated bending machine designed for bending reinforcing steel.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Placing Concrete Reinforcement:

1. Place metal concrete reinforcement accurately and in accordance with ACI 318.

a. Do not lay metal reinforcement on formwork.

b. Terminate reinforcement two inches from the face of expansion joints.

c. Continue reinforcement across or through construction joints.

d. Place additional concrete reinforcement around openings in slabs and walls as detailed on the Contract Drawings.

e. Use reinforcing accessories to securely brace the reinforcement against displacement outside of permitted tolerances.

2. Slab Reinforcement:

a. Install welded wire fabric as indicated, lapping joints eight inches and securely wiring the joints together.

b. Extend welded wire fabric to within two inches of sides and ends of slabs.

c. To support slab reinforcement from the ground, place the reinforcement on concrete blocks of the correct height and having a compressive strength equal to or greater than the specified compressive strength of concrete being placed.

1) Use concrete blocks not larger than 3 inches by 3 inches and of a height equal to required bottom steel cover.

d. To support slab reinforcement from formwork, place the reinforcement on bar chairs made of plastic or metal.

e. Field weld deformed bar anchors to slab edge steel bent plate as shown on the Contract Drawings.

3. Provide fiber reinforcement in concrete sidewalks and in other applications

as indicated on the Contract Drawings.

B. Concrete Reinforcement Field Bends:

1. Do not field bend bars partially embedded in concrete unless approved by the Engineer.

2. When obstructions interfere with the placement of reinforcement, pass such obstructions by placing reinforcement around it.

a. Do not bend the reinforcement to clear the obstructions.

C. Splicing Concrete Reinforcement:

1. Splice metal reinforcement in accordance with ACI 318 and as indicated on the Contract Drawings.

a. Make mechanical butt splices in accordance with the rebar splicing coupler manufacturer's installation instructions.

1. Secure metal reinforcement at intersections with not less than 16-gauge annealed wire or appropriately sized clips.

b. When bar spacing is less than 12 inches, tie alternate intersections.

c. Do not tack-weld crossing bars.

D. Slab Joint Dowel Bar Installation:

1. Install one-half the length of the coated bar dowel into the slab to be placed.

3.02 FIELD QUALITY CONTROL

A. Notify the Engineer 48 hours before placing concrete so the placement of metal reinforcement can be inspected.

3.03 CLEANING

A. Clean or otherwise protect metal reinforcement so that at the time the concrete is placed, the reinforcement is free from rust, scale, or other coatings that could destroy or reduce the concrete to steel bond.

3.04 PROTECTION

A. Provide protection for concrete reinforcement during concrete placement in accordance with ACI 318, unless indicated otherwise on the Contract Drawings.

B. Protect in-place reinforcement from excessive construction traffic and other work.

END OF SECTION

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SECTION – 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Requirements for designing the cast-in-place concrete mixes.

B. Requirements for furnishing, placing, and curing Portland cement concrete for concrete structures, both reinforced and un-reinforced, as indicated in the Contract Documents.

C. Requirements for testing and accepting of cast-in-place concrete structures.

1.02 REFERENCED SECTIONS

A. Division 01 Specification Sections.

B. Section 03 10 00 – Concrete Forming and Accessories.

C. Section 03 20 00 – Concrete Reinforcing.

1.03 CITED STANDARDS

A. American Concrete Institute (ACI):

1. ACI 117/117R; Standard Specifications for Tolerances for Concrete Construction and Materials and Commentary.
2. ACI 211.1; Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
3. ACI 301; Specifications for Structural Concrete.
4. ACI 302.1R; Guide for Concrete Floor and Slab Construction.
5. ACI 304R; Guide for Measuring; Mixing, Transporting and Placing Concrete.
6. ACI 304.2R; Placing Concrete by Pumping Methods.
7. ACI 305R; Hot Weather Concreting.
8. ACI 306R; Cold Weather Concreting.
9. ACI 308R; Guide to Curing Concrete.
10. ACI 318/318R; Building Code Requirements for Structural Concrete and Commentary.

B. American Institute of Steel Construction, Inc. (AISC):

1. AISC 303, Code of Standard Practice for Steel Buildings and Bridges.

C. American Society for Testing and Materials (ASTM):

1. ASTM C 31/C 31M; Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C 33; Standard Specification for Concrete Aggregates.
3. ASTM C 39/C 39M; Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

4. ASTM C 42/C 42M; Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C 94/C 94M; Standard Specification for Ready-Mixed Concrete.
6. ASTM C 138/C 138M; Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
7. ASTM C 143/C 143M; Standard Test Method for Slump of Hydraulic-Cement Concrete.
8. ASTM C 150; Standard Specification for Portland Cement.
9. ASTM C 156; Standard Test Method for Water Retention by Concrete Curing Materials.
10. ASTM C 171; Standard Specification for Sheet Materials for Curing Concrete.
11. ASTM C 172; Standard Practice for Sampling Freshly Mixed Concrete.
12. ASTM C 173/C 173M; Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
13. ASTM C 192/C 192M; Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
14. ASTM C 231; Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
15. ASTM C 260; Standard Specification for Air-Entraining Admixtures for Concrete.
16. ASTM C 309; Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
17. ASTM C 494/C 494M; Standard Specification for Chemical Admixtures for Concrete.
18. ASTM C 779/C 779M; Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
19. ASTM C 881; Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
20. ASTM C 882; Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.
21. ASTM C 989; Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
22. ASTM C 1077; Standard Practice for Laboratories Testing Concrete and Concretes for Use in Construction and Criteria for Laboratory Evaluation.
23. ASTM C 1315; Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
24. ASTM D 638; Standard Test Method for Tensile Properties of Plastics.
25. ASTM D 695; Standard Test Method for Compressive Properties of Rigid Plastics.

26. ASTM D 1751; Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

27. ASTM E 329; Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

1.04 QUALITY CONTROL:

A. Regulatory Requirements:

1. Only provide curing compounds which comply with the low volatile organic compound (VOC) requirements of the U.S. Environmental Agency as defined in 40 CFR Part 51.100.

B. Certifications:

1. Batch Mixing Plant Certification:

a. Submit to the Engineer and local authorities requiring them, certificates originated by the batch mixing plant certifying that the ready mixed concrete, as manufactured and delivered, is in conformance with ASTM C 94/C 94M.

2. Curing Compound/Architectural Finish Bond Certification:

a. Submit written certification by the product manufacturer that liquid membrane-forming curing compounds to be applied over concrete with an architectural finish is non-detrimental to the bond of the finish material.

3. Clear Curing and Sealing Compound Certification:

a. Submit written certification by the product manufacturer that liquid-type membrane-forming clear curing and sealing compound is compatible with other treatments and finishes to be applied to the concrete.

4. Mix/Admixture Certification:

a. Prior to submitting the concrete mix design to the Engineer for approval, submit written certification that the mix conforms to the requirements of proposed admixtures.

C. Field Samples:

1. Submit Samples of materials being used when requested by the Engineer, including the Samples' names, sources, and descriptions.

D. Pre-Installation Meetings:

1. Prior to placement of concrete, convene an onsite meeting to establish and coordinate procedures that will enable the Contractor to provide the best possible product under anticipated field conditions.

2. Required attendees to this meeting include representatives of organizations and material suppliers involved with the design and construction of floor slab.

1.05 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with Section 01 33 00 – Submittal Procedures:

1. Product Data:

   a. Concrete materials and accessories per Subparagraph 1.04.D.1.

2. Shop Drawings:

   a. Schedule showing construction methods, construction joint locations, and the sequence of placement per Paragraph 1.10.A.

3. Samples:

   a. Samples of materials being used per Paragraph 1.07.D.1.

4. Quality Assurance/Control Submittals:

   a. Design Data.

      1) Design mixes per Subparagraph 2.03.A.1.

   b. Test Reports.

      1) Source concrete test reports per Subparagraph 2.05.A.1.a.

      2) Test reports for concrete slump per Subparagraph 3.05.A.1.f and Subparagraph 3.05.A.2.

      3) Test reports for concrete air content tests for new concrete per Subparagraph 3.05.A.1.f and Subparagraph 3.05.A.3.

      4) Test reports for new concrete strength tests per Subparagraph 3.05.A.1.f and Subparagraph 3.05.A.4.

      5) Test reports for concrete core tests for in-place concrete per Subparagraph 3.05.A.1. and Subparagraph 3.05.A.5.b.

      6) Test reports for concrete load tests for in-place concrete if required per Subparagraph 3.05.A.1.f and Subparagraph 3.05.A.5.b.2.b.

   c. Certificates.

      1) Batch Mixing Plant Certification per Subparagraph 1.07.C.1.a.

      2) Curing Compound/Architectural Finish Bond Certification per Subparagraph 1.07.C.2.a.

      3) Clear Curing and Sealing Compound Certification per Subparagraph 1.07.C.3.a.

      4) Mix/Admixture Certification per Subparagraph 1.07.C.4.a.

   d. Manufacturers' Instructions.

      1) Concrete material and accessories installation instructions per Subparagraph 1.04.D.2.

      2) Submit a letter from the curing compound manufacturer that specifies the coverage rate necessary to meet the restriction

for loss of water per Subparagraph 2.01.J.1.c.1.a.1.

e. Manufacturers Field Reports.

1) Concrete delivery tickets per Subparagraph 1.08.A.1.c.

1.06 DEFINITIONS

A. Cementitious Material: A mixture of cement and ground granulated blast-furnace slag.

B. VOC: An acronym for volatile organic compounds, generally meant to refer to organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere.

1.07 GENERAL DESIGN AND FABRICATION REQUIREMENTS

A. American Concrete Institute (ACI) Compliance:

1. Provide cast-in-place concrete work conforming to the requirements of ACI 301 except as modified by the Specifications and Contract Drawings.

B. Concrete Mix Design Properties:

1. Design concrete mixes to provide the following properties for the classes listed:

a. Minimum compressive strength of 4,000 psi at 28 days, and a minimum cementitious material content of 564 pounds per cubic yard.

C. Concrete Admixtures:

1. Only provide non-corrosive, non-chloride concrete admixtures.

D. Product Data and Installation Instructions:

1. Submit the manufacturer's descriptive product data and current specifications for the concrete materials and accessories specified in this Section.

2. Submit manufacturer's installation instructions for the concrete materials and accessories specified in this Section.

1.08 PERFORMANCE REQUIREMENTS

A. Requirements for Acceptance:

1. Concrete Compressive Strength:

a. If concrete fails to meet the minimum specified compressive strength test requirements, the concrete represented by such tests will be considered questionable and subject to further testing and other requirements as follows:

1) Additional curing may be required as directed by the Engineer.

2) Modifications may be required for remaining concrete work, including changes in the concrete mix designs.

3) When the strength of the structure is considered potentially deficient by the Owner and/or the Engineer, structural

analysis and/or additional testing may be required.

a) If in the opinion of the Owner and/or the Engineer there is cause for concern over the adequacy of the structure regardless of the results of any previous tests, additional tests of the hardened concrete may be required.

(i) Conduct the additional testing of questionable concrete in accordance with the requirements of ASTM C 42/C 42M at no increase in Contract Price, except as noted in Subparagraph 1.05.A.1.a.3.a.2.

(ii) If the initial test acceptance requirements had been met, the Contractor is not required to bear the costs of such additional tests unless their results confirm that the concrete in place is deficient.

b) If concrete work is judged inadequate by the Engineer based on structural analysis or by results of a load test, reinforce it with additional construction if so directed by the Engineer or Owner, or replace it at no increase in Contract Price.

2. Concrete Appearance:

a. Repair defects which adversely affect the appearance of the specified finish in concrete exposed to view if possible.

1) If in the opinion of the Engineer the defect cannot be repaired, the concrete may be accepted or rejected as provided in this Section.

2) Concrete not exposed to view is not subject to rejection for defective appearance.

3. Location of Members:

a. Concrete members cast in the wrong location may be rejected if the strength, appearance, or function of the structure is adversely affected; or if the misplaced items interfere with other construction.

4. Dimensional Tolerances:

a. Inaccurately formed concrete surfaces which are exposed to view and exceed the requirements of ACI 117/117R may be rejected.

1) Repair, or remove and replace, the section if required.

2) If the outlines of formed concrete surfaces are smaller than required by an amount exceeding the requirements of ACI 117/117R, they will be considered deficient in strength and subject to the provisions of Subparagraph 1.05.A.1.

3) If the outlines of formed concrete surfaces are larger than required by an amount exceeding the requirements of ACI

117/117R, they may be rejected.

a) The Engineer may require that the excess material be removed.

b) If the excess material is to be removed, do so in a manner that maintains the strength of the section and meets the other applicable requirements of function and appearance.

b. Finished flatwork exceeding the allowable tolerances may be repaired provided that the strength or appearance of the flatwork is not adversely affected.

1) Remove high spots with a terrazzo grinder.

2) Fill in low spots with an approved patching compound.

3) Perform other remedial measures as permitted by the Engineer.

B. Concrete Acceptance:

1. Completed concrete work which meets the specified requirements will be accepted without qualification.

2. The Engineer will determine the extent and manner of actions to be taken to correct defective concrete revealed by surface defects or otherwise.

a. Prior to repairing defects, submit proposed materials and repair methods to the Engineer for approval.

b. Obtain approval from the Engineer before performing repair work other than removing imperfect texture and filling pin holes and insert holes.

3. Completed concrete work which fails to meet one or more requirements but which has been repaired to be in compliance will be accepted without qualification.

a. Repairs must be made at no increase in the Contract Price.

4. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected as provided in this Section.

a. The Owner and the Engineer reserve the right to reject any or all items which do not meet the requirements of the Contract Drawings and Specifications.

b. Repairs and additional testing and/or analysis must be performed at no increase in the Contract Price unless otherwise noted.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site:

1. Delivery Tickets:

a. Each load of concrete from the batch plant must be accompanied by a delivery ticket.

b. Each delivery ticket must be signed by the Contractor's representative, and be annotated with the time and place of concrete placement using the concrete from the load represented by the delivery ticket.

c. Keep the original delivery tickets as a record at the Work Site, and submit copies to the Engineer for information.

1) Make delivery tickets available for inspection upon request by the Engineer.

d. Include the tabulation described by ASTM C 94/C 94M as well as any additional information the local codes may require on the delivery ticket.

B. Storage and Protection:

1. Store the concrete admixtures in a manner that prevents contamination, evaporation, moisture penetration, and damage.

2. Do not use concrete admixtures that have been stored longer than 6 months.

1.10 PROJECT CONDITIONS

A. Project Environmental Requirements:

1. Cold Weather Concreting:

a. Perform cold weather concrete work in accordance with the requirements of ACI 306R and the following additional requirements:

1) The temperatures of the subbase and other surfaces that come in contact with concrete must be above freezing.

a) The subbase and surfaces of concrete forms must be free of snow and ice.

b) Do not place concrete around any embedment which has a temperature below freezing.

2) Provide equipment for heating and protecting concrete and concrete materials during freezing or near-freezing weather.

a) Do not use foreign materials or materials containing snow or ice.

b) When using artificial heat indoors, vent exhaust gases to the outside.

2. Hot Weather Concreting:

a. Perform hot weather concrete work in accordance with the requirements of ACI 305R and the following additional requirements:

1) Do not deliver concrete having a temperature exceeding 90 degrees Fahrenheit to the Work Site.

2) Cool the mix’s ingredients before mixing to prevent the

temperature of the mix from exceeding 90 degrees Fahrenheit.

a) Furnish windbreaks, shading, fog spraying, sprinkling, or wet covering when necessary.

1.11 SCHEDULING

A. A minimum of 10 days prior to placing concrete, submit a schedule to the Engineer showing proposed construction methods, construction joint locations, and the sequence of placement.

B. Before concrete is to be placed, give five days' notice to those performing other construction work related to the concrete placement, such as to those performing work that must be supported by or embedded in concrete, to allow embedded items to be introduced or furnished before the concrete is placed.

C. When placing concrete in walls and slabs, allow at least two days elapsed time for slabs and five days elapsed time for walls before concrete is placed against an adjacent vertical joints.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Cement:

1. Provide Portland Cement conforming to the requirements for Type I, Normal, cement specified in ASTM C 150, except for concrete exposed to water, wastewater, or hydrogen sulfide gas.

2. For concrete exposed to water, wastewater, or hydrogen sulfide gas, provide Portland Cement conforming to the requirements for Type II, Moderate Sulfate Resistance, cement specified in ASTM C 150.

3. Use cementitious material to determine the water/cementitious (W/C) ratio for cement.

4. For exposed concrete, provide only one approved brand and manufacturer of cement.

B. Normal Weight Concrete Aggregate:

1. Provide processed aggregate meeting the requirements of ASTM C 33.

2. Coarse Aggregate Size:

a. Within the following maximum size limitations, but in no case larger than 1 1/2 inches:

1) One-fifth or less of the narrowest dimension between the sides of the forms within which the concrete is to be cast.

2) Three-fourths or less of the minimum clear spacing between reinforcing bars.

3) One-third or less of the slab thickness for unreinforced slabs.

b. For use in metal pan stairs only, provide reduced aggregate concrete containing aggregate with a particle size not less than 1/8

inch or more than 1/2 inch in any dimension, and containing a maximum of 5 percent of particles passing a No. 8 sieve.

C. Water:

1. Provide water clean and free of injurious amounts of oils, acids, alkalis, salts, organic materials, and other substances that may be deleterious to concrete or concrete reinforcement.

D. Concrete Admixtures:

1. Admixture Manufacturers:

a. Provide admixtures produced and serviced by established, reputable manufacturers.

2. Air-Entraining Admixture:

a. Provide a product conforming to requirements of ASTM C 260.

3. Water-Reducing Admixture:

a. For all concrete except where an admixture listed below is used, provide a product conforming to the requirements specified for Type A in ASTM C 494/C 494M.

b. Manufacturers:

1) The Euclid Chemical Company, Eucon WR-75, www.euclidchemical.com.

2) BASF Admixtures, Inc., Pozzolith 220N, www.basf-admixtures.com.

3) Sika Corporation, Plastocrete 161, www.sikaconstruction.com.

4) Approved equal.

4. Water-Reducing and Retarding Admixture:

a. Provide a product conforming to the requirements specified for Type D in ASTM C 494/C 494M.

b. Manufacturers:

1) The Euclid Chemical Company, Eucon Retarder-75, www.euclidchemical.com.

2) BASF Admixtures, Inc., Pozzolith 100XR, www.basf-admixtures.com.

3) Sika Corporation, Plastiment, www.sikaconstruction.com.

4) Approved equal.

5. Water-Reducing and Acceleration Admixture:

a. Provide a product conforming to the requirements specified for Types C or E in ASTM C 494/C 494M.

b. Manufacturers:

1) The Euclid Chemical Company, Accelguard 80,

www.euclidchemical.com.

2) BASF Admixtures, Inc., Pozzutec 20, www.basf-admixtures.com.

3) Sika Corporation, Plastocrete 161 FL, www.sikaconstruction.com.

4) Approved equal.

6. High-Range, Water-Reducing Admixture:

a. Provide a product conforming to the requirements specified for Type F in ASTM C 494/C 494M.

b. Manufacturers:

1) The Euclid Chemical Company, Eucon 1037, www.euclidchemical.com.

2) BASF Admixtures, Inc., Pozzolith 400N, www.basf-admixtures.com.

3) Sika Corporation, Sikament 2000, www.sikaconstruction.com.

4) Approved equal.

E. Preformed Expansion Joint Fillers:

1. Nonextruding and Resilient Bituminous Types:

a. Provide nonextruding and resilient bituminous types of joint fillers for exterior use in pavements and sidewalks only.

b. Provide nonextruding and resilient bituminous joint fillers conforming to the requirements of ASTM D 1751.

2. Manufacturers:

a. The Euclid Chemical Company/Tamms Industries, Inc., www.euclidchemical.com.

b. W. R. Meadows, Inc., www.wrmeadows.com.

c. APS Supply Company, http://apscork.com.

d. Approved equal.

F. Vinyl Waterstops:

1. Provide ribbed type waterstops conforming to the requirements of COE CRD C 572, and manufactured from virgin polyvinyl chloride plastic compound.

2. Construction Joints:

a. Provide flat ribbed 6-inch by 3/8-inch construction joints, such as Catalog Number R6-38 manufactured by Vinylex Corporation, www.vinylex.com; or approved equal.

3. Expansion Joints:

a. Provide 9-inch by 3/8-inch; ribbed expansion joints with a 1½-inch

outside diameter center bulb, such as Catalog Number RLB9-38 manufactured by Vinylex Corporation, www.vinylex.com; or approved equal.

4. Retro-fit Waterstops:

a. Provide 6-inch by 3/8-inch retro-fit vinyl waterstops with a 3 3/16-inch T-leg, such as Product Number 609 manufactured by Greenstreak, Inc., www.greenstreak.com; or approved equal.

5. Manufacturers:

a. Vinylex Corporation, catalog numbers as specified above, www.vinylex.com.

b. The Euclid Chemical Company/Tamms Industries, Inc., www.euclidchemical.com.

c. W. R. Meadows, Inc., www.wrmeadows.com.

d. Approved equal.

G. Curing Materials:

1. Provide curing materials that will not stain or affect the concrete finish, or lessen the concrete strength.

a. Burlap:

1) Provide burlap materials conforming to the requirements of AASHTO M 182.

b. Sheet Materials:

1) Provide sheet materials conforming to the requirements of ASTM C 171.

c. Liquid Membrane-Forming Curing Compound:

1) Provide liquid membrane-forming curing compound material conforming to the requirements for Type 1 specified in ASTM C 309.

a) Provide a compound that restricts the loss of water to not more than 0.039 gallons per cubic centimeter of surface in 72 hours when tested in accordance with ASTM C 156 at the coverage rate recommended by the manufacturer.

(i) Submit a letter from the manufacturer that specifies the coverage rate necessary to meet this restriction for loss of water.

b) Provide liquid membrane-forming curing compounds which are nontoxic, free of taste and odor, and comply with the low volatile organic compound (VOC) requirements of the U.S. Environmental Agency.

2) Manufacturers:

a) L&M Construction Chemicals, Inc., L&M Cure, www.lmcc.com.

b) BASF Admixtures, Inc.., Masterkure 200W, www.basf- admixtures.com.

c) Euclid Chemical Company, Kurez DR, www.euclidchemical.com.

d) Approved equal.

H. Clear Curing and Sealing Compound:

1. Provide a liquid-type membrane-forming clear curing and sealing compound conforming to the requirements for Type I, Class A, specified in ASTM C 1315.

2. Provide material that has a maximum volatile organic compound (VOC) rating of 350 grams per liter.

3. Provide material that has a moisture loss not more than 0.40 kilograms per square meter when applied at an application rate of 300 square feet per gallon.

4. Manufacturers:

a. Euclid Chemical Co., Super Diamond clear VOX, www.euclidchemical.com.

b. BASF Admixtures, Inc., Sonneborn®, Kure-N-Seal 25LV, www.chemrex.com.

c. L&M Construction Chemical, Inc., Lumiseal WB Plus, www.lmcc.com.

d. Approved equal.

I. Non-Slip (Dry-Shake) Aggregate Surfacer:

1. Provide aluminum-oxide, non-slip aggregate surfacer to be applied to fresh concrete by the dry-shake method.

2. Manufacturers:

a. Sonneborn; Frictex, www.chemrex.com.

b. Approved equal.

J. Epoxy Bonding Compound:

1. Provide a high-modulus, low-viscosity, moisture-insensitive epoxy adhesive conforming to the requirements for Type II, Grade 2, Classes B and C, specified in ASTM C 881 when mixed, and having the following properties:

a. Compressive Strength (Minimum): 8,000 psi at 28 days when measured in accordance with the requirements of ASTM D 695.

b. Tensile Properties:

1) Tensile Strength (Minimum): 4,000 psi at 14 days when measured in accordance with the requirements of ASTM D

638.

2) Elongation at Break: One to three percent when measured in accordance with the requirements of ASTM D 638.

3) Modulus of Elasticity: 3 x 105 psi when measured in accordance with the requirements of ASTM D 638.

c. Minimum Bond Strength (Plastic Concrete to Hardened Concrete): 1,700 psi at 14 days (moist cure) when measured in accordance with the requirements of ASTM C 882.

2. Manufacturers:

a. Sika Corporation; Sikadur 32 Hi-Mod, www.sikaconstruction.com.

b. Euclid Chemical Company; Euco Epoxy #452 MV or #620, www.euclidchemical.com.

c. Fosroc, Inc.; Notobond 881, www.studiolina.com/studio/websites/fosroc.

d. Approved equal.

K. Epoxy Adhesive (For Grouting Dowels):

1. Provide a high-modulus, moisture insensitive epoxy adhesive of thick (gel) consistency conforming to the requirements for Type I, Grade 3, Classes B and C, specified in ASTM C 881, and having the following properties:

a. Compressive Strength (Minimum): 10,000 psi at 28 days when measured in accordance with the requirements of ASTM D 695.

b. Tensile Properties:

1) Tensile Strength (Minimum): 3,000 psi at 14 days when measured in accordance with the requirements of ASTM D 638.

c. Minimum Bond Strength (Hardened Concrete to Hardened Concrete): 2,000 psi at 14 days (moist cure) when measured in accordance with the requirements of ASTM C 882.

2. Manufacturers:

a. Sika Corporation; Sikadur 31 Hi-Mod Gel, www.sikaconstruction.com.

b. Euclid Chemical Company, Euco Epoxy #452 Gel or #620 Gel, www.euclidchemical.com.

c. Fosroc, Inc.; Anchorbond, www.studiolina.com/studio/websites/fosroc.

d. Approved equal.

L. Dovetail Anchor Slots:

1. Provide 24 gauge-galvanized steel, foam filled dovetail anchor slots.

M. Construction Joint Devices:

1. Provide integral, galvanized steel construction joint devices formed to make

a tongue and groove profile.

a. For exposed concrete areas, provide plastic joint cap strips that can be removed to allow placement of sealant.

2. Manufacturers:

a. Meadowburke, www.meadowburke.com.

b. Heckmann Building Products, Inc., www.heckmannbuildingprods.com.

c. Approved equal.

N. Contraction Joint Inserts:

1. Provide two-piece, plastic, preassembled, preformed contraction joints with a depth of embedment equal to 1/4 of the slab thickness.

2. Manufacturers:

a. Meadowburke, Burke Zip Strip, www.meadowburke.com.

b. W.R. Meadows, Speed - E - Joint., www.wrmeadows.com.

c. Approved equal.

O. Construction and Contraction Joint Filler (For Slabs-on-Grade):

1. Provide two-component epoxy construction and contraction joint fillers.

2. Manufacturers:

a. Sika Corporation, Sikadur 51 SL, www.sikaconstruction.com.

b. Euclid Chemical Company, Euro 700, www.euclidchemical.com.

c. BASF Admixtures, Inc., Masterfill 300, www.basf-admixtures.com..

d. Approved equal.

2.02 EQUIPMENT

A. Furnish plant equipment and facilities conforming to the requirements specified in the NRMCA Plant Certification Checklist - Section 3 for producing the ready-mixed concrete.

2.03 MIXES

A. Design Mix:

1. Prior to producing concrete, submit all mix designs proposed for Contract to the Engineer for approval on form attached at the end of this Section.

a. Include a standard deviation analysis or laboratory trial mixture test data with the submittal in accordance with Section 4 of ACI 301.

b. Use materials in proposed design mixes as specified in this Section.

c. Make adjustments in the proposed design mix as directed by the Engineer at no increase in the Contract Price.

2. Do not add water to concrete mixes at the Work Site unless it is withheld from the mix at the batch mixing plant.

a. Indicate the amounts of mix water to be withheld for later addition at the Work Site in the approval form.

B. Proportions of Ingredients:

1. Select the proportion of normal weight concrete in the mix in accordance with the requirements of ACI 211.1.

2. Establish proportions of ingredients of the mix, including the water-cement ratio, on the basis of either laboratory trial mixture tests or standard deviation analysis, using the materials specified within this Section.

a. Perform the Laboratory Trial Mixture Test in accordance with Section 4 in ACI 301.

b. Perform the Standard Deviation Analysis in accordance with Section 4 in ACI 301.

C. Water-Cement Ratio:

1. Provide a maximum water-cement ratio of 0.45.

D. Slump:

1. Proportion and produce concrete to produce a slump as indicated in Table 03 30 00-1.

Table 03 30 00-1 Concrete Slump Requirements

Type of Construction	Slump (Inches)	
	Maximum[1]	Minimum
Slabs	4	1
Building columns, piers	4	1
Pavements and slabs-on-grade	3	1

2. For pumped concrete, use concrete having a maximum slump measured prior to pumping of 5 inches.

3. For concrete containing high-range water-reducing admixtures, the maximum allowable slump after the admixture is added to concrete with an initial slump of 2 to 4 inches is 8 inches.

E. Admixtures:

1. Comply with the manufacturer's recommendations when using concrete admixtures.

2. Air Entraining Admixture:

a. Provide air-entrained concrete for each concrete placement unless indicated otherwise in the Specifications or on the Contract Drawings.

1) Do not air-entrain concrete for interior floor slabs.

b. The total air content required is as indicated in Table 03 30 00-2:

Table 03 30 00-2 Air Content	
Maximum Coarse Aggregate Size (Inches)	**Air Content (Percent by Volume)**
1 1/2	5 ± 1
3/4 or 1	6 ± 1

3. Water-Reducing Admixture:

   a. Unless high temperatures occur or placing conditions dictate a change, provide concrete containing a water-reducing admixture.

4. Water-Reducing and Retarding Admixture:

   a. When high temperatures occur or placing conditions dictate, the water- reducing admixture (Type A) may be replaced with a water-reducing and retarding admixture (Type D).

      1) Notify the Engineer of this change, and submit product data for the water-reducing and retarding admixture prior to placing the modified concrete.

5. Water-Reducing and Accelerating Admixture:

   a. When low temperatures occur or placing conditions dictate, the water- reducing admixture (Type A) can be replaced with a water-reducing and accelerating admixture

      1) Notify the Engineer of this change, and submit product data for the water-reducing and accelerating admixture prior to placing the modified concrete.

2.04 FINISHES

A. Concrete Surface Irregularities:

1. Allowable surface irregularities in concrete finishes are designated as either "abrupt" or "gradual" in this Section.

   a. Furnish 10-foot straightedges to check gradual irregularities in concrete finishes.

B. Formed Surface Finishes:

1. Apply one or more of the following finishes to the surfaces of formed concrete after removing the forms:

   a. Rough Form Finish:

      1) The surface of the formed concrete may not include roughness and irregularities exceeding 1/2 inch.

      2) Patch tie holes and defects.

   b. Ordinary Wall Finish:

1) The surface of the formed concrete must be true and uniform without any conspicuous offsets or bulges.

2) Gradual irregularities may not exceed 1/2 inch, and abrupt irregularities may not exceed 1/4 inch.

c. Plywood Finish:

1) The surface must comply with the requirements for the Ordinary Wall Finish, except gradual irregularities exceeding 1/2 inch and abrupt irregularities exceeding 1/8 inch must be removed.

a) Completely remove all fins on the surface.

b) Rub the surfaces which cannot meet these requirements as specified in Subparagraph 2.04.B.1.d.

2) Construct the surface of the forms using 5/8-inch plywood or boards lined with tempered hardboard not less than 3/16 inch thick.

3) Place the plywood or liner sheets in an orderly and symmetrical arrangement using sheets as large as practicable.

4) Do not use sheets showing torn grain, worn edges, patched holes from previous use, or other defects which will impair the texture of the concrete surfaces.

C. Unformed Surface Finishes:

1. Apply one or more of the following finishes to the surfaces of unformed concrete:

a. Floated Finish:

1) After the concrete has been placed, consolidated, struck off, and leveled, do no further work until the concrete is ready for the floating operation.

2) Begin a floating operation when the water sheen has disappeared and the surface of the concrete has stiffened sufficiently to permit the operation.

a) During or after the first floating, check the planeness of surface by laying a straightedge on top of the concrete surface at not less than two different angles.

b) During this procedure, cut down high spots and fill low spots to produce a surface with true planes within 1/4 inch in ten feet as determined by placing a ten foot straightedge anywhere on the slab in any direction.

c) Immediately following checking the surface with the straightedge, re-float the slab to a uniform texture.

b. Steel Trowel Finish:

1) This finish is applied immediately to a fresh Floated Finish by working the floated finish with a steel trowel.

a) Perform the first troweling to produce a smooth surface which is relatively free of defects, but which may still show some trowel marks.

b) Perform additional trowelings by hand after the surface has hardened sufficiently.

c) Perform the final troweling when a ringing sound is produced as the trowel is moved over the surface.

2) Thoroughly consolidate the surface by hand trowel operations to produce a finished surface essentially free of trowel marks, uniform in texture and appearance, and with true planes within 1/4 inch in ten feet as determined by a ten foot straightedge placed anywhere on the slab in any direction.

c. Broom or Belt Finish:

1) This finish is applied immediately to a fresh Floated Finish by drawing a broom or burlap across the surface to give the surface a coarse transverse scored texture.

d. Nonslip Finish:

1) Apply non-slip aggregate surfacer to the surfaces using the "dry shake" method of application.

2) Apply the non-slip aggregate surfacer in accordance with manufacturer's recommendations and at a rate not less than 25 pounds per 100 square feet.

2.05 SOURCE QUALITY CONTROL

A. Tests:

1. Materials specified in this Section require advance examination or laboratory testing according to the methods referenced herein, or as required by the Engineer.

a. Submit concrete test reports for the testing specified in this Section.

2. Compression Test:

a. For laboratory trial batches of concrete, make compression test cylinders in accordance with ACI 301.

b. Test four compression test cylinders for each class of concrete, breaking two at seven days and breaking two more at 28 days per the requirements of ASTM C 192/C 192M and ASTM C 39/C 39M.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Inspect the locations that will receive cast-in-place concrete for deficiencies which

would prevent proper execution of the concrete work.

1. Do not proceed with concrete placement until deficiencies discovered by the inspection are corrected to the satisfaction of the Engineer.

3.02 PREPARATION

A. Prepare formwork in advance in accordance with the requirements of Section 03 10 00, Concrete Forming and Accessories; and remove snow, ice, water, and debris from within forms.

B. Pre-position reinforcement in accordance with the requirements of Section 03 20 00, Concrete Reinforcing; in advance of concrete placement.

C. Sprinkle the subgrade sufficiently to eliminate water loss from concrete in accordance with ACI 302.1R.

1. Verify that the subgrade is moist, with no free water and no muddy or soft spots, before placing concrete.

D. Vapor Barrier:

1. Immediately before placement of concrete floor slabs, place vapor barrier on their crushed stone bases under the imminent slab placement.

a. Lap all vapor barrier sides 6 inches and vapor barrier ends 12 inches.

b. Parch any holes and rips in the vapor barrier film to the satisfaction of the Engineer.

c. At exterior walls, turn the vapor barrier up to the top of the slab.

2. Coordinate vapor barrier placement with installation of the perimeter foundation insulation.

E. Embedded Pipes and Conduits:

1. The Engineer may permit material that is not harmful to concrete to be embedded in the concrete if the following conditions are satisfied:

a. The maximum outside dimension of an item to be embedded is not greater than one-third the overall thickness of the member in which it is to be embedded.

b. The minimum spacing between items to be embedded is not less than 3 widths on center, or 3 inches clear between items, whichever is less.

c. The item(s) to be embedded will not impair the strength of the concrete member.

d. A 2-inch minimum clearance from the embedded item(s) to the face of the concrete slab is maintained.

e. Items to be embedded are not made of aluminum.

f. Concrete reinforcement within the concrete member will not be cut, bent, or displaced in order to embed the item(s).

2. Anchor Rods:

a. Install anchor rods accurately, both vertically and horizontally, in the formwork as shown on the Contract Drawings.

b. Insure anchor rods are held firmly in the correct position and at the proper elevation by suitable templates during the placement of concrete.

c. Limit the variation in the locations of anchor rods and other embedded items from the dimensions shown on the Contract Drawings to within the tolerances listed in AISC 303.

3. Dovetail Anchor Slots:

a. Recess dovetail anchor slots for brick veneer masonry anchors in concrete every 24 inches horizontally and 16 inches vertically.

F. Anchor Reinforcement Dowels into Existing Concrete.

1. Using a carbide tip bit or star bit, drill holes for each dowel to the size and depth indicated on the Contract Drawings.

a. Core drilling is not permitted.

b. Do not drill into, cut, or otherwise damage existing reinforcement bars.

1) If existing reinforcement bars are encountered during the drilling operation, relocate the hole to clear the existing reinforcement as directed by the Engineer.

2. Blow clean each finished hole with an oil free air jet, and then flush the hole with a jet of clean water.

3. Immediately prior to placing and grouting the dowel bar into the hole, remove all water from the hole and from the walls of the hole.

4. Mix and place epoxy adhesive completely around the dowel bar in the hole in strict accordance with the manufacturer's recommendations.

a. Pay particular attention to the manufacturer's specified time limit within which the material must be placed after mixing.

b. Do not re-temper grout that has begun to stiffen; discard such grout.

3.03 CONSTRUCTION

A. Construction of Concrete Elements:

1. Construct the concrete elements indicated on the Contract Drawings or in the Specifications; including but not limited to, beams, columns, slabs, foundations, subsurface stormwater management structures and vaults, concrete weir walls, in-ground encasement of piping and conduit, reaction backings for piping, concrete backfill, and the reinforced concrete bases for equipment and piping provided under this Contract.

2. Provide only Class A concrete to construct concrete elements for this Contract except where indicated otherwise on the Contract Drawings or in the Specifications.

a. For in-ground encasement of piping, provide Class B concrete.

1) Encase pipes in concrete that are under structures and buildings or that are indicated to be encased in concrete on the Contract Drawings for the full length of the pipe run under the structure and as indicated.

b. For in-ground encasement of conduit runs, provide Class B concrete.

1) Encase conduit runs indicated to be encased in concrete on the Contract Drawings as indicated and detailed on the Contract Drawings.

c. For reaction backings, provide Class B concrete.

d. For backfilling of over-excavated foundation area, foundation voids, and cavities, provide Class B concrete.

B. Concrete Production:

1. Batch, mix, and transport ready-mixed concrete in accordance with ASTM C 94/C 94M.

2. Add admixtures to the mix in accordance with ACI 301.

C. Conveying and Placing Concrete:

1. Maintain the required concrete quality by rapidly conveying the concrete from the mixer to the location of the placement, and by using methods which will prevent segregation and loss of ingredients.

a. After introducing either the mixing water to the cement and aggregates, or the cement to the aggregates, complete discharging the concrete within 1 1/2 hours or before the mixing drum has revolved 300 revolutions; whichever comes first.

b. Do not convey concrete through aluminum or aluminum alloy equipment.

2. If the concrete is to be conveyed and placed by pumping, conform to the applicable requirements of ACI 304R, Chapter 9, and ACI 304.2R.

a. Do not place concrete by pumps or other similar devices without prior written approval of the Engineer.

3. Place concrete in accordance with the requirements of ACI 304R and the additional requirements specified in this Section.

a. Do not drop concrete freely more than 4 feet or in areas where reinforcing will cause segregation.

b. Deposit concrete in approximately horizontal layers 12 to 18 inches deep.

c. Do not allow concrete to flow laterally more than three feet.

d. Do not use concrete which has partially hardened, or has been contaminated by foreign materials.

1) Place concrete at a rate so that the concrete which is being integrated with the fresh concrete is still plastic.

2) Do not deposit concrete on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within sections.

e. Do not place concrete in forms containing standing water.

f. Do not bend reinforcement out of position when placing concrete.

g. Within placement sections, continuously place concrete to produce a monolithic unit.

h. Do not cast or erect beams, girders, or slabs supported by columns or walls until the concrete in the vertical support members is no longer plastic.

4. Consolidating Concrete:

a. Consolidate concrete by vibration, spading, rodding or other manual methods.

1) Work the concrete around the concrete reinforcement and embedded items, and into corners.

2) Eliminate all air or stone pockets; and eliminate other causes of honeycombing, pitting, and planes of weakness.

3) Use vibrators capable of transmitting vibrations to the concrete in frequencies sufficient to provide satisfactory consolidation.

a) Use the internal type of vibration equipment, and not the type attached to forms or concrete reinforcement.

b) Do not use vibrators to spread the concrete.

4) Do not leave vibrators in one spot long enough to cause segregation.

b. Keep sufficient vibration equipment in reserve on the Work Site to prevent a shutdown of the Work occasioned by a failure of the primary vibration equipment.

D. Joints:

1. Joint Locations:

a. Only the locations of critical joints are indicated on the Contract Drawings.

1) Subject to the Engineer's approval, locate additional joints that are required in walls, slabs, and foundations throughout the structures.

a) Submit requests for approval of additional joint locations to the Engineer ten days prior to scheduled concrete placement adjacent to the proposed joints.

b) Do not make concrete placement unless the joint locations have been approved by the Engineer.

b. If concreting is to be interrupted for more than 45 minutes, or long enough for the concrete to harden, form and construct a construction joint.

c. Locate the additional construction joints required in walls and foundations where they will least impair the strength of the structure.

1) Do not locate construction joints in continuous grade beams and footings more than 60 feet apart horizontally.

2) Do not locate construction joints in foundation slabs more than 30 feet apart horizontally.

3) Do not locate construction joints in continuous walls more than 30 feet apart horizontally.

a) At corners or other intersections of two or more walls, provide a construction joint in each wall in all directions that is less than 20 feet from the intersection point.

b) Align construction joints in walls with the construction joints placed in the supporting foundation element (base slab, continuous footing, grade beam), or offset the construction joints a minimum of 5 feet.

d. Locate the additional construction joints required in elevated (suspended) formed slabs where they will least impair the strength of the structure.

1) Locate joints within the center third of an elevated formed slab's span.

2) Do not locate construction joints more than 30 feet apart in each direction in an elevated formed slab.

a) Some minor deviation from this spacing may be approved by the Engineer to allow correction for column spacing and construction details.

3) Continue the concrete reinforcement through the construction joints.

4) Locate joints in girders with intersecting beams a minimum offset distance from the beam of two times the width of the beam.

5) Do not cast or erect beams, girders, or slabs supported by columns or walls until the concrete in the vertical support member is no longer plastic.

e. Locate additional contraction joints and construction joints in slabs-on-grade at the following maximum spacing unless noted otherwise:

1) In 5-inch slabs, space the joints 15 feet apart each way.

2) In 6-inch slabs, space the joints 18 feet apart each way.

3) In 8-inch slabs, space the joints 24 feet apart each way.

f. Install expansion joints and contraction joints where indicated on the Contract Drawings.

2. Construction Joints:

a. Typically, construct construction joints before the initial hardening of the concrete can take place by forming keyways, installing PVC waterstops in the concrete if required, and embedding reinforcement dowels in the concrete extending a minimum of one splice length beyond the joint.

1) Provide PVC waterstops in construction joints that will be exposed to liquids, are in contact with earth, or are exposed to the weather;.

2) If concrete placement is interrupted long enough for a “cold joint” (hardened surface) to form, install dowel so that one splice length will extend into the present concrete section placement, and one splice length will extend into the adjacent future placement.

a) Size the embedded dowels to match the size of the concrete reinforcement in the slab, wall, or foundation being placed.

b) In elevated slabs, splice the dowels to the top and bottom concrete reinforcement.

b. Only use the “construction joint devices” in concrete that is not intended to retain water.

c. Horizontal construction joints are not permitted in slabs or footings.

3. Contraction Joints and Construction Joints in Slabs-On-Grade:

a. Contraction joints can be constructed in a slab-on-grade by installing a “contraction joint insert” in the slab by pressing a straight edge cutting tool into the slab’s wet concrete to part the aggregate.

1) Place the insert into the separation until the top of the insert lays on the surface of the wet concrete.

2) Remove the top section of the insert and float the concrete to fill voids adjacent to the insert and finish the concrete surface.

b. Contraction joints can also be constructed in a slab-on-grade by saw-cutting a continuous straight slot to a depth of one-fourth the thickness of the slab.

1) Submit detailed procedures and plans to the Engineer for review and acceptance before constructing contraction joints.

2) Saw the slot as soon as the concrete has hardened sufficiently; but complete the sawing within 12 hours after the concrete has been placed.

c. Fill all construction and contraction joints in slabs-on-grade with construction and contraction joint filler.

4. Expansion Joints and Contraction Joints in Walls:

a. Do not extend reinforcing or other embedded metal items through expansion and contraction joints except where indicated otherwise on the Contract Drawings.

b. For expansion joints and contraction joints that will be exposed to liquids, are in contact with earth, or are exposed to the weather; provide PVC waterstops in the joints.

5. Bonding Hardened Concrete to New Concrete:

a. Bond fresh new concrete to hardened previously placed concrete in accordance with the following:

1) Roughen and clean the hardened concrete to remove foreign matter and laitance, and then dampen the hardened concrete with water.

2) Cover the hardened concrete with a heavy, 1/2-inch thick, coating of grout.

a) Provide grout having the same material composition and proportions as the concrete being placed, except omit the coarse aggregate.

b) Provide grout with a slump of 6 inches, minimum.

3) Place the new concrete on the grout before the grout has attained its initial set.

4) Any other bonding methods must be approved by Engineer prior to use.

6. No exceptions to the specified requirements for joints are permitted unless written approval is given by the Engineer.

E. Finishing Concrete:

1. Whether the concrete is to remain natural concrete or will receive an additional applied finish or material, finish the concrete surfaces as indicated or scheduled on the Contract Drawings and as specified in this Section

a. For concrete having unformed surfaces, use just enough mortar to avoid the need for excessive floating.

b. Slope exposed unformed surfaces to provide quick, positive drainage; and to avoid puddles in low spots.

1) Unless noted otherwise on the Contract Drawings, slope all unformed surfaces exposed to the weather 1/4 inch per foot for drainage.

2. Unless the type of finish is indicated on the Contract Drawings or is a Special Finish, finish concrete surfaces as follows.

a. Rough Form Finishes:

1) Provide a Rough Form Finish on concrete surfaces to be covered by earth.

b. Ordinary Wall Finishes:

1) Provide an Ordinary Wall Finish for the following:

a) Interior and exterior concrete wall surfaces not exposed to view.

b) The inside vertical concrete surfaces of tank type structures 18 inches or more below the normal water level.

c) The interior concrete walls of water filter structures 6 inches or more below the filter media.

d) The concrete walls and overhead surfaces of clearwells.

e) The undersides of concrete slabs to be covered by architectural ceilings.

c. Plywood Finishes:

1) Provide a Plywood Finish for all surfaces to be painted.

d. Rubbed Finishes:

1) Provide a Rubbed Finish for the following:

a) Interior and exterior concrete surfaces exposed to view which will not be painted.

b) Exterior concrete surfaces above the level beginning 6 inches below finished ground.

c) Concrete equipment pads.

d) The inside vertical concrete surfaces of tank type structures above the elevation located 18 inches below the normal water level.

e) The interior concrete walls of water filter structures above the level 6 inches below the filter media.

f) Concrete pipe support bases.

e. Floated Finishes:

1) Provide a Floated Finish for all unformed concrete surfaces unless otherwise specified.

f. Steel Trowel Finishes:

1) Provide a Steel Trowel Finish for the following:

a) The tops of exposed concrete walls.

g. Broom or Belt Finishes:

1) Provide a Broom or Belt Finish for the following:

a) Concrete traffic surfaces.

b) Concrete sidewalks.

h. Non-slip Finishes:

1) Provide a Non-slip Finish for exterior concrete stair treads and landings.

F. Curing Concrete:

1. Immediately after placing and finishing concrete, protect the concrete from premature drying, excessive hot or cold temperatures, and mechanical injury.

2. Cure the concrete by water curing, sheet form curing, or liquid membrane forming methods in accordance with ACI 308R.

a. Cure concrete continuously for a minimum of 7 days at ambient temperatures above 40 degrees Fahrenheit.

1) Cure the concrete during cold weather according to the requirements of Subparagraph 1.09.A.1.

2) Cure the concrete during hot weather according to the requirements of Subparagraph 1.09.A.2.

b. Control the curing of concrete surfaces that will get a membrane coating, by using water fog spraying, water damped coverings, and/or an impermeable sheet film cover for the full 7-day period specified in Subparagraph 3.03.F.2.a.

1) Do not apply the membrane until the concrete surfaces have cured a minimum of 28 days.

2) Do not use liquid membrane- forming curing compounds on these surfaces.

c. If liquid curing compounds will be used to cure the concrete, complete finishing operations prior to applying the compound; and apply the compound as soon as the free water on the concrete surface disappears and no water sheen is visible.

1) Do not use liquid curing compounds on concrete surfaces which will receive later treatments, such as hardeners, special finishes, protective coatings, damp proofing, waterproofing, future grout, grout fill, or other coatings.

2) Do not use liquid curing compound when the ambient air temperature during placement and for 24 hours after placement is or will fall below 35 degrees Fahrenheit.

3) The surface must be capable of having workers walk on it without marring the surface.

4) Apply the liquid curing compound twice.

a) Do not apply liquid curing compound to the surfaces of construction joints.

b) Protect exposed reinforcement during application of curing compound.

c) Water cure those areas not coated with liquid curing compound.

3. Note that concrete containing ground granulated blast furnace slag may require a longer time to set compared to 100 percent Portland cement concrete.

4. Protect the finished surfaces and slabs from the direct rays of the sun to prevent checking and crazing.

3.04 REPAIR/RESTORATION

A. Remove concrete segregated into ingredients during consolidation by vibrator operations, and replace the segregated concrete with new concrete.

B. As soon as the forms have been stripped from the concrete and the concrete surfaces have been exposed, do the following:

1. Remove fins and other projections, fill recesses left by the removal of form ties, and repair surface defects which do not impair the structural strength of the concrete.

2. Clean all exposed concrete surfaces and adjoining areas stained by the leakage of concrete to the satisfaction of the Engineer.

C. Repair tie holes and other small cavities by cleaning out the resulting cavities, wetting the cavity area, and then filling the cavity with a stiff mortar of the same material used in the concrete, but somewhat leaner.

D. Repair and patch other defective areas with cement mortar of mix proportions and materials identical to those used in the surrounding concrete.

1. Produce a finish on the patch that is indistinguishable from the surrounding concrete.

E. Where honeycomb or voids are not excessive, and repairs are authorized by the Engineer; saw cut a 1/2 to 3/4 inch deep square outline around the area of defective concrete to be removed and patched, and chip out the defective concrete inside the outline to a depth not less than 2-inches until sound solid concrete is encountered.

1. If chipping is necessary, make the edges of the depression perpendicular to the concrete surface or slightly undercut to provide a key at the edge of the patch.

2. Thoroughly clean, dampen, and brush coat the area to be patched with neat cement grout; and follow this preparation by placing a cement mortar to patch the concrete.

a. Other patching materials may be used if accepted by Engineer in writing prior to start of repair work.

3. Keep the patch damp for 7 days at a temperature above 50 degrees Fahrenheit.

3.05 FIELD QUALITY CONTROL

A. Site Tests:

1. During the period when concrete is being placed, must perform routine and other testing of materials at no additional cost to the Agency.

   a. Advise the Testing and Inspection Agency sufficiently in advance of operations to allow testing personnel to be assigned and to provide sufficient time for quality tests to be performed and completed.

   b. Provide and maintain adequate and separate facilities for safe storage and proper curing of concrete test cylinders on the Work Site for the sole use of the Testing and Inspection Agency.

   c. Provide containers for transporting concrete test cylinders to the testing laboratory.

   d. The Testing and Inspection Agency must perform additional materials testing due to changes in materials or proportions requested by the Contractor or testing required by failure of material to meet specified requirements.

   e. Failure of Testing and Inspection Agency to detect defective work will not prevent its rejection later when the defect is discovered, neither does it obligate the Engineer or Owner to grant final acceptance of the Work.

   f. Submit the test results of the following field quality control testing to the Engineer for information.

2. Concrete Slump Test:

   a. Test Procedure:

      1) Determine the slump of a concrete Sample from each truckload of concrete upon its arrival at the Work Site, and from other concrete whenever the consistency of the concrete appears to vary.

      2) Determine the temperature of the concrete Sample.

      3) Determine the slump according to the requirements of ASTM C 143/C 143M.

   b. Acceptance Criteria:

      1) Refer to Paragraph 2.03.D.

3. Air Content Test:

   a. Test Procedure:

      1) Determine the air content of the concrete on a regular and frequent basis in accordance with ASTM C 231, ASTM C 173/C 173M, or ASTM C 138/C 138M.

   b. Acceptance Criteria:

      1) Refer to Subparagraph 2.03.E.2.b.

4. Concrete Strength Test for New Concrete:

a. To evaluate the potential strength and uniformity of new concrete, perform at least five strength tests for each specified mix design to represent the mix's strength.

b. Test Procedure:

1) Secure composite samples in accordance with ASTM C 172.

a) Obtain representative test samples from different batches of concrete on a truly random basis by selecting a test batch number at random before commencing the placement of concrete.

b) When pumping or pneumatic equipment is used, obtain samples at the truck and discharge ends.

c) Take sufficient test samples to perform not less than 5 strength tests of two 28 day cylinders per test for each concrete mix design.

(i) Take samples for each concrete mix design not less than once a day, or not less than once for each 100 cubic yards of concrete, or not less than once for each 3000 square feet of surface area placed.

2) Mold at least 4 concrete test cylinders in strict compliance with the requirements of ASTM C 31/C 31M for each strength test, and cure the cylinders for a 24-hour initial curing period.

a) Have a responsible representative from the Quality Assurance Testing and Inspection Agency observe the making of the concrete test cylinders by the Contractor, and immediately thereafter pack them in a sturdy container that was furnished by the Contractor and approved by the Quality Assurance Testing and Inspection Agency.

b) Surround the concrete test cylinders with wet sand or sawdust and protect them from freezing.

c) Sequentially number the concrete test cylinders and record the number, the date each cylinder was made, and the results of the slump test and the temperature for each sample on the proper form; forward the form to the Engineer, and then transport the cylinders to the testing laboratory where they will be cured in strict compliance with ASTM C 31/C 31M until the time of the test.

3) Conduct each strength test in accordance with ASTM C 39/C 39M as follows:

a) Test 2 concrete test cylinders from the same sample 7 days after the cylinders were made for information.

b) Test 2 additional concrete test cylinders from the same sample 28 days after the cylinders were made for acceptance.

c) Average the compressive strengths of the two specimen cylinders tested at 28 days.

d) If one concrete test cylinder in a strength test manifests evidence of improper sampling, molding, or testing, discard it and consider the strength of the remaining cylinder to be the test result; if both specimen cylinders in a test for a single sample show any of the above defects, discard the entire test for that sample.

c. Acceptance Criteria:

1) Evaluate the test results for standard molded and cured test cylinders separately for each specified concrete mix design by comparing the test results to the minimum requirements for the Class of concrete as specified in Subparagraph 1.04.B.1.

2) The strength level of the concrete will be considered satisfactory so long as the average of all sets of three consecutive compressive strength test results equal or exceed the specified strength f'c, and no individual strength test result falls below the specified strength f'c by more than 500 psi.

5. Concrete Strength Test for Concrete in Place:

a. The Engineer will determine locations where the concrete in place is potentially deficient, and where to obtain test cores to least impair the structure's strength.

1) As an aid to evaluate in place concrete strength or for selecting areas to be cored, the Engineer may permit concrete-in-place to be tested by impact hammer, sonoscope, or other nondestructive device to determine the relative strengths at various locations in the structure.

2) Preliminary tests of concrete-in-place will not be used as a basis for accepting or rejecting the concrete, but the core testing will be the basis for accepting or rejecting the in-place concrete.

b. Concrete Core Test:

1) Test Procedure:

a) The Engineer will determine the locations in each member or area of concrete in place where the required cores may be obtained.

b) Where required, take at least three representative core samples, each at least 2-inches in diameter,

from each member or area of concrete in place that is considered potentially deficient.

(i) If the concrete in the structure will be dry under service conditions, air dry the cores for 7 days before the test at a temperature of 60 to 80 degrees Fahrenheit and a relative humidity of less than 60 percent; and test the cores dry.

(ii) If the concrete in the structure will be more than superficially wet under service conditions, the cores test the cores after moisture conditioning them in accordance with ASTM C 42/C 42M.

c) Test the core samples in accordance with ASTM C 42/C 42M.

(i) If one or more of the cores shows evidence of having been damaged before the testing, replace it either subsequent to or during its removal from the structure.

d) Solidly fill core holes with low slump concrete.

2) Acceptance Criteria:

a) Concrete in the area represented by a core test will be considered adequate if the average compressive strength of the cores is equal to at least 85 percent of the specified strength f'c, and if no single core is less than 75 percent of the specified strength f'c.

b) If the core tests fail to demonstrate concrete strengths adequate for the intended purpose of the member or members in question, or are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the structure, load tests may be required.

(i) Evaluate the results in accordance with ACI 318/318R.

END OF SECTION

FINAL CONCRETE MIX DESIGN SUBMITTAL FORM

(One for each required mix design)

PROJECT: Location: _____

General Contractor:

Mix design no.:_____ Design strength: _____

USE:(Describe): _____

Mix Design Preparation: Based on Standard Deviation Analysis: _____

(check one) or Based on Trial Mixture Test Data: _____

MATERIALS:

Aggregates: (Provide size, type, source, specification)

Coarse:

_____

Fine:

_____

Cement Type/Source:

_____

___

Admixtures: (Provide product, manufacturer)

Water Reducer (WR):

_____

Air Entraining (AE):

_____

Accelerator:

_____

Other:

_____

CONCRETE PROPERTIES

Water/Cement Ratio: _____
Slump:_____inches
Entrained Air:_____%
Density__pcf

SPECIFIC GRAVITIES

Fine Aggregate: _____

Coarse Aggregate: _____

ADMIXTURES

Accelerator_____oz. per 100# cement

W. R._____oz. per 100# cement

A. E._____oz. per 100# cement Other_____oz. per 100# cement

MIX PROPORTIONS

	Weight Absolute Volume (lbs)	(cubic feet)
Cement:	_____ Fine	_____
Aggregate:	_____	_____
Coarse Aggregate:	_____	_____
Water:	_____	_____
Entrained Air:	_____	_____
Other:	_____	_____
TOTAL	_____	_____

TEST RESULTS SUBMITTAL FORM

METHOD 1 - STANDARD DEVIATION ANALYSIS (ACI 318/318R, ACI 301):

Number of Test Cylinders Evaluated:_____Standard Deviation: _____ (Attach Copy of All Test Results)

Mix Designs Proportioned to Achieve Both of the Following:

$f'_{cr} = f'_c + 1.34s =$_____ _____psi $f'_{cr} = f'_c + 2.33s - 500 =$_____psi

Actual $f'_c =$_____psi (f'_{cr})

Slump =_____in. Air Content =_____%

METHOD 2 - TRIAL MIXTURE TEST DATA (ACI 318/318R-05, 5.3.2.2):

Age (days)	Mix 1 (comp. str.)	Mix 2 (comp. str.)	Mix 3 (comp. str.)
7	_____	_____	_____
28	_____	_____	_____
28	_____	_____	_____
28-day avg.	_____	_____	_____
Mix Design Proportioned to Achieve the Following:			
or	$f'_{cr} = f'_c + 1200$ psi $f'_{cr} = f'_c + 1400$ psi	(for f'c 5000 psi or less) (for f'c > 5000 psi)	

Slump =_____in. Air Content =_____%

REMARKS:

_____

_____

_____

Note: Fill in all blank spaces. Use -0- (zero) or N.A. (not applicable).

SUBMITTED BY:

Ready-Mix Supplier: Name

_____

Address:

_____

Phone Number:

_____

END OF SECTION

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SECTION – 10 14 23

ALUMINUM SIGN PANELS AND SUPPORTS

PART 1 – GENERAL

1.01 SUMMARY

A. This Section specifies requirements for the following:

1. Aluminum sign panels for use in permanent and temporary pedestrian, bicycle, and vehicular, guide, warning and regulatory roadway signs.

2. Posts and footings for aluminum sign panel installations.

1.02 REFERENCES

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

American Association of State Highway and Transportation Officials (AASHTO)

LTS-5-I2	Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals.
MASH	Manual for Assessing Safety Hardware.

American National Standards Institute (ANSI) /
American Society of Mechanical Engineers (ASME)

ANSI/ASME B18.2.1	Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
ANSI/ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
ANSI/ASME B1.13	Metric Screw Threads: M Profile.

American Society for Testing and Materials (ASTM International)

ASTM A 153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
ASTM A 193	Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
ASTM A 194	Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

ASTM A 325	Specification for Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
ASTM A 490	Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
ASTM B 209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
ASTM B 211	Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire.
ASTM B 221	Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
ASTM D 4956	Specification for Retroreflective Sheeting for Traffic Control.

American Welding Society, Inc. (AWS)

AWS D1.2	STRUCTURAL WELDING CODE – ALUMINUM.

Federal Highway Administration (FHWA)

MUTCD	Manual on Uniform Traffic Control Devices.
SHS	Standard Highway Signs.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Design of signs, supports and framing shall provide sufficient strength to withstand the wind loading generated by a basic wind speed of 120 miles per hour as per AASHTO LTS-5-I2.

B. The construction of all signs shall be in conformance with the FHWA's MUTCD and AASHTO's MASH.

1.04 QUALITY ASSURANCE

A. All welders shall be qualified in accordance with the qualification procedures of AWS D1.2.

1.05 DELIVERY, STORAGE, AND HANDLING

A. All sign components and materials shall be transported and handled in a manner that shall cause no permanent deformation, injury or damage. Store sign components and materials above ground.

1.06 SUBMITTALS

A. See Appendix "A" for submittal requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Aluminum Sign Panels

1. Aluminum sheets and plates shall conform to ASTM B 209, Alloy 6061-T6.

2. Fabricate panels from standard sheet widths. The thickness for panel sizes of 30 inches by 30 inches or smaller shall be 0.080 inch and the thickness of larger panels shall be 0.125 inch, unless otherwise shown on the Contract Drawings.

3. Panel blanks shall be free from laminations, blisters, open seams, pits, holes or defects that may affect their strength, appearance or use. The thickness shall be uniform and the blanks shall be commercially flat.

B. Retroreflective Sheeting

1. Retroreflective sheeting shall be colored, flexible, weather resistant and shall have a smooth outer surface. If the retroreflective sheeting contains spherical lens elements, the lens elements shall be embedded within a transparent plastic, to produce a smooth, flat outer surface. All sheeting shall be of uniform appearance, free from ragged edges, cracks, scales, blisters or other defects.

2. Prepare the surface of the sign panels for the application of the retroreflective sheeting in strict accordance with the recommendations of the manufacturer of the retroreflective sheeting.

3. Retroreflective sheeting shall be one of the following ASTM D 4956 types, as shown on the Contract Drawings:

   a. ASTM Type I: A medium-intensity reflective sheeting also known as engineer grade. Use for pedestrian signs, except where high reflectivity is required, as shown on the Contract Drawings.

   b. ASTM Type III: A high-intensity reflective sheeting also known as high intensity. Use for pedestrian signs, temporary delineators and other work zone devices with the exception of vehicular and bicycle construction signs.

   c. ASTM Type IX: A very-high-intensity retroreflective sheeting having highest retroreflective characteristics at short road distances. Use for bicycle and pedestrian signs, temporary vehicle construction signs, delineators, construction zone devices and vertical panels.

   d. ASTM Type XI: A full cube prismatic retroreflective sheeting with highest level of retroreflective characteristics. Use for permanent vehicular, pedestrian and bicycle signs.

e. Comply with sign design standards in FHWA's MUTCD, including design standards for retroreflectivity, illumination and color.

4. Sign Supports

a. Sign posts, framing, supports, foundations and mountings shall be so constructed as to hold signs in a proper and permanent position, and to resist swaying in the wind or displacement by vandalism.

b. Sign posts, framing, supports and foundations shall be constructed and installed in accordance with the FHWA's MUTCD and AASHTO's LTS-5-I2.

c. All sign posts, framing and supports shall be metal. The use of wood and other non-metallic materials will not be permitted for the fabrication of any sign posts, framing and supports.

5. Stiffeners, Brackets and Miscellaneous Hardware

a. Horizontal and vertical sign panel stiffeners (Z bars) and panel brackets shall be fabricated of aluminum Alloy 6061-T6 conforming to ASTM B 221.

b. Other miscellaneous aluminum hardware including bolts, nuts, washers, screws, rivets, pull-type lockbolts and serrated or knob stem blind rivets shall be fabricated to meet the requirements of ASTM B 209 and ASTM B 211 for Alloy 2024-T4 with No. 205 Alumilite Finish. Ensure that bolt heads and nuts are American National Standard, Regular Series, hexagonal, semi-finished, conforming to ANSI/ASME B18.2.1 and ANSI/ASME B18.2.2, and that threads are American National Standard, Coarse Series, Class 2 Fit, conforming to ANSI/ASME B1.13. Finish bolts with an anodic coating thickness of not less than 0.0002 inches and chromate seal. Use washers conforming to ASTM B 209, Alloy 2024-T3.

c. High strength steel bolts, nuts and washers used in steel-to-steel connections shall conform to ASTM A 325 or ASTM A 490. High-strength bolts, nuts and washers shall be galvanized in accordance with ASTM A 153. Steel bolts, nuts and washers used in contact with aluminum shall be coated with cadmium or a cadmium/tin combination. All cadmium and cadmium/tin coatings shall be given a chromate treatment in or with an aqueous solution of salts, acids or both to produce a protective chromate coating.

d. Stainless steel nuts shall conform to ASTM A 194, Grade 8F, except that the nuts shall be lock nuts with semi-finished hex nuts equivalent to American Standard Heavy Series. Stainless steel bolts, washers and screws shall conform to ASTM A 193, austenitic steel.

6. Footings and Foundations

a. Footings and foundations shall be designed in accordance with the requirements of 1.03, or as otherwise shown on the Contract Drawings.

b. Breakaway posts, if required, shall be as shown on the Contract Drawings. Breakaway posts and footings shall be designed in accordance with the requirements of 1.03, or as otherwise shown on the Contract Drawings.

c. Concrete footings, if required by 1.03, shall conform to 2.01 F.

7. Concrete

a. All concrete footings and foundations for sign construction, as required by 1.03, shall conform to the requirements of Division 3 Section on concrete.

2.02 CONSTRUCTION FEATURES

A. Sign face text, symbol, and border layouts shall be as shown on the Contract Drawings and shall conform to the requirements of the FHWA's MUTCD.

B. Sign characters shall be as shown on the Contract Drawings, or if not shown, shall be in accordance with the FHWA's SHS, and shall include letters, numerals, symbols and borders.

C. Sign corner and border radii shall be approximately one-eighth of the height of the sign but shall not exceed 12 inches; or radii shall be as shown in the FHWA's SHS. Sign borders shall be of the same type character as the legend and shall be approximately the same width as the stroke width of the major lettering on the sign, or as shown in the FHWA's SHS.

D. The Contract number shall be painted on the bottom right of the back of sign panel. Text height shall be 2 inches and painted in white. For overhead sign structures, Contract number, sign panel number as well as sign structure number shall also be painted on the bottom right and back of sign panel.

2.03 FABRICATION

A. All shearing, cutting and punching shall be performed prior to preparing the blanks for application of retroreflective material. All edges and corners shall be filed or ground smooth, leaving the entire sign blank free from sharp edges and burrs.

B. The blanks shall be cleaned, degreased, and chromated or otherwise properly prepared in accordance with the sheeting manufacturer's recommendations. After treatment, clean cotton gloves shall be used in handling the sign blank until the retroreflective sheeting is applied. All fabrication except for cutting the lower ends of embedded posts shall be done in the shop. The aluminum panels shall be clean, dry and free from oils, dust, grit or any other contaminants that would adversely affect the adhesion of the retroreflective sheeting.

C. Welding of aluminum shall consist of inert gas shielded metal arc welding with consumable electrodes. All welding of aluminum shall be performed in the shop. No field welding of aluminum shall be permitted.

D. Necessary drilling of holes required for shop and field assembly after sheeting is applied shall be done such that the drill bit does not snag, rip or damage the sheeting outside of the drill hole. Holes shall be deburred prior to assembly.

E. Exposed bolt heads on the face of the assembly sign shall be touched up with enamel paint of the same color as the sheeting surrounding the bolts.

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PART 3 – EXECUTION

3.01 INSTALLATION

A. Erect, cover and remove signs as shown on the Contract Drawings.

B. Side-of-road ground mounted signs shall be erected so that the sign face is truly vertical to the profile line, and so the intersection angle measured between the sign face and the centerline of the travel lane which the sign serves is 93 degrees. Where lanes divide or curve, sign faces shall be oriented to be most effective both day and night, and to avoid the possibility of specular reflection.

C. Securely fasten all sign panels to their supports with bolts, nuts and washers of aluminum (2024-T4 alloy), hot-dip galvanized steel or stainless steel in accordance with 2.01 D, and in accordance with the design requirements in 1.03.

D. Horizontal and vertical sign clearances shall be as shown on the Contract Drawings.

E. Concrete footings, if required by 1.03, shall be placed in accordance with the requirements of Division 3 Section on concrete, and shall not extend more than 4 inches above grade.

3.02 FIELD QUALITY CONTROL

A. Field Inspections

1. Immediately prior to erection, all material will be inspected by the Engineer for damage that is attributable to improper transportation, handling or storage procedures.

2. The Engineer will conduct an inspection of each completely erected sign in the daylight and at night for proper location, line and grade of signs, vertical post alignment, condition, appearance, reflectorization and visibility.

3. As the Work progresses, the location, position and condition of all signs shall be monitored by the Contractor in accordance with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1 – GENERAL PROVISIONS.

END OF SECTION

SECTION 101423

ALUMINUM SIGN PANELS AND SUPPORTS

APPENDIX "A"

3.03 SUBMITTALS

A. Submit the following in accordance with the requirements of Section 01 33 00 – Submittal Procedures:

1. Shop Drawings

   a. Detailed sign face layout for all sign panels showing letter height, width, colors, spacing between letters, words, symbols and lines, border width, symbols details and overall dimensions of the sign panels.

   b. Shop drawings of sign panels showing the sizes of the members and their connection details including joining and anchorage, stiffening and bracing.

2. Catalog Cuts

   a. Catalog cuts of all the materials used for sign faces.

3. Calculations

   a. Prior to fabrication, submit computations for the design of the sign panels and supports, including all footings and foundations, as required in 1.03, signed by a Professional Engineer licensed to practice in the State where the Work is performed.

END OF APPENDIX "A"

END OF SECTION

SECTION – 11 12 00

PARKING CONTROL EQUIPMENT

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and Division 01 Specification Sections, apply to the Work of this Section.

1.02 SUMMARY

A. Section Includes:

1. Pay stations.

B. Related Requirements:

1. Section 13 34 00 – Fabricated Aluminum Pay Station / Bus Shelter

2. Section 26 05 26 – Grounding and Bonding

3. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for parking control equipment.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties.

B. Shop Drawings: For parking control equipment.

1. Include plans, elevations, sections and attachment details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For parking control equipment to include in emergency, operation, and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.

2. Program Software Backup: On USB media and approved online or cloud solution.

3. Device address list.

4. Printout of software application and graphic screens.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 – PRODUCTS

2.01 PAY STATIONS

A. General: Provide self-contained, cashiering **central** pay stations designed for self-service operation; with mechanisms, components and fee computers housed in a combined enclosure.

1. Luke II Multi-Space Pay Station from T2 Systems or approved equal.

B. Physical Characteristics:

1. LCD display.

2. Time and date display.

3. Voice annunciation.

4. Battery backup for clock and RAM memory.

5. Thermostatically controlled heater with on/off/auto switch.

6. Thermostatically controlled fan with on/off/auto switch.

7. Ticket printing and dispensing mechanism.

8. Credit card activation slot, credit card reader with smart card reader, and "Insert Ticket/Card" message.

9. Coin and bill acceptor.

10. Access card reader.

11. Printer.

12. Intercom.

13. Pinhole camera.

C. Operational Characteristics:

1. Online communication to remote computer.

2. Activation by payment method insertion.

3. Compute multiple taxes by percentage and fixed amount.

4. Display fee.

5. Accept payment by cash and credit card, debit card, smart card, prepaid value card.

6. Compute change.

7. Print receipts on demand.

8. Print validation on ticket.

9. Print audit trail.

10. Programmable for up to **six** fee structures.

11. Test mode to verify accuracy of fee structure program.

12. Programmable time.

13. Programmable facility code.

14. Programmable display.

15. Programmable merchant validations.

16. Built-in service diagnostics.

17. Print cash audit, revenue, operational, and statistical reports on demand.

18. Duress alarm output for emergencies.

19. Cancel transaction function.

D. Cabinets: Fabricated from cold-rolled steel sheet with seams welded and ground smooth, approximately 36 inches wide by 18 inches deep by 60 inches tall (914 mm wide by 457 mm deep by 1524 mm tall). Provide single, gasketed access door with flush-mounted locks. Furnish two keys for each lock, all locks keyed alike. Fabricate cabinet with internal reinforcing and four mounting holes accessible only from inside cabinet.

1. Finish cabinet, interior and exterior, with manufacturer's standard charcoal gray baked-enamel or powder-coat finish.

2.02 ANCHORAGES

A. Anchor Bolts: Galvanized.

1. Hot-dip galvanized according to ASTM A153/A153M and ASTM F2329/F2329M.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including equipment bases; accurate placement, pattern, and orientation of anchor bolts; critical dimensions; and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical and communication systems to verify actual locations of connections before parking control equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF PAY STATIONS

A. Attach cabinets to concrete bases with anchor bolts or expansion anchors.

1. Connect equipment to remote computer.

2. Load ticket dispenser with supply of tickets.

3.03 INSTALLATION OF ELECTRICAL

A. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Parking control equipment will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.05 ADJUSTING

A. Adjust parking control equipment to function smoothly and lubricate as recommended by manufacturer.

B. Confirm that locks engage accurately and securely without forcing or binding.

C. After completing installation of exposed, factory-finished parking control equipment, inspect exposed finishes and repair damaged finishes.

3.06 MAINTENANCE SERVICE

A. Maintenance Service Description: Beginning at Substantial Completion, maintenance service shall include six months' full maintenance by manufacturer's authorized service representative. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper parking control equipment operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.07 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.08 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain parking control equipment.

END OF SECTION

SECTION – 13 34 00

FABRICATED ALUMINUM PAY STATION / BUS SHELTER

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The work herein includes the provision and installation of a fabricated aluminum **Pay Station / Bus Shelter** as shown on the Contract Drawings. Unit shall be completely pre-assembled.

1.02 SUBMITTALS

A. Shop Drawings – Include plans, elevations and sections. Indicate standard and optional component features, dimensions, materials, anchoring details, and other items required for fabrication and installation.

B. Product Data – Catalog sheets, specifications, safety data sheets, and installation instructions for all related products.

C. Product Samples:

1. Safety Laminated Glazing: 12”x12”.
2. Aluminum Framing.
3. Sheet metal roofing: 12” square, each type.
4. Fasteners: (6) of each type.
5. Sealant and color samples, each type.
6. Paint and powder coating for each component - steel and aluminum framing.

1.03 MEASUREMENTS

A. Verify all dimensions by taking field measurements and from final accepted Shop Drawings; proper fit and attachment of all items is required.

B. Coordinate locations of existing conduits, including **Pay Station / Bus Shelter** electrical and communication conduit feeds.

1.04 QUALITY ASSURANCE

A. Manufacturer Requirements: Manufacturer must have a minimum of 7 years in the design, fabrication, and installation of fabricated metal shelters and meet the following qualifications:

1. Fabricator Qualifications – A qualified fabricator that participates in the AISC Quality Certification Program and is designated as an AISC-Certified Plant, Category STD. Fabricators shall also be approved by Metro-North Railroad and the local code authority to perform steel and aluminum fabrication at their facility without special inspection.
2. Shop Painting Qualifications – Qualified according to AISC’s Sophisticated Paint Endorsement or to SSPC-QP 3, “Standard procedure for Evaluating Qualifications of Shop Painting Applicators.”
3. Installer Qualifications – A qualified installer who participates in the AISC Quality Certification Program and is designated as an AISC-Certified

Erector, Category ASCE.

4. Welding Qualifications – Qualified procedures and personnel according to AWS D1.1/D1.1M, “Structural Welding Code”

B. Product Options: Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect’s approval. All site-specific treatments are noted on the Contract and Design Drawings and must be approved by Metro-North Railroad prior to procurement, fabrication and installation.

C. Regulatory Requirements: All prefabricated shelters shall comply with accessibility requirements, comply with the 2010 ADA Standard for Accessible Design and/or jurisdiction having authority.

D. Reference Standards applicable to this section:

1. AISC 303
2. AISC 360
3. RCSC’s “Specification for Structural Joints Using ASTM 307 Bolts”
4. ASTM A123
5. ASTM A500
6. ASTM C1401
7. ASTM E283
8. ASTM E330
9. ASTM E331
10. ASTM E699
11. ASTM F3125
12. AWS D1.1 – Structural Welding Code – Steel.
13. AWS D1.3 – Structural Welding Code – Sheet Steel.

1.05 DESIGN REQUIREMENTS

A. Provide factory built, prefabricated structures and shelters capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

B. Wind Loads: Determine loads based on the following minimum design wind pressures: 126 MPH.

C. Roof/Ground Snow Loads: 30 PSF.

D. Thermal Movements: Provide factory built, prefabricated structures and shelters that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces

E. Electrical Devices: Devices UL listed with wiring bearing UL classification and conforming to the current NEC.

F. Submit complete shop drawings and design calculations signed and sealed by a Professional Engineer licensed in the state of New York.

1.06 WARRANTIES

A. Fabricator's standard 2-years warranty for workmanship.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Five (5) years from date of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Transport products/assemblies to avoid damage during shipment, with all tags and labels intact and legible, as applicable for timely application/installation.

B. Inspect for and note all damages to products on the carrier's bill of lading, and report damages immediately for proper compensation and reorder of product if necessary.

C. Protect materials and product assemblies to prevent damage from dropping, careless storage, and improper handling.

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PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Shelter shall be manufactured by one of the following approved fabricators:

1. Columbia Equipment Co., 72 Albany Ave, Freeport, NY 11529; Telephone: (516) 442-3340, Website: www.columbiaequipment.com; Email: info@columbiaequipment.com
2. Brasco International, 32400 Industrial Drive, Madison Heights, MI 48071; Telephone: (800) 893-3665; Website: www.brasco.com; Email: info@brasco.com
3. Austin Mohawk and Company, Inc. 2175 Beech grove Place. Utica, NY 13501. Telephone: (800) 765-3110, Website: www.austinmohawk.com; Email: info@austinmohawk.com.
4. Or approved equal by Metro-North Railroad.

2.02 COMPONENTS

A. Structural Steel Frame and Roof Framing:

1. All structural steel members shall conform to ASTM A500 Grade B Fy=46 ksi, Fu=58 ksi, and be constructed using the section sizes noted on the Contract Drawings.
2. Baseplates shall conform to ASTM A36.
3. High strength bolts shall conform to ASTM A325 U.O.N.
4. All components shall be constructed to the section sizes indicated on the Contract Drawings.
5. All structural steel components to be hot-dip galvanized to conform to ASTM A123/A123M Requirements.
6. All structural steel components to receive Kynar 500 Finish system or approved equal. Paint and primer shall be applied to produce the specified dry-film thickness as directed by the paint manufacturer's data sheets. The coating thickness for both the galvanized and powder coated components shall be measured independently. Apply all paint material in a suitable designed spray booth capable of controlling environmental conditions as per paint manufacturer's specification.
7. All dissimilar metals shall be electrically isolated from steel structural framing to prevent galvanic corrosion.

B. Aluminum Framing, Glazing Channel and Glazing:

1. All standard glazing shall be 3/8" (3/16" inner and outer layer) clear tempered laminated safety glass with laminated interlayer, aluminum frames and fully sealed to prevent water infiltration.
    a. Glazing Sealants and Gaskets as recommended by Manufacturer.
2. Deflection of Aluminum Framing Members: At design wind pressure, as follows:
    a. Based on Project conditions, more stringent deflection criteria than

specified in subparagraphs below may be required; see "Seismic Performance" Article in the Evaluations. First option in "Deflection Normal to Wall Plane" Subparagraph is based on IBC requirements for framing members supporting glass. Second option is based on AAMA TIR-A11 recommendations.

b. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch whichever is less.

c. First option in "Deflection Parallel to Glazing Plane" Subparagraph below is based on typical deflection criteria for glass. Second option is based on GANA's "Glazing Manual."

d. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch whichever is smaller.

3. Aluminum mechanical glazing channel 1-3/4"h x 1-1/4"w for 3/8" safety laminated glass by CR Laurence O.A.E; or approved equal by Metro-North Railroad.

4. All aluminum framing and glazing channels to receive Kynar 500 Finish system or approved equal. Paint and primer shall be applied to produce the specified dry-film thickness as directed by the paint manufacturer's data sheets. The coating thickness shall be measured to ensure consistency. Apply all paint material in a suitable designed spray booth capable of controlling environmental conditions as per paint manufacturer's specification.

a. Color: Kawneer Permacoat Powder Coatings – color "Light Gray"; or approved equal by Metro-North Railroad.

5. All dissimilar metals shall be electrically isolated from steel structural framing to prevent galvanic corrosion.

C. Roof Panels and Membranes:

1. Aluminum-zinc alloy-coated SS (structural steel) sheet conforming to ASTM A 792/A 792M; minimum AZ50 coating plus a thin acrylic coating applied to both sides.

2. Design is based on S2500 Standing Seam Roof, manufactured by Englert, Inc.; or approved equal by Metro-North Railroad.

a. Hydrostop Premium Coat Finish Coat. Color: Battleship Grey; or approved equal by Metro-North Railroad

3. Roof slope to maintain ¼" per foot pitch unless otherwise noted on the Contract Drawings.

4. Fabricator to coordinate integrated gutter/fascia system.

5. Roof Sheathing: Solid Plywood Sheathing, APA Marine, exterior exposure, PS1.

a. Nominal Thickness: Not less than 3/4"

b. Span Rating: Not less than 20/0

c. Screw to metal framing.

d. Space panels 1/8” apart at edges and ends.

6. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

a. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.

b. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

c. Panel Fasteners: Self-tapping screws designed to withstand design loads.

d. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are non-staining, and do not damage panel finish.

7. Roof to include pad style snow guards installed as per manufacturers recommendation. Guards shall not penetrate the roofing system. Color to match Standing Seam Roof finish.

8. All dissimilar metals shall be electrically isolated from steel structural framing to prevent galvanic corrosion.

D. Roof Accessories

1. Coping and flashing shall be integrated into the roofing system and shall be fabricated as per recommendation of manufacturer.

a. All accessories to be fabricated from same metal stock and finish. No post painting of product.

2. All anchors, clips, fasteners, sealants, closure strips, flashing, and trim to be fabricated as per manufacturer’s recommendation, using same materials as roof panels unless otherwise noted or recommended by manufacturer.

3. Roof to include pad style snow guards installed as per manufacturers recommendation. Guards shall not penetrate the roofing system. Color to match Standing Seam Roof finish.

E. Lighting

1. LED lighting: Solara Flex System LED Lighting Tape, standard mounting bracket with snap-in boxed lens by Apogee O.A.E; or approved equal by Metro-North Railroad.

a. CRI8 LED light strip, 3000K, High Output, IP66 outdoor weather rated by Apogee O.A.E; or approved equal by Metro-North Railroad.

PART 3 – EXECUTION

3.01 FABRICATION

A. Fabricate factory built, prefabricated structures and shelters completely in factory.

B. Pre-glaze windows at factory.

C. Prewire factory built, prefabricated structures and shelters at factory, ready for connection to service at Project site.

D. Separate dissimilar materials using nonconductive tape, paint, or other material not visible in finished work.

E. Fabricate factory built, prefabricated structures and shelters for forklift unloading under base of booth with forklift pockets in base of booth or welded in place concealed lifting lugs at roof that are suitable for placement of the structure on prepared foundations.

3.02 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. Anchoring system complete per final accepted Shop Drawings and in full accordance with the manufacturer's specifications and instructions. Minor adjustments to the shelter may be necessary at the time of installation, due to possible variances and irregularities in the existing concrete slab. Existing conditions of concrete slab and specifications to be coordinated with shelter manufacturer.

B. Set shelter on existing concrete slab/foundation.

C. Set shelter plumb and aligned. Level true with full bearing on concrete base.

D. Fasten with expansion anchors at pre-drilled anchor points.

END OF SECTION

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SECTION – 16 01 25

TRAFFIC SIGNAL CABLES

PART 1 – GENERAL

1.01 SUMMARY

A. This Section specifies requirements for traffic signal cables.

1.02 REFERENCES

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

American Society for Testing and Materials (ASTM)	
ASTM B3	Standard Specification for Soft or Annealed Copper Wire.
ASTM B8	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
ASTM B33	Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.
Electrical Testing Laboratories, Inc. (ETL)	
International Municipal Signal Association (IMSA)	
IMSA 19-1	Polyethylene Insulated, Polyvinyl Chloride Jacketed Signal Cable Specification.
IMSA 19-3	Polyethylene Insulated, Polyvinyl Chloride Jacketed Integral Messenger Signal Cable Specification.
National Electrical Manufacturers Association (NEMA)	
NEMA TS 2	Traffic Controller Assemblies with NTCIP requirements
National Fire Protection Association (NFPA)	
NFPA 70	National Electrical Code (NEC)
Underwriters Laboratories, Inc. (UL)	

1.03 QUALITY ASSURANCE

A. Wires and cables that have been manufactured more than two years prior to installation shall not be used in the Work of this Section.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store material in a clean, dry space and protect from weather.

1.05 SUBMITTALS

A. See Appendix "A" for submittals requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Traffic signal cable wires shall be soft annealed copper wire in accordance with ASTM B33 for tinned coated conductors or ASTM B3 for bare copper conductors and shall be stranded copper conductors with concentric stranding conforming to ASTM B8.

B. Color-Coding for Conductors

1. Insulation or covering of wires and cables shall be factory color-coded by the use of colored compounds or coatings, consistently following the color-code throughout the performance of the Work.

2. Color-code for conductors shall be as shown in Table 16 01 25.2.01-1.

Table 16 01 25.2.01-1 Conductor Cable Assignments

Cable	Function	Wire Color Code	Number
Two-Conductor	Pedestrian Push Button	14/2C-A Black	1
	Neutral	14/2C-A White	2
Five Conductor (One Pedestrian Signal)	Spare	14/5C-A Black	1
	Neutral	14/5C-A White	2
	Don't Walk	14/5C-A Red	3
	Walk	14/5C-A Green	4
	Spare	14/5C-A Orange	5
Five-Conductor (Traffic Signal)	Green Arrow (Spare)	14/5C-A Black	1
	Neutral	14/5C-A White	2
	Red	14/5C-A Red	3
	Green	14/5C-A Green	4
	Yellow	14/5C-A Orange	5
Ten-Conductor (Traffic Signal)	Green Arrow (Spare)	14/10C-A Black	1
	Neutral (1)	14/10C-A White	2
	Red (1)	14/10C-A Red	3
	Green (1)	14/10C-A Green	4
	Yellow (1)	14/10C-A Orange	5
	Arrow Neutral(spare)	14/10C-A Blue	6
	Neutral (2)	14/10C-A White-Black	7
	Red (2)	14/10C-A Red-Black	8
	Green (2)	14/10C-A Green-Black	9
	Yellow (2) or Yellow Arrow	14/10C-A Orange-Black	10

C. All wires, cables, splice and terminations for which there are established Underwriters Laboratories (UL) standards shall bear the UL label.

D. Traffic Signal Cable:

1. Shall meet the requirements specified herein, shall be Underwriters Laboratories (UL) and Electrical Testing Laboratories (ETL) approved and shall bear such approval labels.

2. Conductors shall be stranded copper of the gauge and number shown on the Contract Drawings. Standard conductor size for traffic signal cable applications shall be #14 AWG. Where voltage drop exceeds 5 percent, the conductor size for the traffic signal cable shall be #12 AWG.

3. Ground wire shall be 7 strand, #8 AWG and color-coded green.

4. Cables shall have a 600-volt rating, shall be factory tested for each conductor insulation resistance and for continuity of conductors and shall conform to the following International Municipal Signal Association (IMSA)

Specifications:

a. Cable in conduit and raceways: IMSA Specification 19-1 for polyethylene insulated polyvinylchloride jacketed signal cable, with individual color-coded conductors and black outer jacket.

b. Aerial Cable: IMSA Specification 19-3 for polyethylene insulated polyvinylchloride jacketed signal cable with integral messenger, with individual color-coded conductors and black outer jacket.

2.02 CONSTRUCTION FEATURES

A. Cable Tags

1. Dry and Wet Locations

a. Polyethylene tags, 0.025 inches thick and 1-1/2 inches wide, with letters and numbers 7/8-inch wide, with 2-14 AWG nylon, weather-resistant cable ties.

b. PVC tags, 0.025 inches thick and 9/16-inch wide, with letters and numbers 5/16- inch wide, with 2-14 AWG nylon, weather-resistant cable ties.

B. Splicing and Terminating

1. All splicing and terminating materials shall be compatible so that no one material will adversely affect the physical or electrical properties of any other or of the wire or cable itself.

2. All materials for making splices and terminations shall be specifically designed for use with the type of wire or cable, insulation and installation and operating conditions of the specific application.

3. All cable terminations shall meet the requirements of NEMA TS 2.

PART 3 – EXECUTION

3.01 PREPARATION

A. Prior to pulling wires and cables, clean raceway systems of all foreign matter and perform all operations necessary so as not to cause damage to wires and cables while pulling.

B. Prior to pulling wires and cables into underground conduit systems, place a feeding tube approved by the Engineer at the entrance end of such systems.

3.02 INSTALLATION

A. Locations, types, sizes and numbers of wires and cables are shown on the Contract Drawings. Where not indicated, provide traffic signal cable selection to comply with this Section and NFPA 70 standards.

B. Keep wires and cables dry at all times.

C. Use adequate lubrication when installing cables in conduits or raceways. Any pulling compounds shall be compatible with the finish of the wires and cables furnished.

D. Pull wires and cables through conduits in such a manner as not to overstress or stretch any wire. Do not score, twist or damage the protective covering or

insulation. In the pulling of wire or cable into conduits where the strain on the wire or cable may prove excessive, use wire lubricant. Without exception, provide all cables and wires in junction or pull boxes with an adequate amount of slack formed around the interior of the box.

1. Provide one coil of slack wire to allow for proper connection of all wiring. The allowable slack specified below shall be the minimum amount of slack required. Secure wires and cables to the racks using nylon cable ties:
    a. Three (3) feet minimum in all pole bases
    b. Seven (7) feet minimum in rectangular hand holes
    c. Ten (10) feet minimum in base of controller cabinet
2. In circular hand holes, provide one coil of slack wire, five feet minimum, secured in a loop with nylon cable ties and placed in the bottom.
3. At certain locations or under certain conditions additional slack may be necessary, as shown on the Contract Drawings.

E. Cables and wires installed in a conduit system shall be properly trained through the hand holes to permit racking and connection to traffic signal poles and controller cabinets.

F. For wiring trained through existing hand holes, if any, which are not equipped with cable racks, furnish and install a cable rack assembly. Provide ground bushing and bonding wire on all metallic conduit ends within such hand holes. Cable rack assemblies for installation in existing hand holes, if any, shall consist of four cable racks, including inserts and fasteners.

G. After cables have been installed and pending permanent splicing, make a thorough inspection to determine that water has not entered the wires and cables and that the wires and cables have not been damaged. Carefully seal the end of each section of cable in hand holes and service panels or cabinets using rubber tape, and paint with a sealing type of waterproof compound. All cables in hand holes shall be placed on cable racks while waiting to be permanently spliced.

H. Install Ground wire continuously throughout the traffic signal system and secured to all ground rods, cabinets, pull boxes, traffic signal bases and any other material requiring grounding as shown on the Contract Drawings.

I. Bonding of pull boxes shall be done by drilling a 1/2” hole and installing hole compression crimp cable lugs in both the pull box lid and frame. Ground wire shall be installed in both holes and then secured to the grounding rod with one continuous wire.

J. Install cable terminations and terminate cables with insulated locking spade terminals conforming to NEMA TS 2 within cabinet.

K. Splicing of Cable:

1. Cable shall be run between units of equipment without splices except in pole bases or unless otherwise shown on the Contract Drawings.
2. Where joints or splices are specified:
    a. Make them with compression solderless connector and secured mechanically and electrically. Thoroughly clean conductors with a

minimum of insulation removed.

b. Insulate joints and splices with insulating tape and provide one and one half times the insulation equivalent to that of the original conductor. Insulate the taped joints and splices with resin splicing kits.

L. Identification of Wires and Cables

1. Identify each wire and cable by its signal number in all cabinets, boxes, manholes, hand holes, wire ways and other enclosures, access locations and at all terminal points.

2. The signal number designations shall be as shown on the Contract Drawings. Attach tags to wires and cables in such a manner as to be readily visible.

3. Wrap tag ties around all conductors comprising the signal number to be identified.

3.03 FIELD TESTS

A. Test all wires and cables up to equipment installed under the Contract with a Megohmmeter. Furnish the Engineer with a copy of the "Megger" readings together with an outline of the method used. If, in the opinion of the Engineer, any reading is lower than that required by codes that would apply if the Authority were a private corporation, promptly replace the materials involved, at the Contractor's expense, and retest.

B. When each wiring system is completed and before any connection is made to operating equipment, perform the following tests on each circuit in the presence of the Engineer to determine whether the installations are in acceptable working order:

1. Tests for continuity.

2. Tests for ground.

3. Tests for insulation resistance performed between circuit wires and from circuit wires to ground. Upon completion of the electrical system with fuses removed, or devices removed from the circuit, and before energizing, the insulation resistance shall not be less than 150 megohms between conductors, or between conductor and ground on those circuits with a total single conductor length of 1,500 feet and over, and no less than 175 megohms for those circuits with a single conductor length of less than 1,500 feet.

C. Perform tests on the system as a whole. Circuits shall be complete, including all splicing from the control cabinet to all the devices it services.

D. Once the signal installation is complete, the following approval process inspection schedule will be followed:

1. The contractor shall be notified 2 weeks prior to the Pre-final Inspection.

2. Following the Pre-final inspection, the contractor shall have 2 weeks to complete any punch list items generated from the inspection.

3. After the 2 week period, the contractor shall then be notified 2 weeks prior

to the Final inspection.

4. Following the Final inspection, the contractor shall have 2 weeks to complete any punch list items generated from the inspection.
5. Once all punch list items have been completed, the signal shall be placed into flashing operation for a minimum of one week.
6. Once the signal is fully operational a 30-day test period begins.
7. Following the 30-day test period, the contractor shall work with the engineer to complete the Asset Commissioning forms. These forms must be completed within 1 week.
8. All maintenance and operational responsibilities shall be assumed by the Authority upon completion of the forms.

END OF SECTION

SECTION 16 01 25

TRAFFIC SIGNAL CABLES

APPENDIX A

3.04 SUBMITTALS

A. Submit Catalog Cuts for the following in accordance with the requirements of Section 01 33 00 – Submittal Procedures :

1. Wires and cables for each type and size;
2. Termination and splice kit materials and installation procedures.
3. Furnish four copies of wire and wiring test results identifying the observed readings with their respective circuits as outlined in Section 3.03. Identify test results with the Contract title, the date of the test and the atmospheric conditions. The Contractor is responsible for recording data and preparing the report with test results.
    a. Submit certified shop test reports for wires and cables.
    b. Submit field test results for wires and cables, including "Megger" readings with the test method used.

END OF APPENDIX "A"

END OF SECTION

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SECTION – 16 05 72

TRAFFIC SIGNAL POLES, MAST ARMS, SPAN WIRE AND POLE FOUNDATIONS

PART 1 – GENERAL

1.01 SUMMARY

A. This Section specifies requirements for traffic signal poles, mast arms, span wire and pole foundations.

1.02 REFERENCES

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

American Association of State Highway and Transportation Officials (AASHTO)	
Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals	
American Society for Testing and Materials (ASTM)	
ASTM A36	Carbon Structural Steel
ASTM A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A193	Alloy Steel and Stainless steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
ASTM A194	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
ASTM A325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A370	Methods and Definitions for Mechanical Testing of Steel Products
ASTM A475	Zinc-Coated Steel Wire Strand
ASTM A563	Carbon and Alloy Steel Nuts
ASTM A572	High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A595	Steel Tubes, Low-Carbon or High-Strength Low-Alloy, Tapered for Structural Use
ASTM A615	Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM B108	Aluminum-Alloy Permanent Mold Castings
ASTM B221	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes
ASTM B228	Concentric-Lay-Stranded Copper-Clad Steel Conductors
ASTM F436	Hardened Steel Washers
ASTM F1554	Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

Federal Highway Administration (FHWA)	
MUTCD	Manual on Uniform Traffic Control Devices
National Fire Protection Association (NFPA)	
NFPA 70	National Electrical Code (NEC)

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Traffic signal poles, mast arms, span wire and pole foundations shall conform to requirements specified herein; and where specific requirements are not listed herein, the traffic signal poles shall, as a minimum, conform to the requirements of the standards and publications listed in 1.02.

B. Traffic signal poles, mast arms, span wire and pole foundations furnished as Work of this Section shall be as shown on the Contract Drawings, constructed to standard similar dimension sections.

C. Traffic signal poles, mast arms, span wire and pole foundations shall consist of readily available and proven equipment, fully consistent with their intended design and operation as specified herein. Special or custom-built components may be used only upon written approval from the Engineer.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Equipment shall operate without degradation or damage under ambient shock (thermal and mechanical), vibration, lightning and electromagnetic/electrical interference at the construction site.

1.05 QUALITY ASSURANCE

A. Provide independent test certification of foundations, poles, bases, span wires, guy wire and mast arms to show compliance with the load requirements.

B. Submit complete design calculations signed and sealed by a professional engineer licensed in the state in which the traffic signals are to be installed to the Engineer for approval. Calculations shall include design of all elements necessary to construct the signal structure including, but not limited to transformer and shoe bases, base plates, poles, span wires, guy wires, non-standard foundations and anchorages, connections and mast arms.

C. Design criteria shall be in accordance with the AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 6th Edition, 2013 with Latest Interims and the following:

1. Steel Mast Arm Traffic Signals

a. All steel traffic signals shall be designed for fatigue to resist the following equivalent static wind load effects: Galloping, Vortex Shedding (as applicable), Natural Wind Gust, and Truck Induced Gust. Fatigue design shall be in accordance with Chapter 11 and the following:

1) For traffic signals with mast arms greater than 50’ in length, use Fatigue Category I.

2) For traffic signals with mast arms 50’ or less in length, use

Fatigue Category II.

b. The base plate thickness shall be equal to or greater than the anchor bolt diameter.

c. A double nut connection between the base plate and the anchor bolt shall be used. The distance between the bottom of the lower nut and the top of the foundation shall be no more than 1 ½" or the diameter of the anchor bolt, whichever is less.

2. Aluminum Traffic Signals

a. Fatigue Design shall be waived.

3. Span Wire Supported Traffic Signals

a. Design Life

1) Permanent Installation: 25 Years

2) Temporary Installation: 10 Years

b. The design wind pressure, P_z, shall be calculated using Equation 3.8.3-1. The basic wind speed, V, to be used in Equation 3.8.3-1 shall be 110 mph.

D. After installation, inspect the equipment in the presence of the Engineer to show compliance with the requirements of this Section. Continue inspection until the results are satisfactory to the Engineer. Perform any repairs, construction and modifications as required to comply with the Specifications without additional cost to the Authority.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to the construction site in original unopened containers or bundles with labels that clearly identify the manufacturer and product name, including storage requirements and instructions.

B. Properly store and handle all materials delivered to prevent deterioration or damage due to moisture, temperature change, contaminants or other causes.

1.07 SUBMITTALS

A. For submittal requirements see Appendix "A".

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PART 2 – PRODUCTS

2.01 MATERIALS

A. Furnish poles and mast arms of material shown on the Contract Drawings as follows:

1. Aluminum poles and mast arms: ASTM B221, Alloy 6063-T6.
    a. Rotary ground, paper protection wrapped.
    b. Anodized aluminum poles and arms in the quantities shown, shall be furnished only if specified on the Contract Drawings.
    c. Furnish powder coated poles and arms if a color is specified on the Contract Drawings.
2. Aluminum struts and plates: ASTM B221, Alloy 6063-T6
3. Steel poles and mast arms: ASTM A572, Grade 50 or ASTM A595, Grade A.
    a. The steel poles and mast arms shall be galvanized in accordance with ASTM A123.
    b. Furnish powder coated poles and arms if a color is specified on the Contract Drawings.
4. Timber poles shall be Douglas Fir.

B. Shoe Bases/Base Plates:

1. Aluminum:
    a. ASTM B108, Alloy 356-T6.
    b. ASTM B221, Alloy 6005-T5 at handhole reinforcement.
2. Steel: In accordance with 2.01 A.3.

C. Transformer Bases:

1. Aluminum: ASTM B108, Alloy 356-T6.
2. Furnish powder coated transformer bases and bolt covers in the quantities shown if a color is specified on the Contract Drawings.

D. Clamps:

1. Cast Aluminum pole clamps: ASTM B108, Alloy 356-T6.
2. Steel: In accordance with 2.01 A.3.

E. Connection Devices:

1. Aluminum: ASTM B221, Alloy 6061-T6.
2. Steel: ASTM A36.

F. Bolts, Nuts and Washers:

1. Steel Traffic Signal Pole Installations:
    a. Bolts
        1) Anchor bolts shall be ASTM F1554, Grade 55.

2) Bolts used for structural connections shall be ASTM A325.

b. Nuts and Washers:

1) Nuts for use with anchor bolts shall be in accordance with ASTM A563A Heavy Hex.

2) Washers for use with anchor bolts shall be in accordance with ASTM F436.

c. Galvanize bolts, nuts and washers in accordance with ASTM A153.

2. Aluminum Traffic Signal Pole Installations:

a. Bolts

1) Anchorage Assembly

a) Anchor bolts shall be ASTM F1554, Gr. 55. Hot Dip Galvanized in accordance with ASTM A153.

b) Heavy Hex Cap Screws shall be stainless steel ASTM A193 Grade 8.

2) Bolts used for structural connections shall be stainless steel in conformance with ASTM A193 Grade B8, size as noted or as determined by the manufacturer.

b. Nuts and Washers

1) Anchorage Assembly

a) Nuts embedded within foundation shall be ASTM A563A Heavy Hex. Embedded nuts shall be hot dip galvanized in accordance with ASTM A153.

b) Washers embedded within foundation shall be ASTM F436. Embedded washers shall be hot dip galvanized in accordance with ASTM A153.

c) Coupling nuts shall be ASTM A563A Heavy Hex. Coupling nuts shall be hot dip galvanized in accordance with ASTM A153.

d) Flat washers and lock washers shall be Type 304 stainless steel.

2) Nuts used in structural connections shall be stainless steel in accordance with ASTM A194 Grade 8.

3) Washers used in structural connections shall be made from Type 304 stainless steel.

G. Span Wire, Tether Cable & Accessories:

1. Span wire cable: ASTM A475, Extra High Strength Grade with Class A weight zinc coating. Diameter shall be as shown on the Contract Drawings.

2. Tether wire, where required, shall be 5/16-inch diameter, ASTM A475 Extra High Strength Grade with a Class A weight zinc coating.

3. Fabricate wire dead ends with heat-treated aluminum alloy strand vice yoke

and cartridge and case hardened plated steel alloy jaws.

4. Span wire attachment shall be 3/4-inch diameter galvanized eye through bolts with double nut and curved stubbing washer.

5. The working load and breaking strength of all hardware attached to wire shall meet or exceed the working load and breaking strength of the wire to which it is attached.

H. Guy Wire Cable & Accessories:

1. Guy wire cable: ASTM A475, Extra High Strength Grade with a Class A weight zinc coating. Diameter shall be as shown on the Contract Drawings.

2. Guy wire attachment shall be a guy strand vise with a 3/4-inch angle thumb eye bolt and 3/4-inch diameter galvanized through bolts with double nut and curved stubbing washer.

3. Guy guard shall be a minimum of 8 ft.

4. Helix anchor shall be provided as shown on the Contract Drawings.

5. The working load and breaking strength of all hardware attached to wire shall meet or exceed the working load and breaking strength of the wire to which it is attached.

I. Foundations:

1. Concrete Category VI shall be monolithically placed, cast-in-place and of the size and shape shown on the Contract Drawings.

2. Reinforcement shall be placed as shown on the Contract Drawings. All reinforcement shall be ASTM A615, Grade 60. Reinforcement shall be epoxy coated where shown on the Contract Drawings.

J. Grounding:

1. All poles shall be grounded, meeting or exceeding the NFPA 70 National Electrical Code (NEC) standards.

K. Safety Chain:

1. Safety chain shall be 1/4-inch coil proof straight link chain fabricated in accordance with ASTM A36 and hot dipped galvanized in accordance with ASTM A123.

2.02 CONSTRUCTION FEATURES

A. General:

1. Traffic signal poles shall be of the following types as shown on the Contract Drawings:

a. Span wire poles: Poles for supporting a steel cable or cables to which are attached traffic signals and overhead signs.

b. Mast arm poles: Vertical pole(s) and approximately horizontal arm(s) to which are attached traffic signals and overhead signs.

c. Post-top mount poles: Vertical pole(s) used for mounting traffic or pedestrian signals directly on post top.

d. Bracket mount poles: Vertical pole(s) used to support traffic or pedestrian signals, bracketed from side.

2. Pole shapes shall be round, unless otherwise noted, and of length shown on the Contract Drawings. The length of span wire poles shall allow for the wire sag shown on the Contract Drawings after all signals and signs are installed.

3. Anchor bolts shall be designed for the orientation of the pole as shown on the Contract Drawings. Furnish and install anchor bolts, nuts and washers for each pole supplied.

4. Shop paint shall be rust-inhibitive, non-lead or chromium-based oil/alkyd primer on non-galvanized steel fabrications, junction box frames and covers and exterior exposed metallic conduits and anchor bolts. Field paint all uncoated steel with rust-inhibitive, non-lead primer tinted to distinguish it from shop paint coating; and finish paint one coat of black graphite or foliage green paint.

B. Pole Construction:

1. Fabricate pole of material listed in 2.01 with a uniform wall thickness and a uniform taper, starting at the butt end, decreasing in diameter at a rate of not more than 0.14 inches, but not less than 0.07 inches per foot of length.

2. The maximum base diameter of span wire poles shall be 0.70 inches per foot of pole length.

3. Equip poles with removable end caps and a 1/2-13 threaded bolt, grounding terminal accessible through a hand hole.

4. Fabricate aluminum shafts free of longitudinal welds.

5. Fabricate steel shafts of one-piece construction with full-length high frequency resistance welds. Use submerged arc welds for all poles.

6. Steel Poles – Connection plate used to secure the mast arm to the pole shaft shall be fabricated from a steel plate drilled or tapped to accept bolts from the mast arm and welded to the pole in accordance with details shown in the Shop Drawings. Connection shall exhibit fatigue behavior and produce stress levels consistent with what is shown in the design calculations.

C. Shoe Base/Base Plate Construction:

1. Steel Poles – Weld base plate to shaft in accordance with details shown in the Shop Drawings. Connection shall exhibit fatigue behavior and produce stress levels consistent with values shown in design calculations.

2. Aluminum Poles – Equip shoe base with gussets, as needed, slots sized to accommodate the anchor bolts, and shoe base anchor bolt covers.

D. Transformer Base Construction

1. Equip aluminum transformer and pedestal bases with an aluminum hand hole door and stainless steel mounting hardware. A grounding clip shall be located on wall opposite door opening.

2. Attach removable type transformer base to pole shaft by bolting to a shoe

base welded to shaft. Attach rotary transformer base into a reinforced collar arrangement that shall accept pole shaft. Arrange shaft disconnections so that no special tools are required for unbolting disconnection.

E. Mast Arm Construction: Fabricate arm of material, length and configuration shown on the Contract Drawings. Provide a hole with smooth wiring cable guide in flange plates on shaft and on mast arms at signal location for complete internal wire routing.

1. Aluminum Mast Arms:

a. Fabricate arms of one-piece horizontal plane ovalized aluminum tubing of minimum 0.125-inch wall thickness, with welded vertical struts.

b. For truss type mast arms, design for both free swinging and adjustable fixed vertical signal mounting. Join outboard ends of arms by welding a one-piece extrusion shaped to accept arm members back to back and maintain a 1/4-inch minimum separation between tubes. Extend upper arm to form a 2-inch slipfitter at outboard end and provide a welded signal strap to mount free-swinging signal.

c. Secure mast arm to pole shaft with aluminum plate clamp welded to inboard end of arm and a matching pole back clamp, with four stainless steel through bolts and locknuts for attachment.

2. Steel Mast Arms:

a. Fabricate with longitudinal high frequency resistance welds and provide a uniform taper starting at the butt end, decreasing in diameter at a rate of not more than 0.14 inches, but not less than 0.07 inches, per foot of length.

b. Fabricate arms in one piece for lengths up to and including 40 feet. For mast arms over 40 feet, fabricate of two piece construction with an overlap joint length of 1 1/2 times the maximum inside diameter of the outer shaft, and secure with a through bolt and locknut.

c. Provide a removable galvanized steel end cap secured with stainless steel screws.

d. Connection plate used to secure mast arm to pole shaft shall be fabricated from a steel plate drilled to fit mast arm and circumferential welded in accordance with details shown in the Shop Drawings. Connection plate shall be secured to the plate provided on the pole shaft with ASTM A325 through bolts with nuts, galvanized in accordance with ASTM A153. Connection shall exhibit fatigue behavior and produce stress levels consistent with what is shown in the design calculations.

F. Hand Holes: Equip poles, other than transformer base mounted poles, with hand holes. The bottom of the hand hole shall not be set at a height lower than the distance equal to the pole diameter above the top of the base plate. The hand hole size shall be in accordance with details shown on the Contract Drawings.

1. Internally reinforce poles with metal of a cross section area at least equal

to the cross section area of hole area removed.

2. Provide removable door flush with outside of shaft.

G. Ground Lug: Equip poles and transformer bases with ground lug.

H. Safety Chain: Furnish and install hot dipped galvanized 1/4-inch coil proof straight link chain with stainless steel bolts, nuts and washers at all mast arm signal head installations.

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PART 3 – EXECUTION

3.01 PREPARATION

A. Before manufacture or procurement of equipment, submit calculations, Catalog Cuts and Shop Drawings for prior Engineer approval as specified in 1.03 and 1.05 herein. Do not procure equipment until the Engineer has given written approval.

B. Related equipment to be removed and not required for relocation under the Contract, if and where shown on the Contract Drawings, shall remain the property of New York State Department of Transportation (NYSDOT) and shall be delivered to a location NYSDOT as designated by the Engineer. Removed equipment, if any, shall not be used in a new installation unless specifically shown on the Contract Drawings.

C. Verify that each pole foundation and anchor bolt pattern has been installed using the proper anchor bolt circle for the pole base.

3.02 INSTALLATION

A. Poles

1. Attach pole shaft by bolting shoe base to transformer base or to the foundation. Locate hand hole to face away from traffic.

2. Use shims or leveling nuts to align pole. Shim stack should be no greater than ¼" tall.

3. Traffic signal poles shall be bonded and grounded according to the NEC. Furnish and install a ground cable from the pole's ground lug to a ground rod at the nearest manhole.

4. Install mast arms and span wires so traffic signal heads and signs meet minimum elevation requirements as shown on the Contract Drawings, in accordance with AASHTO standards and MUTCD guidelines.

B. Span Wire:

1. Fasten signal control cable to the span wire by non-corrosive metal lashing, messenger rings or weather resistant plastic cable bands, at no greater than 15-inch intervals. Hang signal heads and brackets from the span wire so that the bottoms of the signal heads on each approach are aligned horizontally. The signal cable shall follow the lowest path to the signal heads.

2. Determine the length of span wire required to span the distance between poles, allowing sufficient length for fastening and sag to produce a final assembly that is consistent with the Contract Drawings.

3. Determine all the loads for the span wire and arrange for the cable manufacturer to verify the cable is adequate for the loads shown on the Contract Drawings.

4. In order to restrict excessive signal movement, install a tether cable to stabilize signal heads, if and where shown on the Contract Drawings. Attach tether cable to the edge shown on the signal head in the Contract Plans.

5. Drill through pole at an approximate straight angle at each connection to

receive the eye through bolts. In no case shall the span wire pull or strain on the eye bolt at an angle greater than 10 degrees plus or minus from straight.

6. Furnish and install galvanized thimble eyebolts to connect ground wires to round signal poles. Circumferential pole clamps, as an alternative to galvanized thimble eyebolts, may be used to connect span wires to the top of polygonal shaped signal poles, where applicable.

C. Foundations:

1. Concrete foundations shall be cast-in-place.

2. Foundations shall rest on firm ground and shall be placed monolithically. Conduit and anchor bolts shall be placed in proper position and shall be held in place by means of a template until the concrete sets. Foundation concrete shall reach sufficient strength and shall have set a minimum of 24 hours prior to removing forms. Exposed portions of foundations shall be neatly finished with a wood float followed by brushing with a wet, soft-haired brush. Construct tops of foundations to a finished grade elevation of 1 inch above final grade sidewalk, unless otherwise shown. Where sidewalks are not constructed or do not exist, finish foundations to an elevation of 2 inches above the final grade of the surrounding lawn or earth, unless otherwise shown on the Contract Drawings.

3. Conduit installed in foundations shall be set plumb. The conduit shall terminate with a coupling flush with the top of the foundations and shall be provided with a close nipple. Conduit shall be provided with pipe caps during the placement of the concrete. When the finishing of the foundation is complete, the pipe caps shall be removed and insulated grounding bushings shall be installed. If the wiring is not immediately installed, the bushings shall be installed with push-penny plugs.

4. Anchor bolts installed in the foundation shall be set plumb. Once the foundation concrete has reached its design strength, connect pole to foundation as shown on the Contract Drawings.

3.03 INSPECTION

A. Perform final installation inspection in accordance with 1.05 C.

B. Once the signal installation is complete, the following approval process inspection schedule will be followed:

1. The contractor shall be notified 2 weeks prior to the Pre-final Inspection.

2. Following the Pre-final inspection, the contractor shall have 2 weeks to complete any punch list items generated from the inspection.

3. After the 2 week period, the contractor shall then be notified 2 weeks prior to the Final inspection.

4. Following the Final inspection, the contractor shall have 2 weeks to complete any punch list items generated from the inspection.

5. Once all punch list items have been completed, the signal shall be placed into flashing operation for a minimum of one week.

6. Once the signal is fully operational a 30-day test period begins.
7. Following the 30-day test period, the contractor shall work with the engineer to complete the Asset Commissioning forms. These forms must be completed within 1 week.
8. All maintenance and operational responsibilities shall be assumed by the Authority upon completion of the forms.

END OF SECTION

SECTION 16 05 72

TRAFFIC SIGNAL POLES, MAST ARMS, SPAN WIRE AND FOUNDATIONS

APPENDIX "A"

3.04 SUBMITTALS

A. Submit the following in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

1. Shop Drawings
    a. Details of all traffic signal poles including their bases, poles, cables, arms, mounting brackets, attachments and fittings, and anchor bolt details and layout.
2. Catalog Cuts, Material Certifications, and Test Results
    a. Certified test results for steel poles and mast arms in accordance with Section 2.01A.3.
    b. Certification for anchor bolt strength in accordance with Section 2.01 F.
    c. Certification for span wire cable strength in accordance with Section 2.01 G.
3. Samples
4. Construction Procedures and Quality Assurance Documents
5. Signed and sealed design computations for all traffic poles in accordance with Section 1.05 B.

END OF APPENDIX "A"

END OF SECTION

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SECTION – 16 05 73

PEDESTRIAN TRAFFIC SIGNALS, PUSHBUTTONS AND MOUNTING HARDWARE

PART 1 – GENERAL

1.01 SUMMARY

A. This Section specifies requirements for Pedestrian Traffic Signal equipment including Light Emitting Diode (LED) Countdown Pedestrian Traffic Signals, Audible-Tactile Pedestrian Signal System (APS) and Pushbutton Assemblies along with all incidental wiring and mounting hardware. The Audible-Tactile Pedestrian Signal System shall consist of all electronic control equipment, mounting hardware, pushbuttons and signs, which are designed to provide both a pushbutton with a raised vibrating tactile arrow on the button, along with a variety of audible sounds for different pedestrian signal functions.

1.02 REFERENCES

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

American Association of State Highway and Transportation Officials (AASHTO)	
Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals	
Americans with Disabilities Act (ADA)	
ADA Accessibility Guidelines for Buildings and Facilities Public Rights-of-Way Accessibility Guidelines	
American National Standards Institute (ANSI)	
ANSI C 78A-21	Bulb, Medium Screw Base
American Society for Testing and Materials (ASTM)	
ASTM B 85	Aluminum Alloy Die Castings
Federal Communications Commission (FCC)	
Title 47	Telecommunications
Federal Highway Administration (FHWA)	
MUTCD	Manual on Uniform Traffic Control Devices
Institute of Transportation Engineers (ITE)	
ITE ST-017B	Equipment and Material Standards of the Institute of Transportation Engineers
ITE ST-055-E	Pedestrian Traffic Control Signal Indications – Part 2: Light Emitting Diode (LED) Pedestrian Traffic Signal Modules
International Electrotechnical Commission (IEC)	
IEC 61000	Electromagnetic compatibility (EMC)
National Electrical Manufacturers Association (NEMA)	
NEMA TS 2	Traffic Controller Assemblies with NTCIP Requirements
NEMA 250	Enclosures for Electrical Equipment (1,000 Volts Maximum)

Underwriters Laboratories, Inc. (UL)	
UL 94VO	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
US Department of Defense Military Standards	
MIL-STD-883	Test Method Standard Microcircuits

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. Where specific requirements are not listed herein, pedestrian traffic signals shall conform to the requirements of the standards and publications listed in 1.02 herein.

B. The units furnished and installed as Work of this Section shall be LED Countdown Pedestrian Traffic Signals in the quantities shown on the Contract Drawings. Furnish and install Audible-Tactile Pedestrian Signal Systems and Pedestrian Pushbuttons in the quantities shown only if specified on the Contract Drawings.

C. The units furnished and installed as Work of this Section shall have polycarbonate housings in the quantities shown on the Contract Drawings.

D. Pedestrian Traffic Signals shall consist of readily available and proven equipment, fully consistent with their intended design and operation as specified herein and shown on the Contract Drawings. Special or custom-built components may be used only upon written approval from the Engineer.

E. Pedestrian Traffic Signals shall use modular type construction with assemblies, sub-assemblies and modules that are available from a second source of supply wherever possible.

F. All assemblies, sub-assemblies and modules shall be readily accessible for removal, testing or replacement without removal of the other modules, assemblies or components. Components shall be located so that there is visibility and access for the use of hand tools and standard test probes where maintenance is required. Test points shall be provided to facilitate troubleshooting.

1.04 ENVIRONMENTAL REQUIREMENTS

A. The Pedestrian Traffic Signals, APS, and Pushbutton Assemblies shall operate over an ambient temperature range from -30 degrees F to +165 degrees F (-34 degrees C to +74 degrees C). Operation of the Pedestrian Traffic Signals, APS, and Pushbutton Assemblies shall not be degraded by rain, snow, fog or normally encountered ambient humidity conditions.

B. Pedestrian Traffic Signals and Pushbutton Assemblies shall be protected against the intrusion of dust and moisture to protect all internal components. Pedestrian Traffic Signals shall have properly installed gaskets and shall be protected against dust and moisture intrusion per requirements of NEMA 250 for Type 4 enclosures to protect all internal LED, electronic and electrical components.

C. Pedestrian Traffic Signals and Pushbutton Assemblies shall operate without degradation or damage under ambient shock (thermal and mechanical), vibration, lightning, and electromagnetic/electrical interference.

D. APS shall meet the following criteria:

1. Operate over the range of relative humidity from 0 percent to 95 percent, non-condensing;

2. NEMA TS 2 Section 2.1 Transient Voltage Protection requirements;

3. NEMA TS 2 Section 2.1 Mechanical Shock and Vibration requirements;

4. IEC 61000-4-4, IEC 61000-4-5 Transient Suppression requirements;

5. FCC Title 47, Part 15, Class A Electronic Noise requirements;

6. Pushbutton Station (PBS) Enclosure shall meet NEMA 250 – Type 4X Enclosure requirements; and

7. The central control unit and station monitor enclosures shall meet NEMA 250 – Type 1 requirements.

1.05 QUALITY ASSURANCE

A. Arrange for all LED signals to undergo Design Qualification (DQ) testing prior to shipment as specified herein and in accordance with ITE ST-017B. Failure of any LED signals to meet requirements of the DQ tests shall be cause for rejection. If any equipment has been damaged or if, for any reason, the equipment does not comply with the requirements or test standards specified, the Contractor shall repair or replace the equipment at no cost to Metro North or NYSDOT. Provide DQ process and test results documentation to the Engineer.

B. Ensure that all LED signals undergo the following production Quality Assurance (QA) testing prior to shipment in accordance with ITE ST-017B. Failure of any LED signal to meet any requirement of the QA tests shall be cause for rejection. If any equipment has been damaged or if for any reason the equipment does not comply with all requirements and test standards specified, the Contractor shall repair or replace the equipment at no cost to Metro North or NYSDOT. Provide QA process and test results documentation to the Engineer.

1. Signal Burn-in

2. The Maintained Minimum Luminous Intensity shall meet Luminous Intensity requirements in accordance with ITE ST-017B.

3. Power Factor

4. Current

5. Visual Inspection

6. After delivery of equipment, notify the Engineer to perform a construction site inspection of the equipment. If in the Engineer's opinion any equipment has been damaged or if, for any reason, the equipment does not comply with the requirements or test standards specified, the Contractor shall repair or replace the equipment at no cost to Metro North or NYSDOT, even though the equipment had been inspected for shipment. After satisfactory replacement and/or repair and subsequent Engineer's written approval, the equipment may be installed.

C. After installation, test the equipment in the presence of the Engineer to show compliance with the requirements of this Section and with the Contract Drawings. Continue testing until test results are satisfactory to the Engineer. If any equipment has been damaged or if for any reason the equipment does not comply with the requirements or test standards specified, the Contractor shall repair or replace the equipment at no cost to Metro North or NYSDOT. Provide installation process and test results documentation to the Engineer. Perform any repairs, construction or modifications required to comply with the Specifications and the Contract Drawings.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Arrange for all materials to be delivered to the construction site in original

unopened containers or bundles with labels that clearly identify the manufacturer and product name, including storage requirements and instructions.

B. Properly store and handle all materials delivered to prevent deterioration or damage due to moisture, temperature change, contaminants and other causes.

1.07 SPARE EQUIPMENT

A. For items with no second source of supply for replacement assemblies, provide spare equipment in quantities as shown on the Contract Drawings.

1.08 SUBMITTALS

A. For submittals requirements, see Appendix “A”.

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PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Audible-Tactile Pedestrian Signal System (APS)

1. See Contract Drawings for manufacturer information.

B. Pedestrian Pushbutton Assemblies (Non-APS)

1. See Contract Drawings for manufacturer information.

2.02 CONSTRUCTION FEATURES

A. General:

1. Furnish and install Pedestrian Traffic Signals for operation on 120 ±3 VAC RMS, 60 Hz, AC line power, unless otherwise shown on the Contract Drawings. Signals shall operate over a voltage range from 80 VAC RMS to 135 VAC RMS, 60 Hz ±3 Hz, AC line power. Variations in operating line voltage shall produce no visible effect on luminous intensity and shall not vary by more than 10 percent over the entire operating voltage range. The current drawn shall be sufficient to ensure compatibility and proper triggering and operation of load switches in the signal controller units.

2. Furnish and install signal heads, mounting brackets, attachments and fittings for a wind load pressure resulting from a wind speed in accordance with the current edition of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

3. All bolts, nuts, washers and lock washers shall be stainless steel.

4. Aluminum signal housings, pushbutton housings, bracket arms, mounting attachments and hardware shall have three coats of paint, each of which shall be baked after application. The first or primer coat shall be a non-lead/non-chromium containing paint for aluminum surfaces. The second and third coats shall be Federal Yellow Matching Color No. 13538 conforming to Federal Standard No. 595, except for the message face and the Z-crate visor, which shall be flat black enamel. Each coat shall be baked on separately. All metal surfaces to be painted shall be suitably cleaned of all foreign deposits, oil and grease, and then neutralized for priming. Paint separate parts before assembly. Stainless steel assemblies and polycarbonate components shall not be painted.

5. Unless specified otherwise, equipment shall be fabricated in accordance with ITE ST-017B.

6. Identify all wire terminations and terminal block connections. Terminate cables with insulated spade terminals conforming to NEMA TS-2. Bring separate continuous #14 AWG, from the terminal block of the signal head to bottom of the standard.

B. Pedestrian Signal Housing and Door:

1. Polycarbonate housings and doors shall be molded, ultraviolet and heat stabilized, flame retardant, unaffected by the heat of the lamp used and permanently colored in accordance with the Contract Drawings. Housings and doors shall be made of UL 94VO flame-retardant materials. The lens

is excluded from this requirement.

C. LED Countdown Pedestrian Signals

1. The number and usage of LED Countdown Pedestrian Traffic Signals shall be as shown on the Contract Drawings.

2. The lens of the unit shall be polycarbonate UV stabilized and a minimum of 1/8-inch thick.

3. LED Countdown Pedestrian Signal shall be a standalone unit that provides pedestrians with numerical timing along with the “WALKING PERSON” or “UPRAISED HAND” international symbols in solid form. The unit’s countdown timer shall operate in conjunction with the pedestrian signal indication’s flashing “UPRAISED HAND”.

4. The signal section shall be designed to display a steady “WALKING PERSON,” flashing “UPRAISED HAND,” and steady “UPRAISED HAND” symbol that complies with ITE Standard ST-017B for the size specified in a single housing. The signal section shall be used for existing installations, where applicable, and all new installations unless otherwise directed by the Engineer.

5. Physical and Mechanical Requirements

a. The unit shall be supplied new, complete with housing for new installations or without the housing for on-site assembly into existing 16-inch housings as shown on the Contract Drawings.

b. For retrofit replacement, installation of the LED signal section shall be in accordance with the following:

1) LED pedestrian traffic signals shall not require special tools for installation when used as retrofit replacements for existing incandescent traffic signals.

2) LED pedestrian traffic signals shall fit into the existing traffic signal housings built to ITE ST-017B without any modification to the housing or to the reflector.

3) LED pedestrian traffic signals shall be weather tight, shall fit securely in the housing and shall connect directly to existing electrical wiring by means of push-on type connectors.

4) Installation of retrofit replacement LED pedestrian traffic signals into existing incandescent signal housings shall require only the removal of the existing optical unit components, i.e., lens, lamps, gaskets and reflector.

5) Ensure that each retrofit kit includes all necessary components to complete conversion, including a one-piece gasket.

6. An LED countdown pedestrian traffic signal unit shall, unless otherwise specified, include a single-piece polycarbonate housing, an illumination light source, a polycarbonate message lens, a single-piece polycarbonate swing door frame, a blank-out Z-crate type sun visor and other appropriate hardware and mounting brackets. Design the signals to fit both standard

post top and side of pole mounting brackets, including clamshell type mounting hardware, as shown on the Contract Drawings. All components and field-wiring terminal shall be readily accessible from the front by opening the signal door.

a. Polycarbonate housings shall be a minimum of 0.090 inches thick.

b. Polycarbonate doors shall have a sufficient-sized opening to accommodate the lens. On one side of the door at top and bottom there shall be a hinge to ensure perfect alignment of the door.

c. Attach the door to the housing by means of stainless steel spring pins with captive stainless steel wing nuts and washers. The case when properly mated to other signal components and mounting hardware shall provide a dustproof and weather-resistant enclosure, with easy access to all components for servicing and replacement.

7. Provide each LED countdown pedestrian traffic signal with a Z-crate type visor designed to eliminate sun phantoms, installed directly into the signal doorframe parallel to the face of the message board and held in place by means of stainless steel screws.

a. Injection-molded polycarbonate, ultraviolet-resistant, heat-resistant, flame-retardant, unaffected by the heat of the lamp used, permanently colored egg crate visor meeting pattern dimensions specified below.

8. The housing shall have neoprene gaskets between the body of the housing and the doors. The door shall be hinged and forced tightly against the gasket and the housing by a simple stainless steel locking mechanism.

9. Provide a screw-in type terminal block assembly with an aluminum base that is bolted to the signal housing for termination of the returned field wires. Field wiring shall be as specified herein unless otherwise shown on the Contract Drawings.

10. Indications shall be made visible by LED illumination, and shall be bright and uniform displays even under strong ambient light.

a. The “UPRAISED HAND” and “WALKING PERSON” signal-indication-bearing surface of the unit shall overlay each other and shall display either a Portland Orange colored LED “UPRAISED HAND” or lunar white colored LED “WALKING PERSON.” These displays shall provide a uniform light dispersion of the “UPRAISED HAND”/“WALKING PERSON” symbols and shall conform to ITE ST-055-E, Section 5. Each symbol shall be in solid format, with the interior of the symbol illuminated and containing a number of LEDs to maintain a uniform appearance.

b. The countdown display message-bearing surface shall be supplied with two LED numerals to display a count from “00" to “99" in Portland Orange color. The display segments that comprise the numerals shall be approximately 0.5-inches wide and shall be formed by two or more rows of LEDs.

c. The message lenses, except for the solid symbol, shall be obscured by a black opaque background. When not illuminated, the symbols shall not be distinguishable by pedestrians at the far end of the controlled crossing.

11. "UPRAISED HAND" and "WALKING PERSON" symbols shall each be a minimum of 11 inches in height and 7 inches in width for nominal 16-inch pedestrian signal housings and 9 inches in height and 5.25 inches in width for nominal 12-inch pedestrian signal housings. The countdown display numbers numerals shall be a minimum 7 inches in height and 3.75 inches in width. They shall be configured as shown in Section 4E.04 of the MUTCD.

12. Design the optical system for pedestrian traffic signals utilizing LED illumination so as to minimize the return of outside rays entering the unit. The system shall consist of a polycarbonate message lens and a LED solid-state signal module.

    a. The lens material shall be clear, UV stabilized, refraction type polycarbonate plastic. Fit the inside of the lens with a one- piece sponge neoprene gasket fitted around the lens perimeter to create a weatherproof seal whenever the lens, doorframe and case are properly mated.

    b. Mount the LED pedestrian traffic signal so as to be impervious to shocks generated during shipping, handling and installation. Removal and installation of the module shall not require the use of tools.

    c. Provide the LED pedestrian traffic signal with colored leads conforming to ITE ST-017B. The leads shall be 18 AWG, 19 strands, wired to the respective terminals of the field wire terminal block.

13. The Portland Orange "UPRAISED HAND" and countdown number shall utilize AlInGaP (Aluminum Indium Gallium Phosphorus) LEDs. The substrate material may be either transparent or absorbing. The white LEDs "WALKING PERSON" shall be InGaN (Indium Gallium Nitride).

14. Luminous Intensity

    a. Maintain minimum luminous intensity in accordance with ITE ST-017B.

    b. The luminous uniformity of the "UPRAISED HAND", "WALKING PERSON" symbols' and countdown display indication's illumination shall maintain a ratio of not more than 1 to 5 between the minimum and maximum luminous intensity measurements (in cd/m^2), as measured in 12mm (0.5in) diameter spots.

    c. LED pedestrian traffic signal shall be designed so that when operated over the specified ambient temperature and voltage ranges, the signal shall attract the attention of, and be readable to, a pedestrian (both day and night) at all distances from 10 feet to the full width of the area to be crossed.

15. Chromaticity

    a. The measured chromaticity coordinates of the LED-based pedestrian traffic signal modules shall conform to the chromaticity requirement of ITE ST-017B.

    b. The color uniformity of the LED pedestrian traffic signal shall conform to the requirement of ITE ST-017B Pedestrian Traffic Control Signal Indications – Part 2: Light Emitting Diode (LED) Pedestrian Traffic Signal Modules.

    c. The measured chromaticity coordinates of the individual LED light sources used in the Countdown Timer shall conform to the chromaticity requirements of the Pedestrian “UPRAISED HAND” symbol of the of ITE ST-017B Pedestrian Traffic Control Signal Indications – Part 2: Light Emitting Diode (LED) Pedestrian Traffic Signal Modules.

16. Electrical

    a. Nominal operating voltage for all measurements shall be 120 ±3 VAC RMS.

    b. The “UPRAISED HAND” and “WALKING PERSON” LED displays and the countdown display numerals shall consume no more than 15 watts each.

    c. All LEDs shall be rated for 100,000 hours or more at 77 degrees F (25 degrees C) and 20 milliamps.

    d. The forward current, as measured through each LED, shall not exceed 60 percent of the LED manufacturer’s maximum current rating or the LED manufacturer’s recommended drive current to achieve a minimum of 100,000 hours of operation without catastrophic failure, whichever is less, when operating at 77 degrees F (25 degrees C).

    e. The LEDs shall not emit visible light when subjected to a 120 VAC, 4-milliamp leakage current from a NEMA solid-state load switch (load switch in the off state).

    f. The LEDs shall be wired in series parallel strings. The failure of any one LED, and its associated string of LEDs, shall not cause the loss of more than 20 percent of the light output of the complete LED display.

    g. The LED circuitry shall prevent flicker at less than 100 Hz over the voltage range specified above.

    h. The LED circuitry shall include voltage surge protection against high-repetition noise transients and low-repetition noise transients as stated in NEMA TS 2.

    i. The LED pedestrian traffic signal, including its circuitry, shall meet Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of noise.

    j. The LED pedestrian traffic signal shall maintain a power factor of

0.90 or greater over the operating voltage range and temperature range specified above.

k. Total harmonic distortion (current and voltage) induced in an AC power line by an LED signal display shall not exceed 20 percent over the operating voltage range and temperature range specified above.

l. Each LED pedestrian traffic signal shall be operationally compatible with the traffic signal equipment that it is designed and intended to interface with. The equipment includes all controllers, conflict monitors, current monitors, switch packs and flashers.

17. Operational Requirements

a. The countdown timer shall be designed to count down to zero only during the “Flashing Don’t Walk” interval. During the “Don’t Walk” interval (steady “UPRAISED HAND” indication), the display shall always be dark. All units shall be delivered configured to count down to zero from the pedestrian clearance time.

b. The unit, when connected to the appropriate pedestrian switch pack outputs, shall have an automatic learn mode in order to learn and store the pedestrian times in its memory and to self-adjust for subsequent changes in pedestrian timing. The individual “Walk” and “Flashing Don’t Walk” times shall be stored in two separate counters.

c. Following power restoration to the unit after a power outage of greater than two seconds the unit shall remain dark for one pedestrian cycle to learn, to acquire the current pedestrian timing and to replace any values that were stored in memory prior to the power outage with the newly acquired values. The unit shall display the newly acquired times on the next pedestrian cycle.

d. The unit shall detect changes in pedestrian timing during normal operation and act upon them as described below:

1) The countdown timer shall automatically re-program itself should it detect any increase in pedestrian timing. The increased timing shall be displayed on the subsequent pedestrian cycle.

2) The countdown timer shall ignore any shortened pedestrian cycle that produces a shortened “Flashing Don’t Walk” interval equal to or less than two seconds.

3) The countdown timer shall detect any reductions in pedestrian timing (such as those occurring during a traffic preemption cycle) and shall display on the subsequent pedestrian cycle the timing stored in its memory prior to the shortened pedestrian cycle.

4) The countdown timer shall re-program itself should it detect two consecutive identical shortened pedestrian cycles and shall display this timing on the next pedestrian cycle.

5) The unit shall be designed to suspend any timing and go dark when, for any reason, the switch pack output displays "Don't Walk" during the timing of a pedestrian "Walk" or "Flashing Don't Walk" interval and if the timer has not arrived at the zero count in the cycle.

e. The countdown timer shall be capable of timing consecutive complete pedestrian cycles outputted by the traffic control system.

f. The unit shall be designed to operate during and following a preemption cycle as described below:

1) The timer shall recognize if the "Walk" or "Flashing Don't Walk" times have been truncated or shortened.

a) During some preemption events, the "Walk" condition, if displayed, would be truncated by the traffic controller and would then proceed immediately to time the full "Flashing Don't Walk" interval. Should this condition be detected, the timer shall detect the termination of the "Walk" and the beginning of "Flashing Don't Walk" and shall begin timing of the "Flashing Don't Walk" interval stored in its memory toward zero.

b) During other preemption events, the "Walk" interval, if displayed, would be truncated by the traffic controller and would then proceed immediately to time a shortened pedestrian clearance interval. Should this condition be detected, the timer shall detect the termination of the "Walk" and the beginning of "Flashing Don't Walk" and shall begin timing of the pedestrian clearance interval stored in its memory toward zero. Once the switch pack output displays "Don't Walk" (steady "UPRAISED HAND" indication) during the timing of this pedestrian clearance interval and if the timer has not arrived at the "zero" count in the cycle, the timer shall go dark.

c) There are also preemptions that immediately eliminate both the "Walk" and clearance outputs. In these cases, the pedestrian indication shall immediately cycle to "Don't Walk" (steady "UPRAISED HAND" indication). If this occurs, the countdown timer shall recognize "Don't Walk" and the timer shall go dark.

2) At the cycle following a preempted time, the countdown timer shall display the correct time as initially programmed and shall not be affected by the reduced time. If the reduced time is equal to or less than two seconds, the countdown shall ignore this and shall continue to display the correct time as initially programmed.

g. The countdown timer shall be designed to retain the pedestrian timing stored in its memory for all power outages of less than one second and to continue timing of the pedestrian timing if the traffic control system has resumed pedestrian timing following the duration of outage. For outages of between one and two seconds, memory may or may not be retained. For all power outages greater than two seconds, the unit shall resume operation as described for power outages above.

D. Audible-Tactile Pedestrian Signal System (APS)

1. The type, number and location of APS shall be as shown on the Contract Drawings.

2. The System shall support from 2 to 16 Pedestrian Pushbutton Stations (PBSs) per intersection (maximum of 4 pushbuttons per channel) controlled by a single base unit located in the traffic control cabinet.

3. The System shall be able to be set to vibrate a tactile arrow button during the “Walk” interval following a button push and/or every time the “Walk” comes up.

4. The System shall have the field-selectable function known as “Locating Tone”. This means that during the “Flashing Don’t Walk” and the “Don’t Walk” intervals, the system shall provide a locating tone that emanates from the PBS. The system shall provide at least three different sounds to choose from.

5. The System shall have the field selectable function known as “Extended Push Activation”. This means that the audible “Walk” message will only be activated and sound during the “Walk” interval if the button is depressed for a field selectable minimum period of time (from 0 to 6 seconds). Also, for the following “Walk” phase, the volumes have a separately settable minimum and maximum volume levels.

6. The System shall have the field selectable function known as “Informational Message” programmed to a custom message as per the Contract Drawings only when the button is depressed for a minimum field selectable time.

7. The System shall provide a “Wait” message that plays once the button is activated until the “Walk” cycle goes into effect. This message must have the field selectable option of OFF or playing every 4, 6, 8 or 10 seconds.

8. The System shall provide audible countdown representing the time remaining during the pedestrian clearance interval and shall be automatically adjusted to “Flashing Don’t Walk” timing.

9. The System shall provide Emergency preemption message in conjunction with a preemption system as a selectable feature if specified on the contract drawings.

10. All sounds for all PBSs must be synchronized.

11. The system shall have an ambient sensing microphone located in the pedestrian station in a non-visible, environmentally protected housing.

12. The System shall mute sounds on all crosswalks except the activated

crosswalk if specified on the Contract Drawings.

13. Central Control Unit and Management Module

    a. Shall be installed inside the traffic signal controller cabinet and powered by the AC receptacle. This unit shall serve as the power supply and signaling interface between the traffic signal controller and the PBS(s) located on the traffic signal equipment.

    b. Shall control up to 16 PBSs in a maximum of 4 channels up to 4 PBSs per channel.

    c. Shall control up to four Pedestrian channels, receiving its timing from the pedestrian signals.

    d. Shall be able to self-test all PBSs and put a channel into recall should a PBS fail the self-test.

    e. Shall be provided with a cable interface harness assembly.

    f. Shall be provided with an interface connection board.

    g. Shall have Ethernet access to PBSs through the unit to be able to change the settings of PBS as well as monitor the self-test events of the PBSs and report back to the central control.

    h. Shall have internal memory to store a minimum of 100 hundred events with a date-time stamp for each event.

    i. The unit shall have a minimum of the following built-in conflict monitoring systems:

        1) Monitors the PBS and the pedestrian signals and powers off the channel upon a conflict.

        2) Processors monitor each other and reset the unit upon loss of internal communication.

    j. Shall provide the ability to test each individual communication channel to each PBS allowing the user to detect problems due to faulty/incorrect wiring.

    k. Shall provide the user the ability to restore an entire intersection's configuration settings from a saved file.

14. Pedestrian Pushbutton Station (PBS)

    a. See Contract Drawings for model and manufacturer information.

    b. PBS shall be a single fixture that contains the vibro-tactile 2-inch ADA-compliant pedestrian pushbutton with directional tactile arrow, a weatherproof speaker, and the appropriate sign for each location.

    c. PBSs shall require only two wires coming from the traffic control cabinet for each phase / crosswalk.

    d. Each PBS shall have a unique ID.

    e. CONSTRUCTION:

        1) FRAME: Cast Aluminum, Powder Coated.

2) MESSAGE SIGN: Aluminum, Powder Coated, Ink Markings.

3) PUSHBUTTON: Aluminum, Powder Coated.

4) MESSAGE SIGN: Aluminum sign panel with panel detail as per the sign legend on the Contract Drawings. Sign shall include a transparent braille overlay for the message on the sign referencing the pushbutton and its associated crossing.

f. PBS shall indicate to the user that the button has been pushed, in either the "Don't Walk" interval or "Flashing Don't Walk" interval, by illuminating a pilot light on the front of the PBS and by providing a momentary tactile pulse.

g. The audible "Walk" indication shall be programmed with a speech "Walk" message and shall provide a clear message that the "Walk" interval is in effect, as well as to which crossing it applies. The audible "Walk" indication shall conform to Section 4E.11 of the current edition of the MUTCD.

E. Pedestrian Pushbutton Assemblies (Non-APS):

1. The type, number and location of pedestrian pushbutton assemblies (non-APS) shall be as shown on the Contract Drawings.

2. Pushbutton Assemblies

a. See Contract Drawings for model and manufacturer information.

b. Pushbutton assemblies shall include the complete pushbutton housing, integral frame and instruction sign, suitable wiring from the terminals of the pushbutton to the base of the support. All pushbuttons shall operate on logic ground 2 conductor wire system.

c. Pushbuttons shall be of the latching type.

d. The pushbutton assembly shall meet or exceed all accessibility guidelines with a vandal-proof design.

e. The pushbutton shall clearly indicate by means of tactile arrows which crosswalk signal is actuated by each pushbutton. The tactile arrow shall be located on the pushbutton, have a high visual contrast (light on dark or dark on light), and shall be aligned parallel to the direction of travel on the associated crosswalk.

f. An accessible pedestrian pushbutton shall incorporate a locator tone that conforms to Section 4E.12 of the current edition of the MUTCD.

g. Provide an instruction sign in conformance with MUTCD requirements and as shown in the Contract Drawings.

h. All exposed screws shall be stainless steel and tamper-proof.

3. Pushbutton Central Control Unit

a. Pushbutton Central Control Unit shall be Push Button Control Unit for Bulldog Buttons (PBCU) with Push Button Control Unit External

Box (PBCU-EB) as manufactured by Polara Engineering Inc., or approved equal.

b. PBCU shall be installed inside the traffic signal controller cabinet and powered by the AC receptacle. This unit shall serve as the power supply and signaling interface between the traffic signal controller and the PBA(s) located on the traffic signal equipment. Unit shall include an external box shelf mount insert enclosure to house the PBCU card. Unit shall be provided with a cable interface harness assembly and interface connection board to field units.

F. Pushbutton poles, if any, shall consist of a traffic signal pedestal and base complete with all mounting hardware including a weather-tight pole cap as detailed on the Contract Drawings.

G. All units shall be assumed to include an extension unit to achieve an unobstructed horizontal reach of 10 inches or less, unless otherwise specified on the Contract Drawings. Extension units shall be of heavy duty construction and of the same manufacturer as the pushbutton or per recommendations of the pushbutton manufacturer. The extension bracket shall be bolted or banded to the pole as per the Contract Drawings, and all wires shall be routed inside of the bracket to protect from vandalism. Any locations where two (2) units are to be mounted on the same pole, a mounting adapter shall be provided so that both units can be mounted without conflict, unless otherwise specified on the Contract Drawings.

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PART 3 – EXECUTION

3.01 PREPARATION

A. Before manufacture or procurement of equipment, submit Catalog Cuts and Shop Drawings for prior Engineer approval as specified in 1.08. No equipment shall be procured until the Engineer has given written approval.

B. Relocated traffic signal equipment, if any, shall be shown on the Contract Drawings. Removed equipment, if any, shall not be used in a new installation unless specifically called for on the Contract Drawings. All removed traffic signal equipment shall remain the property of NYSDOT. Deliver all removed existing above ground traffic signal equipment to NYSDOT. The Contractor shall coordinate delivery with NYSDOT. All other equipment designated on the Contract Drawings for disposal shall be disposed of by the Contractor.

3.02 INSTALLATION

A. Install Pedestrian Traffic Signals in accordance with the guidelines specified in the MUTCD at locations shown on the Contract Drawings.

B. The orientation of the Pedestrian Traffic Signal shall be convenient to the pedestrians intending to cross the roadway controlled by the pedestrian signals.

C. Drill and tap each pole to which the Pedestrian Traffic Signal is to be attached and install the necessary nipples and bushings to secure the Pedestrian Traffic Signal to the poles. The connections of Pedestrian Traffic Signal to the pole shall be weatherproof.

D. Wire the pedestrian traffic signals and pushbutton assemblies to implement the signal operations shown on the Contract Drawings. Route a separate continuous multiple conductor cable to each pedestrian traffic signal and pushbutton assembly. The cable size and number of conductors shall be as shown on the Contract Drawings. Wire each pedestrian signal and pushbutton assembly in accordance with the Contract Drawings.

E. Until the installed signal heads are placed into operation, they shall be covered with an opaque material and turned off. The material shall be adequately fastened to the signal heads in a neat, secure, and weather-proof manner.

F. After installation of equipment, the Engineer may perform a site inspection of the equipment. If any equipment has been damaged or if, for any reason, the equipment does not comply with the requirements or testing hereof, the Contractor shall repair or replace the equipment at no cost to Metro North or NYSDOT, even though the equipment had been inspected previously. After such satisfactory replacement and/or repair and Engineer's subsequent written approval, the equipment may be tested as per 1.05 D.

G. Mounting hardware shall be installed using the appropriate size serrated and lock rings as per the Contract Drawings.

3.03 FIELD TESTS

A. Perform installation test in accordance with Article 1.05 D.

B. Once the signal installation is complete, the following approval process inspection schedule will be followed:

1. The contractor shall be notified 2 weeks prior to the Pre-final Inspection.
2. Following the Pre-final inspection, the contractor shall have 2 weeks to complete any punch list items generated from the inspection.
3. After the 2-week period, the Contractor shall then be notified 2 weeks prior to the Final inspection.
4. Following the Final inspection, the Contractor shall have 2 weeks to complete any punch list items generated from the inspection.
5. Once all punch list items have been completed, the signal shall be placed into flashing operation for a minimum of one week.
6. Once the signal is fully operational a 30-day test period begins.
7. Following the 30-day test period, the Contractor shall work with the Engineer to complete the Asset Commissioning forms. These forms must be completed within 1 week.
8. All maintenance and operational responsibilities shall be assumed by NYSDOT upon completion of the forms.

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SECTION 16 05 73

PEDESTRIAN TRAFFIC SIGNALS, PUSHBUTTONS AND MOUNTING HARDWARE

APPENDIX "A"

3.04 SUBMITTALS

A. Submit the following to the Engineer in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

1. Submit the following to the Engineer within forty-five (45) days after receipt of the acceptance of the Proposal:

a. Detailed drawing(s) for Pedestrian Traffic Signal equipment, including recommended mounting instructions. The submittal shall include the environmental tolerance provisions of the equipment, including the material that the housing, visors, lens, mounting brackets and hardware are fabricated from. Included within this documentation shall be electrical schematic wiring diagrams for the equipment, defining terminal identification number assignment.

b. Five complete sets and one reproducible master set of operations and maintenance instructions including preventive and corrective maintenance.

c. One compact disk containing electronic files of a complete master set of shop drawings for the Pedestrian Traffic Signal equipment, operations and maintenance instructions including preventive and corrective maintenance.

d. Five complete sets and one reproducible master set of all test process and results. This shall include, but not be limited to, the Quality Assurance (QA) process and test results documentation, Design Qualification (DQ) process and test results documentation and installation process and test results documentation.

END OF APPENDIX A

END OF SECTION

SECTION – 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 – PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each

speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.

2. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

3. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.05 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 – EXECUTION (NOT APPLICABLE)

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SECTION – 22 11 13

FACILITY WATER DISTRIBUTION PIPING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes water-distribution piping and related components for water service.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.03 DEFINITIONS

A. EPDM: Ethylene propylene diene terpolymer rubber.

B. LLDPE: Linear, low-density polyethylene plastic.

C. PA: Polyamide (nylon) plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1. Wiring Diagrams: Power, signal, and control wiring for alarms.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control test reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with standards of authorities having jurisdiction for water-service piping, including materials, installation, testing, and disinfection.

B. Piping materials shall bear label, stamp, or other markings of specified testing

agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Non-potable water piping and systems, including valves, shall be conspicuously labeled in accordance with the standards of the authorities having jurisdiction and local and state code requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends and flange faces.

3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.

2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

1.09 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of water-distribution service without Owner's written permission.

1.10 COORDINATION

A. Coordinate system with existing well structure.

PART 2 – PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Application" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Non-potable water piping and systems, including valves, shall be conspicuously labeled in accordance with the standards of the authorities having jurisdiction and local and state code requirements.

2.02 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B88, Type K and ASTM B88, Type L, water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Hard Copper Tube: ASTM B88, Type K and ASTM B88, Type L, water tube, drawn temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

D. Copper Unions:

1. MSS SP-123.

2. Cast-copper-alloy, hexagonal-stock body.

3. Ball-and-socket, metal-to-metal seating surfaces.

4. Solder-joint or threaded ends.

E. Copper, Brass or Bronze, Pressure-Seal-Joint Fittings:

1. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end. Sizes NPS 2-1/2 and larger with stainless steel grip ring and EPDM O-ring seal.

2. Minimum 200-psig working-pressure rating at 250 deg F.

2.03 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8, BCuP Series.

B. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

2.04 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.

a. Standard: AWWA C219.

b. Center-Sleeve Material: Stainless steel.

c. Gasket Material: Natural or synthetic rubber.

d. Pressure Rating: 200 psig minimum.

e. Metal Component Finish: Corrosion-resistant coating or material.

C. Split-Sleeve Pipe Couplings:

1. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.

a. Standard: AWWA C219.

b. Sleeve Material: Stainless steel.

c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.

d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.

e. Pressure Rating: 200 psig minimum.

f. Metal Component Finish: Corrosion-resistant coating or material.

D. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

2. Dielectric Unions:

a. Description:

1) Standard: ASSE 1079.

2) Pressure Rating: 250 psig minimum at 180 deg F.

3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

a. Description:

1) Standard: ASSE 1079.

2) Factory-fabricated, bolted, companion-flange assembly.

3) Pressure Rating: 175 psig minimum at 180 deg F.

4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric Nipples:
    a. Description:
        1) Standard: IAPMO PS 66.
        2) Electroplated steel nipple complying with ASTM F1545.
        3) Pressure Rating: 300 psig at 225 deg F.
        4) End Connections: Male threaded or grooved.
        5) Lining: Inert and noncorrosive, propylene.

2.05 CORROSION-PROTECTION PIPING ENCASEMENT

A. Encasement for Underground Metal Piping:
    1. Standards: ASTM A674 or AWWA C105.
    2. Form: Sheet or tube.
    3. Material: LLDPE film of 0.008-inch minimum thickness.
    4. Material: LLDPE film of 0.008-inch minimum thickness, or high-density, crosslaminated PE film of 0.004-inch minimum thickness.
    5. Material: High-density, crosslaminated PE film of 0.004-inch minimum thickness.
    6. Color: Black.

2.06 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:
    1. Nonrising-Stem, Metal-Seated Gate Valves:
        a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
            1) Standard: AWWA C500.
            2) Minimum Pressure Rating: 200 psig.
            3) End Connections: Mechanical joint.
            4) Interior Coating: Complying with AWWA C550.
    2. Nonrising-Stem, Resilient-Seated Gate Valves:
        a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
            1) Standard: AWWA C509.
            2) Minimum Pressure Rating: 200 psig.
            3) End Connections: Mechanical joint.
            4) Interior Coating: Complying with AWWA C550.
    3. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:

a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.

2) Minimum Pressure Rating: 250 psig.

3) End Connections: Push on or mechanical joint.

4) Interior Coating: Complying with AWWA C550.

4. OS&Y, Rising-Stem, Metal-Seated Gate Valves:

a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.

1) Standard: AWWA C500.

2) Minimum Pressure Rating: 200 psig.

3) End Connections: Flanged.

5. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:

a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.

1) Standard: AWWA C509.

2) Minimum Pressure Rating: 200 psig.

3) End Connections: Flanged.

6. Nonrising-Stem Gate Valves:

a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.

1) Standard: MSS SP-80.

2.07 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.

b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.

c. Valve: AWWA, cast-iron, non-rising-stem, metal-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.08 CHECK VALVES

A. AWWA Check Valves:

1. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.

a. Standard: AWWA C508.

b. Pressure Rating: 175 psig.

2.09 VACUUM BREAKERS

A. Pressure Vacuum Breaker Assembly:

1. Standard: ASSE 1020.

2. Operation: Continuous-pressure applications.

3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

4. Size: To match piping system.

5. Design Flow Rate: 18 gpm max.

6. Accessories: Ball valves on inlet and outlet.

2.10 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:

1. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F when external temperatures reach as low as minus 30 deg F.

a. Standard: ASSE 1060.

b. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.

c. Class I: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.

1) Housing: Reinforced stainless-steel construction.

a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.

b) Drain opening for units with drain connection.

c) Access doors with locking devices.

d) Insulation inside housing.

e) Anchoring devices for attaching housing to concrete base.

2) Electric heating cable or heater with self-limiting

temperature control.

B. Enclosure Bases:

1. Description: 6-inch minimum thickness precast concrete, of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

2.11 HYDRANTS

A. Post-Type Hydrants:

1. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.

a. Pressure Rating: 150 psig minimum.

b. Outlet: One, with horizontal discharge.

c. Hose Thread: NPS 2-1/2, with NFPA 1963 external hose thread for use by local fire department, and with cast-iron cap with brass chain.

d. Barrel: Cast-iron or steel pipe with breakaway feature.

e. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.

f. Security: Locking device for padlock.

g. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

h. Inlet: NPS 2 minimum.

i. Operating Wrench: One for each unit.

PART 3 – EXECUTION

3.01 EARTHWORK

A. Refer to Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 3/4 to NPS 3 shall be the following:

1. Soft copper tube, ASTM B88, Type K; wrought-copper, solder-joint fittings; and brazed copper, pressure-seal fittings joints.

F. Aboveground Water-Service Piping NPS 3/4 to NPS 3 shall be the following:

1. Hard copper tube, ASTM B88, Type K; wrought-copper, solder-joint fittings;

and brazed copper, pressure-seal fittings joints.

3.03 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, non-rising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, non-rising-stem, metal seated gate valves with valve box.

2. Use the following for valves in vaults and aboveground:

a. Gate Valves, NPS 2 and Smaller: Bronze, non-rising stem.

b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, metal seated.

c. Check Valves: AWWA C508, swing type.

3.04 PIPING INSTALLATION

A. Install PE corrosion-protection encasement according to ASTM A674 or AWWA C105.

B. Bury piping with depth of cover over top at least 60 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:

1. Under Driveways: With at least 36 inches cover over top.

2. Under Railroad Tracks: With at least 48 inches cover over top.

3. In Loose Gravelly Soil and Rock: With at least 12 inches additional cover.

C. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

D. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.05 INSTALLATION OF HANGERS AND SUPPORTS.

A. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.

2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.

3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.

4. Spring hangers to support vertical runs.

5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

B. Install hangers for copper tubing with maximum spacing and minimum rod diameters to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping within 12 inches of each fitting and coupling.

D. Support vertical runs of copper tubing to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.06 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools and procedures recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.

3.07 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.08 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. MSS Valves: Install as component of connected piping system.

D. Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.09 VACUUM BREAKER ASSEMBLY INSTALLATION

A. Install pressure vacuum breaker assemblies of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install pressure vacuum breaker assemblies in vault or other space subject to flooding.

3.10 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.11 HYDRANT INSTALLATION

A. Install post-type flushing hydrants with valve below frost line and provide for drainage. Support in upright position. Include separate gate valve or curb valve and restrained joints in supply piping.

3.12 CONNECTIONS

A. Connect water-distribution piping to existing water system. Use tapping sleeve and tapping valve.

B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.13 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.14 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 31 20 00 "Earth Moving."

3.15 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction and local and state codes.

3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction and local and state codes.

a. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

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SECTION – 26 05 00

COMMON WORK RESULT FOR ELECTRICAL

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for basic electrical studies and reports, material handling, and other basic electrical materials and methods.

B. Related Sections:

1. Division 01 Specification Sections
2. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
3. Section 26 05 26 – Grounding and Bonding
4. Section 26 05 29 – Hangers and Supports for Electrical Systems
5. Section 26 05 33 – Raceway and Boxes for Electrical Systems
6. Section 26 05 43 – Underground Ducts and Raceways for Electrical Systems
7. Section 26 05 53 – Identification for Electrical Systems
8. Section 26 05 95 - Heat Tracing
9. Section 26 24 16 – Panelboards
10. Section 26 27 13 – Electricity Metering
11. Section 26 27 26 – Wiring Devices
12. Section 26 27 43 – Electric-Vehicle Service Equipment - AC Level 2
13. Section 26 43 13 – Surge Protective Devices
14. Section 26 56 13 – Lighting Poles and Standards
15. Section 26 56 19 – LED Exterior Lighting

1.2 REFERENCES

A. America National Standards Institute (ANSI):

1. ANSI Z535.4, Product Safety Signs and Labels.

B. Institute of Electrical and Electronic Engineers (IEEE):

1. ANSI/IEEE 141, Recommended Practice for Electric Power Distribution for Industrial Plants – Red Book.
2. ANSI/IEEE 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems – IEEE Buff Book.
3. ANSI/IEEE 399, Recommended Practice for Power Systems Analysis – Brown Book.
4. ANSI/IEEE 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.

5. IEEE 1036, Guide for Application of Shunt Power Capacitors.
6. ANSI/IEEE 1584, Guide for Arc-Flash Hazard Calculations.
7. ANSI/IEEE C37.10, Guide for Diagnostics and Failure Investigation of Power Circuit Breakers.
8. ANSI/IEEE C37.13, Low-Voltage AC Power Circuit Breakers Used in Enclosures.
9. ANSI/IEEE C57.12.59, Standard for Dry-Type Transformer Through-Fault Current Duration

C. InterNational Electrical Testing Association, Inc. (NETA):

1. ANSI/NETA ETT Standard for Certification of Electrical Testing Technicians.

D. National Electrical Contractors Association (NECA)

1. ANSI/NECA 100 Symbols for Electrical Construction Drawings.

E. National Fire Protection Association (NFPA):

1. NFPA 70, National Electrical Code (NEC).
2. NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

F. The Society for Protective Coatings (SSPC):

1. SSPC-SP 2, Hand Tool Cleaning.

G. Other Published References:

1. Electrical Safety Handbook, by John Cadick, McGraw Hill, Inc., Article on Safety Electrical One-Line Diagrams.

1.3 DEFINITIONS

A. PCC: Point-of-Common-Coupling, which occurs at terminals to which both harmonic producing loads, such as variable speed drives, and non-harmonic producing loads are connected.

B. THD: The Total Harmonic Distortion of the electrical system, including the effects of all harmonics.

C. UPS: Uninterrupted power supply, usually an independent electrical power supply designed to provide power when normal electrical service is interrupted.

1.4 DESIGN REQUIREMENTS

A. The contractor shall Prepare and submit a Short Circuit, Arc-Flash, and Protective Device Coordination Study and a Harmonic Distortion Study as specified in this Article.

B. The studies shall be performed under the supervision of a professional engineer using computer software by SKM Systems Analysis Power Tools, ETAP or equal.

1. Immediately after award of the Contract, collect all data needed to perform calculations for the studies.

a. Obtain, in writing, electrical utility source information and any other

information required from the utility to perform the necessary studies directly from the serving utility.

b. The Owner and Engineer will provide, as available, information about the portions of the facility's existing electrical system affected by the work performed under this Contract.

1) The Owner will provide two copies of the latest revision of the existing facility record drawings and the facility equipment list to the Contractor for use in defining existing equipment load requirements.

2) Base the contribution of motors on actual motor loads as indicated on the equipment list, system one-line diagrams, and panel schedules.

3) If the information provided is insufficient to perform the studies or represents unknown ratings of existing equipment, investigate and obtain the information required.

a) Employ qualified technicians to obtain the necessary data.

c. Obtain data for new equipment directly from suppliers and other Contractors working on the project.

2. Once the data needed is obtained, perform a preliminary computerized Short Circuit, Arc-Flash, and Protective Device Coordination Study and a preliminary computerized Harmonic Distortion Study, both complete with calculations.

a. At least two full calendar weeks prior to submitting Shop Drawings for equipment included the respective studies, submit the preliminary studies and corresponding computer printouts and annotated one-line distribution diagram to the Engineer for review and comment.

b. After the Engineer provides his comments, submit four copies of the revised and corrected preliminary studies.

3. Include the following types of information common to each study:

a. Calculations and tabulations.

1) Ensure that the calculations in the Short Circuit, Arc-Flash, and Protective Device Coordination Study are sufficient to ascertain interrupting and/or withstand ratings of the equipment.

a) Identify items of distribution system equipment that are not rated for the available fault current, and provide corrective recommendations for consideration.

2) Ensure the calculations in the Harmonic Distortion Study are sufficient to ascertain the adequacy of harmonic filter performance.

b. Data on the computer programs used to perform calculations and tabulations.

c. An appendix to each report that includes the information obtained from outside entities, agencies, electrical manufacturers, the serving utility company, field inspections, and other field sources such as the following:

1) Copies of letters.

2) Photographic records.

3) Nameplate tracings.

4) Actual data sources from which the data and information was obtained.

C. Final Project Report:

1. After the Engineer accepts the revised and corrected preliminary studies, prepare a report summarizing the results of the individual studies; and submit this Final Project Report to the Engineer for acceptance and approval.

a. Include the following sections in the Final Project Report:

1) Description.

2) Purpose.

3) Basis and scope of the study.

a) A single line diagram of that portion of the power system that is included within the scope of the study.

b) Computerized time versus current coordination graphs and corresponding printouts for protective devices.

c) Include the feeder cable damage curves associated with the items being coordinated in these graphs.

d) Include the ANSI/NEMA MG 1 damage points for the motors in the system and the ANSI/IEEE C57.12.00 mechanical and electrical damage points on the curves.

4) Tabulations of the relay and circuit breaker trip settings, fuse selection, and commentary regarding same.

5) Harmonic data at Points-of-Common-Coupling (PCC).

b. Submit ten bound copies of the Final Project Report for review and approval and two copies of record drawings showing the existing facility as it was before the work of this Contract was performed.

c. Once the Final Project Report has been approved, forward one additional bound final copy of the report to the Owner.

D. Short Circuit, Arc-Flash, and Protective Device Coordination Study:

1. Prepare the Short Circuit, Arc-Flash, and Protective Device Coordination Study under the supervision of a Professional Engineer licensed in the state of NY, or have a NETA certified electrical testing laboratory employing technicians certified according to ANSI/NETA ETT prepare it.

   a. Perform the short circuit portion of the Study in accordance with ANSI/IEEE C37.10, ANSI/IEEE C37.13, ANSI/IEEE 141, ANSI/IEEE 242, and ANSI/IEEE 399.

      1) Calculate short circuit momentary duty values and interrupting duty values on the basis of the following short circuit conditions at every distribution transformer, secondary and primary terminal at every bus in every switchboard, motor control center, distribution panelboard, branch circuit panelboard and at terminals of utilization equipment whether it be Electrical, Process, HVAC, Plumbing or Instrumentation that is either 480V or 208V, 3-phase and rated 15 Amps or higher. Include:

         a) Single line to ground fault.

         b) Bolted three-phase line to ground fault.

         c) Double line (line to line) to ground fault.

   b. Perform the arc flash portion of the Study for the electrical distribution equipment in accordance with NFPA 70E and ANSI/IEEE 1584.

      1) Perform the analysis under worst-case arc-flash conditions; and if applicable, describe in the final report how these conditions differ from worst-case bolted fault conditions.

      2) Provide the following items for each circuit and arc location analyzed:

         a) Printed hardcopy of calculations performed.

         b) Arcing fault magnitude.

         c) Device clearing time.

         d) Duration of arc.

         e) Arc flash boundary distances.

         f) Working distance.

         g) Arc flash incident energy.

         h) Hazard risk category.

         i) Personal-protective equipment classes.

         j) Arc flash warning labels as specified in Section 26 05 53.

         k) Recommendations and potential options for arc flash energy reduction to reduce the Incident Energy levels where they are calculated to be over the 40

cal/cm2. Refer to and coordinate with AW Engineering Standards for conducting this work.

l) Maintenance procedures/guidelines in accordance with the requirements of NFPA 70E for the Owner.

c. Coordinate protective devices with systems and equipment by providing the necessary calculations and logic decisions required to select or to check the selection of power fuse ratings, ratios and characteristics of associated current transformers, and breaker trip characteristics and settings and distribution system fuses.

1) Provide coordination plots for phase and ground protective devices on a system basis.

a) Adhere to National Electrical Code restrictions, and maintain proper coordination.

b) Provide a sufficient number of separate curves to clearly indicate the coordination achieved.

2) Either computer-generate or hand-draw time-current characteristics of the specified protective devices on log-log scale plots.

a) Include complete titles, the respective one-line diagram and identifying legends, associated relays or fuse characteristics, significant motor starting characteristics, complete operating bands of low voltage circuit breaker trip curves and fuses.

b) Indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing inrush, through-fault current duration per ANSI/IEEE C57.12.59, dry-type transformers withstand, cable thermal overcurrent withstand limits, symmetrical fault currents and motor full load current, locked-rotor current, and magnetizing inrush in the coordination plots.

3) Provide the selection and settings of the protective devices separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios and connection, manufacturer and type, range of adjustment, and recommended settings.

a) Use the information from the Study to obtain optimum device protective and coordination performance.

2. In addition to the information common to the studies as listed in Subparagraph 1.04.B.3, include the following information specific to short circuit, arc-flash, and protective device coordination distortion only in the Short Circuit, Arc-Flash, and Protective Device Coordination Study:

a. Complete short circuit and protective device coordination studies,

including coordination plots, for the following electrical distribution systems serving the entire facility:

1) Utility Voltage Service.

2) Not used

3) Utility low voltage service system.

4) Low voltage 208Y/120 volts, 3 phase, 4 wire distribution systems.

b. Power company supply and network characteristics, including the following:

1) The base quantities selected.

2) Source impedance data and impedance diagrams.

3) One-line diagrams.

4) Calculation methods and tabulations.

a) Include short circuit tabulations of the fault impedance, X to R ratios, asymmetry factors, KVA, symmetrical and asymmetrical fault currents, and all multiplying factors.

5) Conclusions and recommendations.

c. Capacitor switching transient surge analysis.

1) Indicate effects the capacitor switching has on the electrical power distribution system.

2) If adverse effects on the power distribution system are indicated by the study, submit corrective recommendations with the short circuit and protective coordination study for review by the Engineer.

d. Provide sufficient information in the study to ensure adequate protection of the cables, transformers, and other equipment; to indicate proper coordination between fuses and circuit breakers; and to determine areas of the system in which additional coordination may be required.

3. Submit Short Circuit, Arc-Flash, and Protective Device Coordination Study information with the equipment submittals for review by the Engineer.

E. Electrical Safety Operating Diagrams:

1. Prepare and submit one-line Electrical Safety Operating Diagrams for the electrical system.

a. Make the diagrams similar to the diagrams shown in the article on Safety Electrical One-Line Diagrams in the Electrical Safety Handbook, or in any other nationally recognized style.

1) Show outlines of equipment using a line weight that contrasts with the line weight of wiring.

2) Use heavier of line weights for buses; and use different line weights for each voltage level, increasing the line weight for increasing voltage.

3) Omit ratings, but include the voltage levels of all buses; and include equipment designations and their common names.

4) Use symbolism similar to that on the Contract Drawings or conforming to ANSI standards, such as ANSI/NECA 100, ASME Y14.2M, ASME Y14.24M, ASME Y14.34M, ASME Y14.35M, and ASME Y14.100.

5) Provide a legend on each sheet.

2. Create a diagram for the facility showing the following items:

a. The electrical system showing all sources supplying power to the facility from the first disconnecting device upstream of the building or structure.

b. Overcurrent protective devices, disconnecting devices, and all wiring between them and equipment buses for the following:

1) Main devices and buses in each panelboard.

c. Include branch circuit overcurrent protective devices within panelboards that supply the following items:

1) Feeders to other panelboards and to transformers.

2) Control panels.

3) Transient voltage surge suppressors.

4) Loads larger than 5 kVA or 5 horsepower, or rated over 300 Volts.

d. Equipment:

1) Transformers external to equipment.

2) Motor starters for motors over 1 horsepower and their disconnecting devices.

3) Utilization equipment that is rated larger than 5 kVA or 5 horsepower, or is rated over 300 Volts, and its disconnecting devices.

4) Motors rated over 1 horsepower and their disconnecting devices.

e. Interconnecting wiring between equipment.

f. Sources of all power upstream of the building or structure, and devices that disconnect this power without ratings.

3. For each device show the first item downstream of that device whether or not the downstream item is in the same structure.

4. Submit the Electrical Safety Operating Diagrams for approval.

a. After approval by Engineer, provide an electronic copy of all

Electrical Safety Operating Diagrams on a CD ROM disc in AutoCAD (dwg) or Adobe (pdf) format.

1.5 SUBMITTALS

A. Submit the following information for approval in accordance with the requirements of Section 01 33 00 – Submittal Procedures:

1. Product Data:

a. Submit Product Data, including catalog cuts, for all products provided for the electrical work of this Contract and as specified in other Sections.

1) Clearly indicate the usage of each product on each submittal.

2. Shop Drawings:

a. Submit Shop Drawings for the electrical work of this Contract as specified in other Sections.

3. Quality Assurance/Control Submittals:

a. Design Data:

1) Short Circuit, Arc Flash and Protective Device Coordination Study Reports:

a) Preliminary Short Circuit, Arc Flash and Protective Device Coordination Study.

b) Final Short Circuit, Arc Flash and Protective Device Coordination Study.

c) CD ROM disc containing:

(i) The complete computer program model(s) used in performing the Short Circuit, Arc Flash, and Protective Device Coordination Study. Provide with both the Preliminary and Final Study Reports.

(ii) Spreadsheet in MS Excel format that tabulates all analyzed scenarios with accompanying results. Provide with both the Preliminary and Final Study Reports.

2) Harmonic Distortion Study Reports:

a) Preliminary Harmonic Distortion Study.

b) Final Harmonic Distortion Study.

c) CD ROM disc containing:

(i) The complete computer program model(s) used in performing the Harmonic Distortion Study. Provide with both the Preliminary and Final Study Reports.

(ii) Spreadsheet in MS Excel format that tabulates all analyzed scenarios with accompanying results. Provide with both the Preliminary and Final Study Reports.

3) Final Project Report, with final Short Circuit, Arc Flash and Protective Device Coordination Study and Harmonic Distortion Study Reports.

4) Motor Overload Relay and Branch Circuit Overcurrent Protective Device Schedule.

5) Electrical Safety Operating Diagrams:

a) Hard copies for approval.

b) CD ROM disc in AutoCAD (dwg) or Adobe (pdf) format.

b. Certificates:

1) Testing agency quality verification that all products meet requirements or manufacturer disclaimer statements.

c. Qualification Statements:

1) Testing agency qualifications.

4. Closeout Submittals:

a. Operation and Maintenance Manuals.

b. CD ROM disc containing the complete computer program model(s) used in performing the Circuit, Arc Flash, Protective Device Coordination, and Harmonic Distortion Studies, updated to reflect the final as-built condition.

1.6 SUBSTITUTIONS, BASIS OF DESIGN, AND ACCEPTABLE MANUFACTURERS

A. All substitutions to identified materials or equipment shall comply with the applicable requirements of Division 1. In any case of conflict between such requirements of Division 1 and this paragraph, the more stringent requirements shall govern.

B. Whenever an item of material or equipment is identified by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function and quality required. Unless the identification or description contains or is followed by words reading that no like, equivalent or “or- equal” item or no substitution is permitted, material or equipment of other Suppliers may be proposed.

C. Where substitutions to identified items are permitted, any proposed substation or alternate must fully comply with the following in order to be considered by the Engineer:

1. Be of a reputable manufacturer,

2. Be fully compliant with the requirements of this Section and the Drawings,

3. Be fully compatible with all interfacing items and work, and with the

installation environment,

4. Be appropriate (as determined by the Engineer) for the proposed application, and

5. Be equivalent (as determined by the Engineer) in character, performance, and quality to any identified Basis of Design.

D. Where a specific manufacturer or product is identified as the Basis of Design or listed first in a list of acceptable manufacturers, the overall project design is based on the identified manufacturer or product. If the Contractor elects to substitute a manufacturer or product which differs from the identified Basis of Design, the Contractor shall bear all efforts and costs of any design changes necessary in order to achieve finished work which is equal in character, performance, and quality to the original design depicted in the Contract Documents. Such changes shall include, but not necessarily be limited to changes to ratings and/or features of other equipment, changes to material sizes and/or types, new material and/or equipment, and changes to structural and/or architectural features (including room sizes). Approval by the Engineer of a proposed substitute item shall not relieve the Contractor of this responsibility.

E. The listing of specific manufacturers is solely intended to identify reputable manufacturers who are known to provide quality products of the general type specified. Such listing is in no way intended to imply that the identified manufacturers product(s) have been verified to satisfy the specified requirements, or to be equivalent to any identified Basis of Design manufacturer. Nor does such a listing imply acceptance of products which do not meet the specified requirements, ratings, features, dimensions, and functions as indicated.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Testing Agency Qualifications:

a. Use a NETA accredited testing agency, or approved equal, that is accredited for the region in which the Contract work is performed.

b. Submit the testing agency’s qualifications to the Engineer for approval.

B. Regulatory Requirements:

1. Perform all electrical work in conformance with the requirements of NFPA 70, the National Electrical Code.

C. Certifications:

1. Submit evidence with all Product Data that the products represented meet testing agency quality verification requirements, including agency listing and labeling requirements.

a. Such evidence may consist of either a printed mark on the data or a separate listing card.

b. Submit a written statement from those product manufacturers that do not provide evidence of the quality of their products that indicates why an item does not have quality assurance verification.

1) Such statements provided in lieu of quality assurance verification are subject to the acceptance of the Owner and the Engineer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and equipment to the work site in accordance with the requirements of Section 26 05 00.

1. Deliver materials and equipment in a clean condition.

a. Provide packaging that plugs, caps, or otherwise seals openings both during shipping and temporary storage.

2. Provide equipment needed for unloading operations, and have such equipment on the work site to perform unloading work when the material and equipment is delivered.

a. If possible, clearly identify pick-points or lift-points on electrical equipment crating and packaging.

b. In the absence pick-points or lift-points on equipment crating and packaging, identify pick-points or lift-points on the equipment itself.

B. Handle materials and equipment in accordance with the requirements of Section 26 05 00.

1. Handle materials and equipment in accordance with manufacturer's written instructions.

2. When unloading materials and equipment, provide special lifting harnesses or apparatus as required by manufacturers.

C. Store electrical materials and equipment, whether on-site or off-site, in accordance with Section 26 05 00 and the following:

1. Follow the manufacturer's written instructions for storing the items.

2. Store electrical equipment and products under cover.

a. Except for electrical conduit, store electrical equipment and products in heated warehouses or enclosed buildings with auxiliary heat and that provide protection from the weather on all sides.

1.9 SYSTEM STARTUP

A. Energize the following items in the presence of the Engineer:

1. Process instrumentation.

2. Equipment rated over 300 Volts.

3. Equipment rated over 1-horsepower.

B. Startup the following items in the presence of the Engineer:

1. Instrumentation.

2. Process equipment.

1.10 MAINTENANCE

A. Operation and Maintenance Manuals:

1. Prepare Operation and Maintenance Manuals in conformance with the requirements of Metro North, other Contract requirements, and as follows:
    a. Organize Operation and Maintenance Manuals by Specification Section and equipment number as designated on the Contract Drawings.
    b. Include suppliers, supplier addresses, and supplier telephone numbers for the equipment and products furnished.
2. 60 days prior to the request for final payment, prepare and submit two copies of the proposed Operation and Maintenance Manuals to the Engineer for approval.
3. Upon approval of the proposed Operation and Maintenance Manuals, submit six corrected copies as follows:
    a. Submit one set to the Engineer.
    b. Place one set in the spare parts and fuse cabinet in the new electrical service building
    c. Deliver the remaining four copies to the Owner.
4. Insert final record drawings in each set of Operation and Maintenance Manuals at Project Closeout.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Grounding and Bonding Materials:
1. Provide grounding and bonding materials in accordance with the requirements of Section 26 05 26.

B. Hangers and Supports:
1. Provide hangers and supports for electrical equipment in accordance with the requirements of Section 26 05 28.

C. Electrical Identification Materials:
1. Provide electrical identification materials in accordance with the requirements of Section 26 05 53.

D. Wire and Cable:
1. Provide low-voltage electrical wire, cable, and accessories in accordance with the requirements of Section 26 05 19.

E. Conduit and Raceway:
1. Provide conduit and raceway as indicated, as appropriate for the application per NFPA 70, and in accordance with the following:
    a. Conduit and Tubing: Provide electrical conduit and tubing in accordance with the requirements of Section 26 05 33.

F. Wiring Devices:
1. Provide electrical wiring devices in accordance with the requirements of Section 26 27 26.

2.2 SHOP FINISHING

A. For electrical equipment, factory-apply paint and coating systems that at a minimum meet the requirements of the NEMA ICS 6 corrosion-resistance test and the additional requirements specified in individual Specification Sections.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Field-Applied Finishes:

1. Except for factory-finished items that have been completely finished with factory- applied primer and final finish coatings, finish installed electrical materials, equipment, apparatus, and items in the field.

    a. Apply paint material matching the composition of the factory-applied products.

        1) Obtain factory-supplied paint for this work whenever available.

    b. Comply with the paint manufacturer's instructions for mixing, thinning, surface preparation, application, spreading rate, drying time, and environmental limitations concerning application of the paint.

    c. Apply paint in such a manner so that the finished appearance will match as nearly as possible the factory finish.

        1) Poorly applied paint may be required to be repaired and re-applied by the Contractor in accordance with Article 3.02 at no additional cost to the Owner.

2. Coordinate the painting of large areas with the Engineer to minimize the duration of exposure of other workers to toxic paint fumes.

3.2 REPAIR/RESTORATION

A. If the factory finish of factory-finished items is damaged for any reason, refinish the item.

1. If an item that has several surfaces has damage on one surface, refinish the entire damaged surface.

    a. Surface Preparation:

        1) Outside the damaged area, lightly sand the entire surface and perform additional sanding to profile the damaged paint edge.

        2) Prepare the surfaces of damaged areas in accordance with SSPC-SP 2.

3.3 FIELD QUALITY CONTROL

A. Contractor shall perform electrical testing as detailed in each Specification Section.

B. Contractor shall have electrical work inspected as required by the local Authority Having Jurisdiction (AHJ).

1. Submit a copy of the certification of inspection with the final project closeout documents, and post the original in the electrical room on-site protected by a metal frame with a protective plate glass cover.

C. The quality of finishing and refinishing work is subject to approval by the Engineer.

3.4 MANUFACTURERS' FIELD SERVICES

A. Contractor shall provide the services of a qualified field engineer and necessary tools and equipment to test, calibrate, and adjust the protective relays and circuit breaker trip devices as recommended in the Final Project Report of the power system study.

END OF SECTION

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SECTION – 26 05 13

MEDIUM VOLTAGE CABLES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes cables and accessories for medium voltage (15,000 V) underground electrical service.

B. Related sections:

1. Section 26 05 29 – Hangers and Supports for Electrical Systems
2. Section 26 05 53 – Identification for Electrical Systems

1.03 DEFINITIONS

A. NETA ATS: InterNational Electrical Testing Association Acceptance Testing Specifications

B. NRTL: Nationally Recognized Testing Laboratory

1.04 SUBMITTALS

A. Cable Product Data

B. Qualification Data: For Installer and testing agency.

C. Material Certificates: For cable and accessories.

D. Design Data: Cable pulling calculations, including conduit size and fill percentage, pulling tensions and cable sidewall pressure.

1.05 QUALITY ASSURANCE

A. Installer: Engage a cable splicer, trained and certified by splice material manufacturer, to install, splice, and terminate medium-voltage cable.

B. Testing Agency Qualifications: Member company of NETA or a NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

C. Comply with requirements of New York State Electric and Gas for underground primary service cables.

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PART 2 – PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2 and NFPA 70.

C. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

2.02 CABLES

A. As manufactured by Okonite or approved equal.

B. Cable Type: URO-J Underground Primary Distribution Cable rated 105 degrees C

C. Conductor Insulation: Ethylene-propylene rubber.

1. Voltage Rating: 15kV.

2. Insulation Thickness: 100 percent insulation level.

D. Conductor: Aluminum.

E. Comply with UL 1072, AEIC CS8 and ICEA S-94-649.

F. Conductor Stranding: Class B.

G. Shielding: Extruded semiconducting EPR conductor and insulation screens.

H. Concentric Neutral: Bare copper wires.

I. Cable Jacket: Polyethylene.

2.03 MEDIUM-VOLTAGE TAPES

A. Description: Electrical grade, insulating tape rated for medium voltage application.

B. Ethylene/propylene rubber-based, 30-mil (0.76-mm) splicing tape, rated for 130 deg C operation. Minimum 3/4 inch (20 mm) wide.

2.04 ARC-PROOFING MATERIALS

A. Description: Fire retardant, providing arc flash protection.

B. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch (8 mm) thick, and compatible with cable jacket.

C. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1 inch (25 mm) wide.

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PART 3 – EXECUTION

3.01 INSTALLATION

A. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inches (1200 to 1800 mm) on the pull rope.

1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.

2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching the pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.

B. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.

2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.

3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.

4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.

C. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

D. In cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.

E. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.

F. Install terminations at ends of conductors.

G. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:

1. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.

2. Band arc-proofing tape with two layers of 1-inch (25-mm) wide half-lapped, adhesive, glass-cloth tape at each end of the arc-proof tape.

H. Identify cables according to Section 26 05 53 "Identification for Electrical Systems." Identify phase and circuit number of each conductor at each splice, termination, pull point, and junction box. Arrange identification so that it is unnecessary to move the cable or conductor to read the identification.

3.02 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.

2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.

3. Perform direct-current High Potential test of each new conductor according to NETA ATS. Do not exceed cable manufacturer's recommended maximum test voltage.

4. Perform Partial Discharge test of each new conductor according to NETA ATS and to test equipment manufacturer's recommendations.

5. Perform Dissipation Factor test of each new conductor according to NETA ATS and to test equipment manufacturer's recommendations.

C. Medium-voltage cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION – 26 05 19

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements for furnishing, installing, connecting, energizing, testing, cleaning, and protecting low voltage cable, shielded cable, and accessories.

B. Related Sections:

1. Division 01 Specification Sections
2. Section 26 05 00 – Common Work Result for Electrical
3. Section 26 05 26 – Grounding and Bonding
4. Section 26 05 29 – Hangers and Supports for Electrical Systems
5. Section 26 05 33 – Raceway and Boxes for Electrical Systems
6. Section 26 05 43 – Underground Ducts and Raceways for Electrical Systems
7. Section 26 05 53 – Identification for Electrical Systems
8. Section 26 05 95 – Heat Tracing
9. Section 26 24 16 – Panelboards
10. Section 26 27 26 – Wiring Devices
11. Section 26 27 43 – Electric-Vehicle Service Equipment - AC Level 2
12. Section 26 43 13 – Surge Protective Devices
13. Section 26 56 13 – Lighting Poles and Standards
14. Section 26 56 19 – LED Exterior Lighting

1.02 REFERENCES

A. American Society for Testing Materials (ASTM):

1. ASTM B 8 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

B. Institute of Electrical and Electronic Engineers (IEEE):

1. IEEE 1202 – Standard for Flame-Propagation Testing of Wire and Cables.

C. National Electrical Manufacturer's Association (NEMA):

1. NEMA WC 26/EEMAC 201 – Binational Wire and Cable Packaging Standard.
2. ANSI/NEMA WC 57 – Standard for Control, Thermocouple Extension, and Instrumentation Cables.

D. National Fire Protection Association (NFPA):

1. NFPA 70 – National Electrical Code (NEC).

E. Underwriter's Laboratories, Inc. (UL):

1. UL 13 – Standard for Power-Limited Circuit Cables.
2. UL 1569 – Standard for Metal-Clad Cables.
3. UL 1581 – Reference Standard for Electrical Wires, Cables, and Flexible Cords.
4. UL 2250 – Standard for Instrumentation Tray Cable.

F. Insulated Cable Engineers Association (ICEA):

1. ICEA T-29-520 – Vertical Cable Tray Flame Test @ 210,000 BTU.

1.03 DESIGN REQUIREMENTS

A. Conductors in Raceway and Conduit Systems:

1. Provide conduit systems for installing the wiring that is outside of equipment.
2. Except for raceway or conduit for control wires or where otherwise indicated on the Contract Drawings, design raceway and conduit systems so that the maximum number of low-voltage current carrying conductors (per NFPA 70, Article 310) in each raceway or conduit does not exceed three, plus a ground.

B. Cable Tension Design Requirements:

1. Design conduit runs so that the tension limits set by the wire and cable manufacturers will not be exceeded.
    a. Provide additional pulling points as required to limit the tension to acceptable levels.
2. Generate and submit tension cable pulling calculations for all underground power runs.
    a. Include pull loads, tension, and safety factors for all cables with the calculations.

C. Product Data and Catalog Cuts:

1. Submit low-voltage ground, power, and control wiring product data as listed below for the products provided as the Work of this Section; and clearly indicate the usage of each product on the data submitted.
    a. Wires and cables.
    b. Lugs.
    c. Connectors.
    d. Tapes.
    e. Pulling lubricant.
    f. Tools used to crimp connectors.

D. Use of Trade Names:

1. The use of trade names within the Contract Documents is intended to establish the basis of design and to illustrate the constructability and level of quality required.

a. The use of trade names is not intended to exclude other manufacturers whose products are equivalent to those named, subject to compliance with Contract requirements.

1.04 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of Section 01 33 00 – Submittal Procedures:

1. Product Data:

a. Wires and cables.

b. Lugs

c. Connectors.

d. Tape.

e. Pulling lubricant.

2. Samples:

a. Wire samples.

3. Quality Assurance/Control Submittals:

a. Design Data.

1) Tension cable pulling calculations for all underground power runs.

b. Certificates.

1) Testing agency/quality verification.

c. Manufacturer's Instructions.

1) Cable manufacturer's recommendations.

d. Qualification Statements.

1) Documented experience of the installing firm.

2) Qualifications of the licensed electricians supervising the Work.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications:

a. To install the Work of this Section, employ the services of a firm specializing in installing wire, cable, and accessories, and that has a minimum of 3 years' experience doing so.

1) Submit the documented experience of the firm installing the wire, cable, and accessories.

b. To supervise installation of the Work of this Section, employ licensed electricians.

1) Submit the qualifications of the licensed electricians supervising the Work of this Section.

B. Regulatory Requirements:

1. Perform the Work of this Section in accordance with the requirements specified in NFPA 70, and to all other applicable state, local, and national governing codes and regulatory requirements.

C. Certifications:

1. Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual, or certified as meeting the standards of UL by the Electrical Testing Laboratory (ETL) for the location installed in, and the application intended, unless products meeting the requirements of these testing laboratories are not available or unless standards do not exist for the products.

a. Provide copper conductors listed and labeled by UL for all wiring.

2. Submit evidence of testing agency/quality verification, listing, and labeling for each product with the submitted product data either by providing a printed mark on the data or by attaching a separate listing card.

a. For items without such evidence, submit a written statement from the product manufacturer that indicates why it does not have quality assurance verification.

D. Field Samples:

1. Submit one 36-inch long sample of each type of wire to be used.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Imprint insulated conductors with the date of manufacture, the wire type, and the manufacturer.

2. Package wire and cable in conformance with the requirements of NEMA WC 26/EEMAC 201.

3. Protect items from damage during delivery, handling, and installation.

a. Comply with the cable manufacturer’s recommendations for inspection, handling, storage, temperature conditioning, bending and training limits, pulling limits, and calculation parameters for installing cable.

b. Submit the cable manufacturer’s recommendations for inspection, handling, storage, temperature conditioning, bending and training limits, pulling limits, and calculation parameters for installing cable.

B. Acceptance at Site:

1. Wire and cable manufactured more than 12 months before delivery to the Site is unacceptable for use under this Contract, and will be rejected.

C. Storage and Protection:

1. Store products indoors on blocking or pallets.

2. Protect items from damage during storage.

1.07 PROJECT ENVIRONMENTAL REQUIREMENTS

A. Install armored instrumentation cable only when the temperature is above -40 degrees Celsius.

1.08 MAINTENANCE

A. Operation and Maintenance Manuals:

1. Include product data for the products provided as the Work of this Section in the Operation and Maintenance Manuals submitted with the record drawings at project closeout in accordance with Metro North standards.

PART 2 – PRODUCTS

2.01 LOW VOLTAGE CONDUCTORS

A. Conductor Design Requirements:

1. Provide conductors of the proper size and ampacity ratings based on Article 310 of NFPA 70.

a. Provide copper conductors that have 98 percent conductivity.

b. Unless otherwise indicated on the Contract Drawings, at a minimum provide conductors of the following American Wire Gauge (AWG) sizes:

1) For power and branch feeder circuits: 12 AWG.

a) For power and branch feeders, provide solid or stranded copper low-voltage conductors for sizes up to and including 10 AWG, provide stranded copper low-voltage conductors for 8 AWG and larger sizes.

2) For control circuits: 14 AWG.

3) For alarm and status circuits: 14 AWG.

4) For single conductor instrument wiring: 14 AWG.

5) For multiple conductor instrument wiring: 16 AWG.

B. Insulation Design Requirements:

1. Provide low voltage ground, power, and control wiring having the proper insulation types as follows:

a. For exterior, wet, and damp locations, including NEMA 4X locations: Type XHHW-2.

b. For underground wiring:

1) For sizes 14 AWG through 10 AWG: Type XHHW-2.

2) For sizes 8 AWG and larger: Type RHW-2 or XHHW-2.

c. For ground wires: THW may be used at the Contractor's option.

2. Color Coding of Wires

a. The use of tape for color coding is prohibited.

C. Manufacturers

1. Acceptable Manufacturers:

a. Continental Wire & Cable Company

b. SouthWire

c. General Cable

d. Okonite Co.

e. Or Approved Equal

2.02 MATERIALS

A. 600 Volt Rated Multi-Conductor Cable:

1. Provide multi-conductor cable that is suitable for use outdoors; exposed or concealed; as open wiring; in any raceway, underground duct, or cable tray; direct buried; or embedded in concrete.

a. Provide cable that is UL listed as Type MC in compliance with the requirements of UL 1569, and is UL listed for 90 degrees Celsius dry or wet, for direct burial, for cable tray use, and as sunlight resistant.

2. Assemble the cable with non-hygroscopic fillers and binder tape.

a. Insulated Conductors:

1) Provide uncoated stranded copper conductors, complying with the requirements of ASTM B 8 for Class B conductors.

2) Provide cross-linked polyethylene type XHHW-2 insulation rated for 600 volts.

b. Grounding Conductors:

1) Provide uninsulated copper conductors.

c. Cover the overall assembly with a single strip of interlocked aluminum tape, and then apply an outer final jacket of black flame-retardant PVC.

3. Manufacturers:

a. General Cable Technologies Corporation,

b. The Okonite Company,

c. Or Approved Equal.

2.03 ACCESSORIES

A. Cable Lubricant:

1. Provide cable lubricant specifically recommended by the cable manufacturer for cable pulling operations.

a. For rubber of plastic jacketed cables, provide soapstone, graphite, or talc cable lubricant.

B. Grounding Braid:

1. Provide conformable, all-metal (tinned copper wires), corrosion resistant, woven grounding braid having a high current-carrying capacity approximately that of 6 AWG wire, such as.

2. Manufacturers:

a. 3M, Scotch, Scotch® 25 Electrical Grounding Braid,

b. Plymouth

c. Permacel

d. Or Approved Equal.

C. Tapes:

1. Arc Proofing Tape:

a. Provide fire retardant arc proofing tape, such as Scotch® 77 Fire Retardant Electric Arc Proofing Tape, that is capable of protecting cables from fault arc generated heat and flames and of protecting adjacent wrapped cables and accessories exposed to fault arcs until limiting devices can interrupt the faulted circuit.

2. Vinyl Insulating Tape:

a. Provide UL-listed flexible polyvinyl chloride (PVC) backed insulating tape with a pressure sensitive adhesive, such as black Scotch® 33+ Vinyl Electrical Tape, that is resistant to abrasion, acids, alkalis, and copper corrosion; resistant to, hot, cold and wet weather; and resistant to damage from UV sunlight exposure.

3. Rubber Splicing Tape:

a. Provide highly conformable, linerless, self-bonding, ethylene rubber (EPR), high-voltage (through 69 kV) insulating tape formulated to provide excellent thermal dissipation of splice heat, and designed to insulate splices and terminate cables whose overload temperatures can reach 130 degrees Celsius, such as Scotch® 130C Linerless Rubber Splicing Tape.

4. Manufacturers:

a. 3M, Scotch

b. Plymouth

c. Permacel

d. Or Approved Equal.

D. Tubing:

1. Heat Shrinkable Tubing:

a. Provide flexible, flame retardant, polyolefin heat shrinkable thin wall tubing that has good resistance to common fluids and

solvents, and has a high dielectric strength.

2. Waterproof Splice Kits:

a. Provide heat shrinkable thin wall polyolefin electrical cable splice kits.

3. Manufacturers:

a. Tyco Electronics, CGPT

b. Thomas & Betts Corp.

c. Or Approved Equal.

E. Wire and Cable Connections:

1. Grounding Connectors:

a. Provide grounding connectors conforming to the requirements of Section 26 05 26, Grounding and Bonding.

2. Connectors for Service Wires and Cables, and for Wires and Cables Larger Than Number 6:

a. Split Bolt Connectors or Compression Type Connectors:

1) Provide UL-listed split bolt connectors or compression type connectors for making parallel or butt splices of stranded copper wire.

2) Use companion preformed plastic insulating covers or tape insulation conforming to NFPA 70 (NEC) requirements.

b. Mechanical compression connectors:

1) Provide mechanical compression connectors that are capable of connecting single or multiple conductors, and of being installed with one wrench.

a) Type: Compact, two-hole mechanical compression connectors having two clamping bolts.

(i) Connector Body: Provide a high copper bronze or brass alloy body.

(ii) Bolts: Provide brass or bronze bolts; plated steel screws are unacceptable.

(iii) Fasteners: Provide silicon-bronze fasteners for bolting connectors to connections.

c. Crimped Compression Connectors:

1) Provide two-hole crimped compression type connectors fabricated from high conductivity, seamless, electrolytic wrought copper, electrolytically tin-plated, and color coded to match the dies.

2) Provide crimped compression type connectors with adequate area to conduct the electrical current.

3) To crimp connectors, provide crimping tools from the same

manufacturer that manufactured the connectors.

3. Control Wiring Connections:

   a. For control wiring connections at terminal boards, provide crimped nylon- insulated ring terminals.

   b. For control wiring splices, provide nylon insulated butt splices with insulation grips.

   c. For joining more than two control wires, provide junction boxes with terminal boards.

4. Instrumentation Cable Connectors:

   a. For connecting instrumentation cable and the equipment being furnished under this Contract, provide companion type connectors.

      1) For equipment controllers/enclosures that are furnished under other Sections of this Contract, furnish the connectors for connecting cable to the equipment with the equipment.

      2) Terminate the wiring as required for proper operation.

   b. Manufacturers:

      1) Thomas & Betts Corp.

      2) AMP Inc.

      3) Ilsco Corp.

      4) Ideal Industries, Inc.

5. Connectors for Other Conductors:

   a. Any of the applicable types listed for larger wire may be provided.

   b. Screw Terminal Connections:

      1) For making terminal connections of stranded copper wire to screw terminals, provide nylon insulated crimped compression terminals with copper barrel on the wire.

      2) For making terminal connections of solid copper wire to screw terminals, provide screw lock connectors.

   c. Wire Nuts:

      1) For making splices of copper wire, provide pre-insulated, UL-listed, solderless connectors of the spring-lock or compression type that can be installed by hand or using tools.

      2) For site lighting, wire nuts used in underground or below grade locations is prohibited. There only permitted use for site lighting is within a pole base.

   d. Manufacturers:

      1) Thomas & Betts Corp.

2) Tyco Electronics, AMP Inc.

3) Ilsco Corp.

4) FCI-Burndy® Products

5) Approved equal.

2.04 SOURCE QUALITY CONTROL

A. Tests:

1. 600 Volt Rated Multi-Conductor Cable:

a. 70,000 BTU/hr Vertical Tray Flame Test:

1) 600 Volt rated multi-conductor cable must pass the vertical tray flame test requirements of UL 1569, IEEE 383, and IEEE 1202.

b. 210,000 BTU/hr Vertical Tray Flame Test:

1) 600 Volt rated multi-conductor cable must pass the vertical tray flame test requirements of ICEA T-29-520.

PART 3 – EXECUTION

3.01 INSTALLERS

A. Install the work of this Section only under the supervision of licensed electricians.

3.02 EXAMINATION

A. Inspect all conduits, junction boxes, electrical vaults, and handholes to verify that they are clean, that they do not have burrs, that conduits are properly aligned, and that they are complete.

1. Ensure that on all conduits without threaded hubs, two locknuts are installed.

2. Ensure that in all conduits with wires larger than No. 10, bushings are installed.

3. Ensure that grounding bushings and fittings are installed at all places specified in Section 26 05 26, Grounding and Bonding.

4. Verify that proper sized boxes are installed.

B. Verify that boxes and conduit fittings conform to the bending requirements specified in Article 314 of NFPA 70 (NEC).

3.03 PREPARATION

A. Verify that pulling calculations have been made and are available for long conduit runs and pulls as indicated in this Section.

B. Do not begin installing wiring until other work which might cause damage to the wires, cables, or conduits has been completed.

1. Correct deficiencies in conduits, junction boxes, and handholes that have been discovered by the inspection required in **Paragraph 3.02.A**.

C. Prepare conduits to receive wire and cable.

1. Swab the conduits with a nylon brush and steel mandrel.
2. Pre-lubricate the conduits for which the pulling tension calculations are based on a coefficient of friction less than that of a dry conduit.

D. Verify that a means of controlling the pulling tension on the wire or cable is installed on the mechanical assist devices furnished for pulling cable.

E. Take the necessary precautions to prevent water, dirt, or other foreign material from accumulating in the conduits during the execution of wiring work.

3.04 INSTALLATION

A. Low Voltage Ground, Power, and Control Wiring:

1. Install Type CL2P, FPLP, or CMP cable as required by the application in accordance with the requirements of NFPA 70 (NEC).
    a. For low voltage wiring concealed from view, only install wiring in the accessible locations permitted by the Contract Drawings.
2. Neutral Conductors:
    a. For each single-phase and each multi-phase feeder, provide separate neutrals.
    b. For branch circuits, provide separate neutral conductors.
    c. Except for feeders with a small unbalanced and single-phase load, size each neutral the same as the largest phase conductor.
        1) For feeders with a small unbalanced and single-phase load, size the feeders to the largest of the following:
            a) The size of any three-phase load connected to the neutral, which contains lighting, computer power outlets, instrumentation, or other electric loads.
            b) The size required for 125 percent of the maximum unbalanced load.
3. Equipment Ground Conductors:
    a. Provide a green equipment ground conductor with all runs.
        1) Provide the equipment ground conductor wire type as specified in Section 26 05 26, Grounding and Bonding.

B. Pulling Cable:

1. Establish a feed-in point at the handhole or enclosure located at the highest elevation of the run, and pull cables down grade using flexible cable feeds to convey the cables into the duct runs through the feed-in point opening.
    a. Furnish quadrant blocks located properly along the cable run.
    b. Limit cable pulling tensions to the maximum pulling tensions recommended by the cable manufacturer.
        1) Measure the cable pulling tension on all runs pulled with mechanical assistance and for all cable runs where

calculations are required to be submitted by using a dynameter.

2) Remove cables subjected to excessive bending and tension and that are cracked or have damaged or nicked outer jackets from the Site, and replace these cables with new undamaged cables.

a) If pulling tension is exceeding during pulling, remove the affected cables and mark them as not to be reused.

c. Lubricate cables with lubricants during pulling.

C. Installing Cables in Handholes:

1. Install cable along the handhole wall that provides the longest route and the maximum spare cable length.

2. Form cables so they closely parallel the walls, and do not interfere with duct entrances.

3. Support cable on brackets and insulators spaced at a maximum of 2 feet apart.

4. Use pulling lubricants approved by the cable manufacturer.

D. Terminating Cable:

1. Terminate cable using materials and methods indicated or specified herein, or in accordance with the written instructions of the cable manufacturer or termination kit manufacturer.

a. For equipment connections, provide split bolt or compression type connectors, mechanical compression connectors, or crimped compression type connectors as specified and approved by the equipment manufacturer; for all other types of connections provide connectors of one of the types specified:

2. Protect insulated power and lighting cable terminations from accidental contact, deterioration of coverings, and moisture by using proper terminating devices and materials.

E. Splicing Wire and Cable:

1. Install all service and feeder conductors from end to end without splices.

2. Only splice cables in accessible locations.

3. Below-Grade Splices:

a. Make below-grade splices using a compression connector on the conductor.

b. Insulate and waterproof below-grade splices by methods suitable for continuous submersion in water using either of the methods that follow:

1) Gravity Pour Method:

a) Provide an approved commercial waterproof splice

kit with the necessary materials and equipment, including a mold suitable for the cables to be spliced.

(i) When the mold is in place around the joined conductors, prepare and pour the resin mix into the mold.

2) Cast-Type Splice Insulation:

a) Provide an approved commercial waterproof splice kit with the necessary materials and equipment, including a thermosetting epoxy resin insulating material applied by a gravity pour method or by a pressure injection method.

b) Fix cables in place until the splicing materials have completely set.

c. Within outlet or junction boxes, make wire and cable splices that conform to the requirements of NFPA 70 (NEC).

d. Install these outlet or junction boxes in accessible locations.

F. Wiring Identification:

1. Color code all feeder wires and cables as indicated in the following tables:

Table 26 05 19-1 Feeder Wire and Cable Color Coding	
Phase	**208Y/120 Volts**
A	Black
B	Red
C	Blue
Neutral	White
Electrical Ground Conductor	Green

Table 26 05 19-2 Feeder Wire and Cable Color Coding	
Phase	**120/240 Volts Single-Phase**
A	Black
B	Red
Neutral	White
Electrical Ground Conductor	Green

2. Identify all power wiring by circuit and panelboard, switchboard, and motor control center numbers.

3. Identify all control wiring with wire numbers.

4. Provide additional electrical identification of cabling and wiring as specified in Section 26 05 53, Identification for Electrical Systems.

3.05 FIELD QUALITY CONTROL

A. Site Tests:

1. Prior to energizing wire and cable, field test the wire and cable.

B. Inspection:

1. Record the actual installed elevations and locations of grounding cables and rods, both concealed and exposed, on the record drawings.

a. Verify that the control wiring wire numbers correspond to the numbers indicated in the record drawings.

END OF SECTION

SECTION – 26 05 26

GROUNDING AND BONDING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements for connecting, energizing, testing, cleaning, and protecting grounding and bonding systems.

B. Related Sections:

1. Division 01 Specification Sections
2. Section 26 05 00 – Common Work Result for Electrical
3. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
4. Section 26 05 29 – Hangers and Supports for Electrical Systems
5. Section 26 05 33 – Raceway and Boxes for Electrical Systems
6. Section 26 05 43 – Underground Ducts and Raceways for Electrical Systems
7. Section 26 05 53 – Identification for Electrical Systems
8. Section 26 05 95 – Heat Tracing
9. Section 26 24 16 – Panelboards
10. Section 26 27 26 – Wiring Devices
11. Section 26 27 43 – Electric-Vehicle Service Equipment - AC Level 2
12. Section 26 43 13 – Surge Protective Devices
13. Section 26 56 13 – Lighting Poles and Standards
14. Section 26 56 19 – LED Exterior Lighting

1.02 REFERENCES

A. American Public Works Association (APWA):

1. APWA Public Works Management Practices Manual.

B. American Society for Testing Materials (ASTM):

1. ASTM B 1; Standard Specification for Hard-Drawn Copper Wire.
2. ASTM B 3; Standard Specification for Soft-Drawn Copper Wire.
3. ASTM B 8; Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
4. ASTM C 653; Standard Guide for Determination of the Thermal Resistance of Low-Density Blanket-Type Mineral Fiber Insulation.
5. ASTM D 5; Standard Test Method for Penetration of Bituminous Materials.

6. ASTM D 149; Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.

7. ASTM D 257; Standard Test Methods for D-C Resistance or Conductance of Insulating Materials.

8. ASTM D 570; Standard Test Method for Water Absorption of Plastics.

C. InterNational Electrical Testing Association, Inc. (NETA):

1. ANSI/NETA ETT Standard for Certification of Electrical Testing Technicians.

D. National Fire Protection Association (NFPA):

1. NFPA 70, National Electrical Code (NEC).

E. National Electrical Manufacturing Association (NEMA):

1. NEMA TC-2; Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.

2. NEMA TC-3; Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.

3. NEMA TC-14; Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

4. NEMA WC-7; Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

F. Underwriter's Laboratories, Inc. (UL):

1. UL 467, Standard for Grounding and Bonding Equipment.

2. UL 486A-486B, Wire Connectors.

3. UL 486C, Standard for Splicing Wire Connections.

4. UL 486D, Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.

5. UL 486E, Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.

1.03 DESIGN REQUIREMENTS

A. Design the electrical system installation to conform to Article 300 of NFPA 70, Wiring Methods, and to other applicable articles of NFPA 70 governing methods of wiring.

B. Ground the conduit systems, metal enclosures, equipment frames, and receptacles in accordance with Article 250 of NFPA 70, Grounding.

1. Ground all metallic conduits, wiring channels, and armored cables continuously from outlet to outlet, and from outlets to cabinets, junction boxes, or pull boxes.

a. Bond each run of raceways to form a continuous path for ground faults from end to end.

b. When liquid tight flexible metal conduit sizes larger than 1-inch or flexible metal conduit are installed, provide external bond wires.

2. Grounding Bushings:

   a. Provide all 1-inch or larger metallic conduits with grounding bushings unless they enter metallic enclosures via integral threaded hubs.

   b. Provide grounding bushings for conduits entering the bottom of freestanding equipment.

   c. Bond wire from every grounding bushing to the equipment ground stud or ground bus in the enclosure.

   d. Bond the grounding bushings to ground studs or ground buses in the enclosures.

3. Provide insulated, internal equipment ground wire in all conduits.

   a. Bond the internal wire to all pullboxes, junction boxes, equipment enclosures, and other enclosures as required by NFPA 70.

C. Equipment Grounds:

1. Design all feeders and branch circuits to include an equipment grounding conductor consisting of a copper wire within a raceway or cable and sized as specified herein.

   a. Where conductors are run in parallel in multiple raceways, run the equipment grounding conductor in parallel to the related conductors.

   b. Size each of the parallel equipment grounding conductors on the basis of the ampere rating of the circuit overcurrent protecting device.

2. Ground enclosing cases, mounting frames, rack mounted components, rack struts, switches, breakers, control panels, and other electrical or electrically operated equipment by providing an equipment grounding conductor with phase conductors from an established equipment ground source.

D. Ground Wire Sizes:

1. The minimum size for bonding jumpers, equipment ground conductors, grounding electrode conductors, and ground grid conductors is as follows:

   a. Under 600 volts:

      1) Provide #12 AWG, minimum.

      2) Control power circuits, Provide #14 AWG, minimum.

2. When the ground wire size is not specified or indicated on the Contract Drawings, provide wire sized in accordance with the requirements of NFPA 70.

E. Within 60 days of the Contract award, submit the following:

1. The Submittals required by Section 26 05 00.

   a. Include Product Data and Catalog Cuts for all products provided and describe the usage of each product.

2. Shop Drawings for the ground well grid installation in unpaved areas.

3. Shop Drawings for the ground well grid installation in paved areas.

4. Shop Drawings for the ground bus installation.

F. Project Record Documents:

1. Prepare and submit record drawings showing the actual installed elevations and locations of grounding cables and rods for both concealed and exposed work provided under this Contract.

G. Project Closeout:

1. Submit Operation and Maintenance Manuals that include the record drawings and all Product Data in accordance with Metro North standards.

1.04 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of Section 01 33 00 – Submittal Procedures:

1. Product Data:

a. Manufacturer's product data

2. Shop Drawings:

a. Ground bus installation.

3. Quality Assurance/Quality Control Submittals:

a. Certificates:

1) Testing agency product certification

b. Qualification Statements:

1) System installers' qualifications

2) Installation supervisors' resumes

4. Closeout Submittals:

a. Operation and Maintenance Manuals

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications:

a. Employ installers who specialize in the work of this Section, and who can demonstrate a minimum of three years documented experience.

b. Submit the system installers' qualifications.

2. Supervisor's Qualifications:

a. Employ supervisor to supervise the installation work who are skilled licensed electricians.

b. Submit the installation supervisors' resumes.

3. All products are to be certified by Underwriters Laboratories, Inc. (UL),

B. Regulatory Requirements:

1. All grounding and bonding Work must comply with the requirements of NFPA 70, the National Electrical Code.

C. Certifications:

1. Testing Agency Product Certification:

a. Verify product quality by certifying products as meeting the requirements of one of the following:

1) Underwriters Laboratories, Inc. (UL).

a) Provide products listed and labeled by UL.

b. Testing agency product certification must include agency listing and labeling, either by a printed mark on the data or by a separate listing card.

1) If an item does not have this quality assurance verification, provide a written statement from the product manufacturer indicating why not; such manufacturer's statements are subject to the approval of the Owner and the Engineer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Transport materials, both on site and from the Contractor's storage to site, in accordance with the recommendations of the respective manufacturers.

B. Storage and Protection:

1. Store materials, both on and off site, in accordance with manufacturer's written instructions.

2. Store products indoors on blocking or pallets.

PART 2 – PRODUCTS

2.01 UNDERGROUND WARNING TAPE

A. Metal detectable polyester material, with minimum one-inch high lettering. Overcoated graphics to read, "CAUTION-BURIED ELECTRIC LINE BELOW" for electric lines and/or "CAUTION – TELECOMMUNICATION BELOW" for telephone lines. APWA color to be red for electric lines and orange for telecommunication or fiber-optic lines.

B. Acceptable Manufacturers:

1. Brady #91600 Series

2. Presco

3. Seton

4. Or Approved Equal

2.02 MATERIALS

A. Conduit and Conduit Fittings:

1. For conduit and conduit fittings that enclose single ground wires without accompanying circuit conductors provide one of the following:
   a. Schedule 80, non-metallic conduit and fittings conforming to the requirements of Section 26 05 33 and the conduit additionally conforming to the requirements of NEMA TC-2, and the fittings additionally conforming to the requirements of NEMA TC-3.
   b. Fiberglass reinforced plastic (FRP) conduit and fittings conforming to the requirements of NEMA TC-14 and Section 26 05 33.
2. For other conduit and conduit fittings, provide conduit of the types specified or indicated and that conform to the requirements of Section 26 05 33.

B. Wire:
1. Bare Ground Wire:
   a. Soft drawn copper, Class A or Class B stranded, meeting the requirements of ASTM B3 for sizes #6 or larger.
   b. Soft drawn solid copper, meeting the requirements of ASTM B3 for sizes #8 or smaller.
2. Insulated Ground Wire:
   a. Provide insulated Class B copper stranded wire rated for 600 volts that conforms to the requirements of NEMA WC-7, and is green in color. Insulation type shall be as specified in Section 26 05 19.
3. Acceptable Manufacturers:
   a. Continental Wire & Cable Company www.continentalwire.com
   b. SouthWire www.southwire.com
   c. General Cable www.generalcable.com
   d. Okonite Co. www.okonite.com
   e. Or Approved Equal

C. Clamps and Non-Welded Connectors:
1. Provide bronze or brass clamps and connectors that are UL listed for use below grade.
   a. All bolts and other material must be bronze or brass, plated steel screws are unacceptable.
   b. Fabricate multi-bolt, solderless compression clamps from high strength electrical bronze, and provide silicon bronze clamping bolts and hardware.
2. Provide bolts, nuts, lock-washers, and similar hardware designed not to damage ground wire.
3. Acceptable manufacturers:
   a. Ilsco.
   b. Framatone Connectors Inc. (FCI), Burndy.

c. Or Approved Equal.

D. Exothermic Welding Kits:

1. Provide molds, thermite packages, and other material for exothermic welds that are rated to carry 100 percent of the cable ratings, and which are letter-coded exothermic welded type.

2. Provide all items such as tees, crosses, splices, and cable connections necessary for connecting ground and bonding cables to the following items:

a. Ground rods.

b. Steel enclosures.

c. Bonding to Copper Grounding Bus Bar

3. Provide all exothermic welding molds, thermite packages, and other material used throughout the Work from a single manufacturer.

4. Acceptable Manufacturers:

a. Erico, Cadweld®.

b. Continental Industries, Inc., Thermoweld®.

c. Or Approved Equal.

E. Ground Rods:

1. Provide UL listed, sectional ground rods fabricated using a electrolytic plating process to copper clad a medium carbon steel core

2. Diameter: 3/4 inch.

3. Length: 10 feet.

a. To obtain longer length rods, join rod sections using copper clad rod couplers.

4. Acceptable Manufacturers:

a. Erico International Corp.

b. Galvan Industries, Inc.

c. South Atlantic, LLC

d. A.B. Chance Co.

e. Or Approved Equal

F. Coating Compound:

1. Provide permanently pliable, moldable, un-backed, black rubber based coating materials for covering or coating grounding clamps and connectors.

2. Coating Physical Properties:

a. Solids/Density: 100 percent; 12 pounds per gallon.

b. Penetration: Within 90 to130 when tested in accordance with

ASTM D 5.

c. Water Absorption: 0.10 percent, maximum, when tested in accordance with ASTM D 570.

d. Dielectric Strength: 500 volts/mil when tested in accordance with ASTM D 149.

e. Volume Resistivity: 2,000 megohm-inches, or 5,000 megohms-cm, when tested in accordance with ASTM D 257.

f. Service Temperature: Minus 40 degrees to 160 degrees Fahrenheit; and having no melting point; flammability, or slow burning when tested in accordance with ASTM C 653.

g. Chemical Resistance:

1) Resistant to alcohol, water, aqueous hydrochloride, and sodium hydroxide.

2) Dissolved by carbon tetrachloride, naphtha gasoline, mineral spirits, and benzene.

h. Cohesive/Adhesive: Adheres to metals, concrete, and itself.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions:

1. The Contract Drawings are generally indicative of the Work, but due to their small scale, it is not possible to indicate some offsets and fittings required nor the minor structural obstructions that may be encountered.

a. Perform field measurements to discover offsets and fitting requirements not shown.

b. Locate all on-site utilities and other obstructions in the area of construction, and verify that interferences will not occur.

3.02 PREPARATION

A. Layout electrical work to suit actual field conditions and in accordance with accepted standard practice.

3.03 INSTALLATION

A. Perform required earthwork including excavation, backfill, and compaction, as specified.

B. Construct each ground system and connection so it is mechanically secure and electrically continuous.

1. Secure grounds to boxes in such a manner that each system is electrically continuous from the point of service to each outlet.

2. Terminate conduits using double locknuts and bushings.

a. Unless a conduit run enters a metallic enclosure via integral threaded hubs, provide the conduit run with two locknuts.

3. Clean paint, grease and such other insulating materials from the contact

points of grounds.

C. Ground Grid:

1. Installing Ground Rods:

a. Drive ground rods head to 6 inches below grade by using a ground rod cap to protect the head of the rod.

1) If the top of the rod is damaged during driving operations, cut it off.

2. Installing Ground Wires:

a. Excavate the trenches for the ground cables, and lay the ground cable in the trenches from ground rod without splice

1) Lay the ground cables cable allowing 10 percent slack.

2) Form 12-inch minimum radius bends at changes in direction.

3) Connect service entrance grounds directly to the ground rod without splices in the cable.

b. Route connecting cables from the ground rod in the trenches to the building structure.

1) Route exposed cables parallel to building lines, except for bends; form all bends with a 12-inch minimum radius.

2) Wherever the cable breaks grade, provide schedule 80 conduit from 2- feet below finished grade to 3-feet above finished grade for protection; and provide conduit at other points where the cable may be subject to damage.

c. Remove any damaged or kinked cable.

3. Welding ground wires to the ground rods and equipment connections.

a. Follow the procedures of the exothermic welding kits manufacturer.

b. Prior to welding ground wires to the ground rods and equipment connections perform the following:

1) Clean the proposed welding area of combustible and flammable materials; and block access to personnel to protect them from harm; and provide a shield to prevent damage to other materials.

2) Clean insulation from ground wire for a distance of 12 inches, and clean the exposed wire to a bright finish.

3) Clean paint, grease, and other similar insulating materials from contact points.

4) Inspect the molds for damage; and discard any faulty mold or any molds used over 40 times.

c. Exothermically weld the ground wires to the ground rods as shown

on the Contract Drawings, including to ground rods at grid crossings, to ground rods at grid intersections on the sides of the ground grid, and at all equipment connections.

d. After completing the welding, replace the insulation removed from insulated wires, and coat connections and the area around connections with coating compound.

1) Coating Thickness: 1/8-inch, minimum.

2) Make sure the coating is free from pin-holes and holidays.

4. Make all connections to electrical equipment and ground buses with compression, two-hole lugs and studs.

a. Clean paint, grease, and other similar insulating materials from the contact points for the ground lugs and studs.

b. Clean all wires to a bright finish prior to construction the connections.

D. Equipment Ground Buses:

1. Whenever several pieces of equipment, other than service grounds, require external bond wires in an area, provide an equipment ground bus.

2. Wherever 5 or more conduits enter a box or enclosure, provide an equipment ground bus.

a. Connect all equipment ground wires and conduit bond wires within the box or enclosure to a single ground stud or single common ground bus.

3. Size ground buses to carry 100 percent of the rating or setting of the largest over current device in the circuit(s) ahead of the equipment, conduit, or other item, and as indicated on the Contract Drawings.

E. Equipment Grounds:

1. Install equipment grounds in spaces accessible to authorized personnel only.

2. Equipment Grounding Connectors:

a. Only use approved grounding connectors.

1) Terminate grounds with closed lugs with star washers on both sides and a 1/4-20 bolt and nut, minimum; spade lugs are not allowed.

b. Do not install grounding lugs on flanges, mounting screws, or standoffs in switches, distribution boxes, or panels.

c. Cover or coat grounding clamps and connectors with coating compound.

3. Equipment Grounding Conductors:

a. Unless using multi-conductor cable, run equipment grounding conductors inside the same conduit or wiring channel enclosing the power conductors.

b. In multi-conductor cable, locate grounding conductor inside the sheath or cable.

c. Do not use a system neutral or a current carrying conductor as the equipment grounding conductor.

1) Do not ground the electrical and electronic equipment neutral to chassis, racks, equipment ground conductor, or any non-current carrying conductor on the equipment.

4. Grounding Lighting Fixtures:

a. Provide the housing of each lighting fixture with a separate, factory-installed grounding device and ground conductor.

b. Use the factory-installed grounding device for connecting a separate grounding conductor meeting applicable grounding requirements of the NEC to the fixture.

1) Provide a green covered grounding conductor of the same wire gauge as the two power feed wires.

2) Provide a continuous ground for the fixture construction.

5. Grounding and Bonding Pumps:

a. Provide a bond from each pump to its motor using a conductor equal in size to the motor circuit equipment grounding conductors.

6. Fences:

a. Fences shall be bonded to dedicated ground rods in at least two locations in and at a maximum interval of 200 feet around fences longer than 400feet. Ground rods shall be equally spaced around the perimeter of the fence.

b. Fences shall be bonded to dedicated ground rods at each side of a gate or other opening.

1) A buried bonding jumper shall be used to bond across a gate or other opening.

c. Gates and any barbed wire strands shall be bonded to the grounding conductor, jumper or fence.

d. When fence posts are of conducting material, a grounding conductor shall be bonded to the fence post as required with a suitable connecting means. For non-conducting posts, suitable bonding connection shall be made to the fence mesh and barbed wire strands at each grounding conductor point.

e. For fences located within 5 feet of electrical equipment (transformers, switchgear, etc.), each fence ground rods shall be bonded to the equipment ground bus.

f. For outdoor substations where a station ground ring and/or mat is installed, each fence ground rod shall be bonded to the station ring and/or mat.

g. Where an overhead power line crosses a fence, the fence shall be

bonded to at least one additional dedicated ground rod installed directly under the line. This ground rod shall be bonded to the nearest pole ground.

h. Bonding conductors shall be minimum 6 AWG copper unless otherwise indicated on the plans.

i. Ground rods, bonding jumpers, and connections shall comply with Section 26 05 26.

3.04 REPAIR/RESTORATION

A. Replace any finished exothermic welded splice connections that inspections find to be defective.

B. After inspection by Engineer and Owner's representative, backfill the direct buried cables and around ground rod protectors.

1. Begin backfilling with clean washed sand to 6 inches above the ground rods or to the depth shown on the Contract Drawings, whichever is greater.

2. Backfill using select fill in accordance with the requirements of Section 31 20 00 – Earth Moving.

3. Slope the finish grade away from ground rods at a slope of 1 inch in 18 inches for a distance of 27 inches from the rods in all directions.

C. Install underground warning tape above all buried cables/conduits at a depth of 12" below finished grade.

3.05 FIELD QUALITY CONTROL

A. Inspection:

1. Prior to completion of the Work of this Section, inspect the items provided for conformity to the Contract Drawings and Specifications.

a. Leave in-place "made grounds" open until they have been inspected and approved by the Engineer.

b. Clean the surfaces involved in "made grounds" before connecting the grounds, and finish the installation with touch up painting or another protective coating to prevent corrosion.

2. Inspect finished exothermic welded connections for the following defects:

a. Conductors appear within the splice area.

b. Top of splice risers are below conductors.

c. Surfaces exhibiting more than 20 percent slag material.

d. Surfaces with over slag material that has flowed into conductors.

e. Mold blowouts.

f. Excessive porosity.

1) Small pores less than 1/32 inch are permitted.

3.06 PROTECTION

A. Protect finished insulated wires from being painted.

B. Protect all ground grid wells from damage during paving and landscaping.

C. Protect all grounding installations and ground wires from damage during the work of other Sections.

END OF SECTION

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SECTION – 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Steel slotted support systems.

2. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, and through bolts.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fabrication and installation details for electrical equipment support systems.

PART 2 – PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- diameter holes at a maximum of 8 inches o.c. in at least one surface.

1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.

2. Material for Channel, Fittings, and Accessories: Galvanized steel.

3. Channel Width: Select for applicable load criteria.

4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

5. Painted Coatings: Manufacturer’s standard painted coating applied according to MFMA-4.

6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Steel clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

PART 3 – EXECUTION

3.01 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.

2. NECA 101

B. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, and RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components

so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to structural elements by the following methods unless otherwise indicated by code:

1. To New Concrete: Bolt to concrete inserts.

2. To Existing Concrete: Expansion anchor fasteners.

3. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

4. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69, Spring-tension clamps.

5. To Light Steel: Sheet metal screws.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 PAINTING

A. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

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SECTION – 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and Division 01 Specification Sections, apply to the Work of this Section.

1.02 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Surface raceways.
4. Boxes, enclosures, and cabinets.
5. Handholes and boxes for exterior underground cabling.

B. Related Section:

1. Division 01 Specification Sections
2. Section 26 05 00 – Common Work Result for Electrical
3. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables
4. Section 26 05 26 – Grounding and Bonding
5. Section 26 05 29 – Hangers and Supports for Electrical Systems
6. Section 26 05 43 – Underground Ducts and Raceways for Electrical Systems
7. Section 26 05 53 – Identification for Electrical Systems
8. Section 26 05 95 – Heat Tracing
9. Section 26 24 16 – Panelboards
10. Section 26 27 26 – Wiring Devices
11. Section 26 27 43 – Electric-Vehicle Service Equipment – AC Level 2

12. Section 26 56 13 - Lighting Poles and Standards

13. Section 26 56 19 – LED Exterior Lighting

1.03 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. Definitions for all items are as stated in NFPA 70, IEEE C2, and in other reference documents unless otherwise stated, specified, or noted.

1.04 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale.

B. Qualification Data: For professional engineer.

C. Source quality-control reports.

PART 2 – PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. GRC: Comply with ANSI C80.1 and UL 6.

3. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

a. Comply with NEMA RN 1.

b. Coating Thickness: 0.040 inch, minimum.

4. FMC: Comply with UL 1; zinc-coated steel

5. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

1. Comply with NEMA FB 1 and UL 514B.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. Fittings, General: Listed and labeled for type of conduit, location, and use.

4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.

5. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions were installed, and including flexible external bonding jumper.

6. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

C. Joint Compound for GRC Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. RNC: Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

2.03 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1 aluminum, Type FD, with gasketed cover.

D. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773 galvanized, cast iron with gasketed cover.

G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep

I. Cabinets:

1. NEMA 250, Type 4X stainless-steel enclosure with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Temporary installations: NEMA 250, Type 3R galvanized steel enclosures.

3. Hinged door in front cover with flush latch and concealed hinge.

4. Key latch to match panelboards.

5. Metal barriers to separate wiring of different systems and voltage.

6. Accessory feet where required for freestanding equipment.

2.04 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Test: Test handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.

2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 – EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit, Above Ground: GRC, PVC Coated

2. Concealed Conduit, Above Ground: GRC

3. Underground: EPC-80-PVC-80 concrete encased or under concrete slab with GRC elbows and stub-ups. Refer to Specification Section 26 05 43.

4. Boxes and Enclosures, Above Ground: NEMA 250, Type 4X.

5. Boxes and Enclosures, Above Ground for Temporary Installations: NEMA 250, Type 3R.

B. Minimum Raceway Size: 3/4-inch trade size or as indicated on Contract drawings.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

E. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.02 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Do not fasten conduits onto the bottom side of a metal deck roof.

C. Complete raceway installation before starting conductor installation.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

F. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

G. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Stub-Ups to Above Recessed Ceilings:

1. Use RMC for raceways.

2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits. Install water-proof hubs in outdoor locations.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.

b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

3.03 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

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SECTION – 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Section Includes:

1. Rigid nonmetallic duct.
2. Rigid Metal Conduit Elbows, Stub-Ups and Fittings
3. Underground handholes and boxes
4. Duct accessories.

B. Related Sections:

1. Section 26 05 33 – Raceways and Boxes for Electrical Systems

1.02 DEFINITIONS

A. PVC: Polyvinyl chloride conduit

B. RGS: Galvanized rigid (steel) conduit.

1.03 SUBMITTALS

A. Product Data: For each type of product.

1. Include conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
2. Include accessories for handholes, boxes, and other utility structures.
3. Include underground-line warning tape.

B. Shop Drawings:

1. Precast or Factory-Fabricated Handholes and Boxes:
   a. Include plans, elevations, sections, details, attachments to other work, and accessories.
   b. Include reinforcement details.
   c. Include grounding details.
   d. Include joint details.
2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
   a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
   b. Include duct entry provisions, including locations and duct sizes.
   c. Include cover design.
   d. Include grounding details.
   e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

C. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858.

D. Source quality-control reports.

E. Field quality-control reports.

1.04 SPARE PARTS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.06 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Owner's written permission.

PART 2 – PRODUCTS

2.01 RIGID METAL CONDUIT ELBOWS, STUB-UPS AND FITTINGS

A. RGS: Comply with the requirements in Division 26 Section 26 05 33 “Raceways and Boxes for Electrical Systems.”

2.02 RIGID NONMETALLIC DUCT

A. Underground Plastic Utilities Duct: Type PVC Schedule 80 complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.

B. Manufacturers:

1. Arnco Corp.

2. Cantec, Inc.

3. Condux International, Inc.

4. Lamson and Sessions

5. National Pipe and Plastics

6. Or approved equal.

C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

D. Solvents and Adhesives: As recommended by conduit manufacturer.

PART 3 – EXECUTION

3.01 UNDERGROUND DUCT APPLICATION

A. PVC Schedule 80 with RGS elbows and stub-ups unless otherwise indicated, with minimum of 2” concrete encasement in areas subject to vehicular traffic.

3.02 EARTHWORK

A. Restoration: Replace area immediately after backfilling is completed or after construction vehicle traffic in immediate area is complete.

B. Restore surface features at areas disturbed by excavation and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground duct and duct bank.

2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.

B. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Prepare test and inspection reports.

3.04 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION

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SECTION – 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements for furnishing, installing, and protecting identification signs and labels for electrical systems.

B. Related Section:

1. Division 01 Specification Sections
2. Section 26 05 00 – Common Work Result for Electrical
3. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
4. Section 26 05 26 – Grounding and Bonding
5. Section 26 05 29 – Hangers and Supports for Electrical Systems
6. Section 26 05 33 – Raceway and Boxes for Electrical Systems
7. Section 26 05 43 – Underground Ducts and Raceways for Electrical Systems
8. Section 26 05 95 - Heat Tracing
9. Section 26 24 16 – Panelboards
10. Section 26 27 13 – Electricity Metering
11. Section 26 27 26 – Wiring Devices
12. Section 26 27 43 – Electric-Vehicle Service Equipment - AC Level 2
13. Section 26 43 13 – Surge Protective Devices
14. Section 26 56 13 – Lighting Poles and Standards
15. Section 26 56 19 – LED Exterior Lighting

1.02 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI Z535.4, Product Safety Signs and Labels.

B. National Electrical Manufacturer's Association (NEMA):

1. NEMA 250, Enclosures for Electrical Equipment.

C. National Fire Protection Association (NFPA):

1. NFPA 70, National Electrical Code (NEC).
2. NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

D. U. S. Government:

1. Code of Federal Regulations (CFR)

a. 29 CFR 1910 Occupational Safety and Health Standards.

1.03 SUBMITTALS

A. Submit the following information to the Engineer for approval in accordance with the requirements of Section 01 33 00 – Submittal Procedures:

1. Product Data:

a. Provide catalog cuts for the actual products provided, and indicate clearly the usage of each product.

2. Shop Drawings:

a. Provide a schedule depicting all nametag legends.

b. Provide drawings of typical nametags.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with the all applicable requirements of OSHA, but particularly those stated in 29 CFR 1910.144 and 29 CFR 1910.145.

2. Comply with the requirements of NFPA 70E that are applicable to electrical identification items as listed below in this Specification Section.

1.05 DELIVERY, STORAGE AND HANDLING

A. Protect items from damage during delivery, storage, and handling in accordance with Section 26 05 00 and as detailed below.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Provide products meeting the specified requirements from one of the following manufacturers, unless otherwise indicated:

1. Brady Worldwide, Inc., P. O. Box 2131, Milwaukee, WI 53201-2131, Telephone (414) 358-6600.

2. Seton Identification Products, 20 Thompson Road, P. O. Box 819, Branford, CT 06405-0819, Telephone (800) 243-6624.

3. LEM Products, Inc.; P. O. Box 190, 4089 Landisville Road, Doylestown, PA 18901, Telephone (800) 220-2400 or (215) 348-9900.

B. To serve as examples of the quality required of the specified products, several Brady Worldwide, Inc. Product Numbers are listed for informational purposes only.

2.02 MATERIALS

A. Laminated Phenolic or Plastic:

1. Provide rigid, thermosetting resin or polymer material that is heat- and fire- resistant, abrasion resistant, electronically non-conductive, and non-corroding.

2. Extrude the thermosetting resin or polymer into sheets, and laminate the sheets together so that colored top and bottom layers sandwich a

contrasting color core in the middle.

B. Mounting Hardware:

1. Provide number 10 hex-head machine screws and lock-washers, or hex-head bolts, lock-washers, and nuts for mounting identification nameplates onto electrical equipment.

2. Provide either type 316 stainless steel or brass fasteners; however, all fasteners used on the same nameplate must be of the same material.

2.03 EQUIPMENT IDENTIFICATION NAMEPLATES

A. Provide laminated phenolic or plastic equipment identification nameplates having beveled edges and engraved lettering.

1. Drill holes for mounting hardware in the equipment identification nameplates as follows:

a. For nameplates that are more than 2 inches wide, drill four holes.

b. For nameplates that are more than 1-1/2 inches high, drill four mounting holes.

c. For smaller nameplates, drill holes for two fasteners.

2. Provide equipment identification nameplates long enough to ensure that the heads of fastening hardware do not extend beyond the nameplate material, and come no closer than 1/16-inch to the nearest letter of the nameplate legend and no closer than 1/16-inch to the nearest edge.

B. Engrave the following information on each equipment identification nameplate, similar to that shown in Examples 1 and 2 below except appropriate for the specific equipment being identified:

1. In the first line, indicate the equipment type and identification number.

2. In the second line, indicate the equipment Voltage, the equipment current if known, the phase, and the number of wires.

a. If the current is listed, provide a description that further identifies the current, such as “overload protection current”, full load amps (FLA), or other information identifying the current indicated.

3. In the third line, indicate the words “SERVED FROM” followed by the serving equipment and the branch circuit.

a. If multiple sources serve the equipment, list all sources on succeeding lines. EXAMPLE 1:

POWER PANELBOARD PPB-2
208/120 VOLTS, 10.8 FLA, 3-PHASE, 4-WIRE
SERVED FROM
PPB-1, CIRCUITS F1 THROUGH T1

b. If the equipment is supplied through automatic transfer switches

and transformers or other items without disconnects, include data on all upstream disconnects; and beneath the sources add the word “THROUGH” followed by the name of the equipment that the sources are connected through. EXAMPLE 2:

POWER PANELBOARD PPB-2
480/277 VOLTS, 3-PHASE, 4-WIRE
SERVED FROM

BOTH EGS-2 AND MCC-1
THROUGH ATS-1

4. For motor starters, circuit breakers, transformers, and disconnect switches, provide an additional line with the word “SERVES” and the equipment served.

   a. Engrave the following information on identification plate for any distribution equipment (i.e. switchboard, panelboard, motor control center, switchgear, etc.).

5. The conductor insulation color coding for feeder and branch circuit wiring originating from each piece of distribution equipment per NFPA 70. Refer to Specification Section 26 05 19 for wire and cable color coding requirements.

   EXAMPLE for 208Y/120 volt equipment:

PHASE	**COLOR**
A	BLACK
B	RED
C	BLUE
GROUNDED CONDUCTOR (NEUTRAL)	GREEN

C. Engrave equipment identification nameplates with all capital, Helvetica Medium font, or equal, lettering.

1. Provide white letters on a black background, except for warning nameplates provide white lettering centered on red backgrounds.

2. Provide a minimum 1/8-inch border between the nameplate lettering and the tops and bottoms of the nameplates.

3. Use 3/8-inch high letters for the first line, and 1/4-inch letters for succeeding lines; except, in cases where the tag will not fit because the equipment is too small, use 3/16-inch letters for the first line and 1/8-inch letters for succeeding lines.

2.04 CONDUIT AND RACEWAY LABELS

A. Conduit Voltage Markers:

1. Provide conduit markers consisting of polymer-coated cloth tape with a printable top coat and a rubber based pressure sensitive adhesive on the back to provide oil and water resistance, good print durability, and the flexibility to allow it to be wrapped around curved surfaces.

2. Clearly mark the voltages in black lettering on orange colored tape backgrounds.

B. Conduit Wiring System Identification:

1. Provide companion type labeling markers to indicate the wiring system in each raceway and consisting of a vinyl film substrate with a pressure sensitive acrylic adhesive backing.

2. Clearly mark the wiring systems in black lettering on orange colored tape backgrounds.

3. To properly identify each electrical system in the raceway, provide the following, or similar, wording on the labeling markers corresponding to the systems:

a. For electrical power systems, word the labels "POWER".

b. For control systems, word the labels "CONTROL".

c. For instrumentation systems, word the labels "INSTR."

C. Conduit Feeder Identification:

1. Provide conduit feeder identification markers consisting of polymer-coated cloth tape with a printable top coat and a rubber based pressure sensitive adhesive on the back to provide oil and water resistance, good print durability, and the flexibility to allow it to be wrapped around curved surfaces.

2. Provide conduit feeder identification labels that identify the feeder circuit with 3/4- inch high black lettering on yellow backgrounds.

D. Conduit and Raceway Label Dimensions:

1. Provide label color field lengths and lettering height as indicated in Table 26 05 53-1:

Table 26 05 53 -1 Conduit and Raceway Label Sizes

Raceway Outside Diameter (Inches)	Background Length (Inches)	Lettering Height (Inches)
3/4 to 2	7	1
1-1/2 to 2	7	1
2-1/2 to 6	14	1-1/4

E. Product Examples:

1. Conduit Voltage Markers: Brady Worldwide, Inc., B-946 custom self-sticking pipe markers or color code tape.

2. Conduit Wiring System: Brady Worldwide, Inc., B-946 custom self-sticking pipe markers or color code tape.

3. Conduit Feeder Identification: Brady Worldwide, Inc., Product Number 31964.

2.05 ARC-FLASH WARNING LABELS

A. Arc Flash Warning Labels shall be prepared in accordance with NFPA 70, NFPA 70E, IEEE-1584 latest editions and ANSI Z535.

1. Minimum label size shall be 4" x 6" as provided by Duralabel or Brady with applicable header information identifying both warning and danger based upon the findings.

2. Minimum information to be included on the Arc Flash label shall consist of the following:

a. Prefaced electrical warning including universal symbol identification, approved safety color, and preface description noting that arc and shock hazard are present. Note where dual labeling is provided/required with the use of arc flash reduction maintenance settings within the equipment, such labels shall be uniquely identified by a different label safety color l, as approved by the Owner. Consult the Owner for acceptable color schemes to be used for the equipment.

b. Statement noting that personnel protective equipment (PPE) requirements are required. Also clearly identify all equipment as “Dangerous” where work on energized equipment is otherwise prohibited and/or where no safe PPE protection so exists.

c. Calculated arc flash hazard boundary, in inches.

d. Calculated arc flash hazard at 18 inches, in calories/cm2.

e. Arc flash hazard risk category, including descriptive summary of required PPE items necessary for entry into energized equipment.

f. Voltage classification and description of conditions present for shock hazard.

g. Insulated glove classification rating, as required for contact conditions and measurements.

h. Limited approach boundary, in inches.

i. Restricted approach boundary, in inches.

j. Prohibited approach boundary, in inches.

k. Available short circuit current

l. Unique equipment locator identification, corresponding to applicable one-line diagram and ESOD as specified in Section 26

05 00 device abbreviation identifiers.

m. Name, address & phone number of the responsible engineer, engineering company or agency contracted to perform the analysis. Also include the preparer's name, where prepared by a subcontract to the named company or agency contracted to perform the analysis report.

n. Respective contract (job) number for the analysis report.

o. Preparation date of the issued/approved Arc Flash Study (analysis) supporting the equipment labeling, as installed.

p. Suffix cautionary warning that "Changes in equipment settings or system configuration will invalidate the calculated values and PPE requirements."

2.06 DANGER WARNING LABELS:

A. Provide danger signage in accordance with the requirements of 29 CFR 1910.145 and NFPA 70E.

1. For enclosures, provide signs with the caption "DANGER HIGH VOLTAGE KEEP OUT"

2. For fences, provide signs similar to the signs for enclosures, except provide dual language sign captions in both Spanish and English and add Mister Ouch symbols.

3. For poles, provide dual language signs similar to the signs for fences, except add the words "KEEP OFF".

B. Product Examples:

1. Enclosure danger signs: Brady Worldwide, Inc. Product Number 84083.

2. Fence Danger signs: Brady Worldwide, Inc. Product Number 69737.

3. Pole danger signs: Brady Worldwide, Inc. Custom markers.

PART 3 – EXECUTION

3.01 PREPARATION

A. Prior to installing electrical identification items, verify with the Engineer that the data on each is correct.

3.02 INSTALLATION

A. Wiring Identification:

1. Identify wiring in conformance with the requirements of Section 26 05 19.

B. Conduit and Raceway Identification:

1. Identify the wiring systems in conduit and raceway by providing companion type labeling markers to indicate the systems in each.

2. Identify the Voltages carried in conduit and raceway by providing voltage labeling markers on all accessible raceways.

3. Identify feeders by providing identification labels.

C. Electrical Box Identification:

1. For each pull box and junction box, if it is not otherwise indicated, install a laminated phenolic identification nameplate with 1/8-inch letters on a black background above or next to the box identifying its source of power; for example, indicate the panelboard and circuit number supplying power to a box with an identification nameplate.

2. For each device and outlet box used as a branch circuit junction or pull box provide a legible hand written panel designation and circuit number on exterior of box cover. Utilize a permanent black marker.

3. For above ground pull boxes and junction boxes, install nameplates adjacent to or above the item in a visible location.

   a. For NEMA 1 and 12 enclosures constructed as specified in NEMA 250, fasten the nameplate to the enclosure using 316 stainless steel screws or an approved equal.

   b. For other than NEMA 1 and 12 enclosures, fasten the nameplate to the enclosure using Seton number15660 adhesive or an approved equal.

4. For in-ground pull boxes and junction boxes, install nameplates adjacent to or above the item in a visible location and inside the box immediately below the cover.

   a. For NEMA 1 and 12 enclosures constructed as specified in NEMA 250, fasten the nameplate to the enclosure using 316 stainless steel screws or an approved equal.

   b. For other than NEMA 1 and 12 enclosures, fasten the nameplate to the enclosure using Seton number15660 adhesive or an approved equal.

D. Wiring Device Faceplate Labeling:

1. Outside of faceplate:

   a. On receptacle faceplates, provide a label indicating panel designation and circuit number. Utilize a thermal label maker device with clear label tape, font color shall be black and type shall be Arial.

2. Inside of faceplate:

   a. On receptacle and lighting control device faceplates, provide a legible hand written panel designation and circuit number tag. Utilize a permanent black marker.

E. Electrical Equipment Identification:

1. Provide identification nameplates on the front of the following electrical equipment:

   a. Surge Protective Devices (SPD), as specified in Section 26 43 13.

   b. Enclosed circuit breakers as specified in Section 26 28 16.19.

   c. Low-voltage enclosed switches as specified in Section

26 28 16.13.

d. Panelboards as specified in Section 26 24 16.

e. Electrical Vehicle Service Equipment in Section 26 27 43

2. Install nameplates in the top center of the front face of the electrical equipment in a visible location.

a. For NEMA 1 and NEMA 12 enclosures constructed as specified in NEMA 250, fasten the nameplate to the enclosure using 316 stainless steel screws or an approved equal.

b. For other than NEMA 1 and 12 enclosures, fasten the nameplate to the enclosure using Seton number 15660 adhesive or an approved equal.

F. Arc-Flash Warning Signage:

1. For each arc location or circuit analyzed as part of the Arc Flash Study in Section 26 05 00, provide Arc Flash Warning labels.

END OF SECTION

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SECTION – 26 05 95

HEAT TRACING

PART 1 – GENERAL

1.01 SUMMARY:

A. Provide heat tracing as indicated in compliance with Contract Documents.

1.02 REFERENCES:

A. National Fire Protection Association (NFPA):

1. NFPA-70: National Electrical Code (NEC), Article 426 Fixed Outdoor Electric Deicing & Snow Melting Equipment
2. National Electrical Manufacturers Association (NEMA):
3. 250 – Enclosures for Electrical Equipment (1000 volts maximum)
4. Underwriters Laboratory (UL): Directory of UL Listed Products
5. IEEE 515.1-2012: Standard for testing, design, installation and maintenance of electrical resistance trace heating for commercial applications.

1.03 SYSTEM DESCRIPTION:

A. Self-regulating heating cable

B. Heating Cable Installation Accessories

1.04 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer’s Data Sheet
2. Installation Instructions
3. Electrical Requirements
4. Shop Drawings indicating the location of the heating cable, sensors & controls.
5. Wiring Diagrams for controller & sensors

1.05 INFORMATIONAL SUBMITTALS

A. Sample of Extended 10 Year Warranty and Requirements

1.06 CLOSEOUT SUBMITTALS

A. Operation & Maintenance Manuals for Roof & Gutter Deicing System

1.07 QUALITY ASSURANCE:

A. Comply with the requirements specified in Section 01 43 00.

B. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code,

Article 100.

C. Manufacturers Qualifications

1. Minimum of 20 years of experience in design, engineering, manufacturer and support of roof & gutter system and components.

2. Manufacturer shall be ISO-9001:2008 Registered

D. Installer Qualifications

1. System installer shall have a complete understanding of product from manufacturer prior to installation.

2. Electrical Connections shall be performed by a licensed electrician.

E. Regulatory Requirements:

1. National Electrical Code: Components and installation shall comply with NFPA 70.

1.08 DELIVERY, STORAGE AND HANDLING

A. Store products in manufacturer's unopened packaging and dry location with a temperature range of 0°F (-18°C) to 100°F (38°C) until ready for installation.

B. Protect Heating Cable from exposure to moisture, water & mechanical damage until ready for installation.

1.09 WARRANTY

A. Provide manufacturer's standard warranty form which manufacturer agrees to repair or replace products that fail in material or workmanship within the following periods following the date of substantial completion:

1. Heating Cable & Components: One Year

2. Controls & Sensors: One Year

PART 2 – PRODUCTS

2.01 MANUFACTURERS:

A. Raychem, Division of Tyco Thermal Controls.

B. Nelson Electric, Division of Emerson.

C. Chromalox Precision Heat and Control

D. Approved Equal

2.02 PRODUCTS

A. Self-Regulating, Heating Cable

1. Operating Voltage 120 VAC

2. The self-regulating, heating cable shall consist of two (2) 16 AWG nickel-copper bus wires embedded in a radiation cross-linked, continuous, self-regulating polymer core.

3. The self-regulating, heating cable shall have a modified polyolefin dielectric jacket cover.

4. The self-regulating, heating cable shall have a tinned-copper braid.

5. The self-regulating, heating cable shall have a fluoropolymer over jacket.
6. The self-regulating, heating cable shall be suited for use on wood, plastic, sheet metal, tile and asphalt building materials.
7. The self-regulating, heating cable have a power output as required for the pipe size protected @ 32°F.
8. The heating cable shall be part of a UL Listed and CSA Certified System.

B. Connection Kits

1. Manufacturer to provide connection kits for power, splice, tee and end seal shall be connection system.
2. Power Connection Kits shall be rated NEMA 4X to prevent water ingress and corrosion.
3. Connection Kits shall be UV stabilized.
4. Connections kits shall be UL Listed and CSA Certified.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Installer to field verify all dimensions as shown on shop drawings.

B. Installer to verify that power is available, in proper location and ready for use.

C. Installer to verify that all surfaces have been properly prepared for heating cable installation.

3.02 INSTALLATION

A. The installer shall comply with the installation, operation & maintenance instructions.

B. The installer shall layout heating cable per approved shop drawings.

C. Grounding shall be in accordance with section 26 05 26 “Grounding & Bonding for Electrical Systems”

D. Connections of all electrical wiring shall be in accordance with section 26 05 19 “Low-Voltage Electrical Systems”

3.03 FIELD QUALITY CONTROL

A. Start-Up and testing shall be performed by factory technician or factory representative per the owner’s requirements.

B. Field Testing & Inspections

1. Field Testing and Inspections
2. The system shall be commissioned in accordance to the Installation, Operation & Maintenance manual for Roof & Gutter Deicing Systems – PJ-485.
3. The heating cable circuit integrity shall be tested using a 2500 Vdc megohmmeter at the following intervals below. Minimum acceptable insulation resistance shall be 1000 megohms or greater.

C. a.Before installing the heating cable

D. After heating cable has been installed onto the roof or gutter

E. After installing connection kits

F. Prior to initial start-up (commissioning)

G. As part of the regular system maintenance

1. The technician shall verify that the controller parameters are set properly application requirements.

2. The technician shall verify that the temperature & moisture sensors are corrected connected to the controller.

3. The installer shall submit test results to owner after commissioning.

3.04 ADJUSTING AND CLEANING

A. Keep temperature & moisture sensors clean of dirt and debris.

3.05 MAINTENANCE

A. Comply with Manufacturers recommendations for service of the system.

END OF SECTION

SECTION – 26 24 16

PANELBOARDS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and Division 01 Specification Sections, apply to the Work of this Section.

1.02 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

B. Related Section:

1. Division 01 Specification Sections
2. Section 26 05 00 – Common Work Result for Electrical
3. Section 26 05 26 – Grounding and Bonding
4. Section 26 05 29 – Hangers and Supports for Electrical Systems
5. Section 26 05 53 – Identification for Electrical Systems
6. Section 26 43 13 Surge Protective Devices (SPD)

1.03 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. SPD: Surge protective device.

G. VPR: Voltage protection rating.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.

4. Detail bus configuration, current, and voltage ratings.

5. Short-circuit current rating of panelboards and overcurrent protective devices.

6. Include evidence of NRTL listing for series rating of installed devices.

1.05 INFORMATIONAL SUBMITTALS

A. Panelboard Schedules: For installation in panelboards.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.

3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F

b. Altitude: Not exceeding 6600 feet

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.

2. Altitude not exceeding 6600 feet

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electric service.

2. Do not proceed with interruption of electric service without Owner's written permission.

3. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.

1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Outdoor Locations: NEMA 250, Type 3R or Type 4X in accordance with Contract drawings.

b. Interior locations: NEMA 250, Type 1.

2. Height: 60 inches maximum.

3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.

4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.

6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

7. Finishes:

a. Panels and Trim: Steel factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.

b. Back Boxes: Galvanized steel Same finish as panels and trim.

F. Incoming Mains:

1. Location: Convertible between top and bottom

2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

a. Plating shall run entire length of bus.

b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.

3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Terminations shall allow use of 75 deg C rated conductors without derating.

3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.

4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.

5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.

I. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

J. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.

2.02 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1. Refer to Specification Section 26 43 13 Surge Protective Devices (SPD).

2.03 POWER PANELBOARDS

A. Panelboards: NEMA PB 1, distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

C. Mains: Circuit breaker, service entrance rated where indicated on Contract drawings.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: Circuit breaker, service entrance rated where indicated on Contract drawings

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling,

but current carrying terminals and bus shall remain concealed.

2.05 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, fully rated to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:
    a. Inverse time-current element for low-level overloads.
    b. Instantaneous magnetic trip element for short circuits.
    c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:
    a. RMS sensing.
    b. Field-replaceable rating plug or electronic trip.
    c. Digital display of settings, trip targets, and indicated metering displays.
    d. Multi-button keypad to access programmable functions and monitored data.
    e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
    f. Integral test jack for connection to portable test set or laptop computer.
    g. Field-Adjustable Settings:
        1) Instantaneous trip.
        2) Long- and short-time pickup levels.
        3) Long and short time adjustments.
        4) Ground-fault pickup level, time delay, and I squared T response.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. MCCB Features and Accessories:
    a. Breaker handle indicates tripped status.
    b. UL listed for reverse connection without restrictive line or load ratings.

c. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

e. Rating Plugs: Three-pole breakers with ampere ratings greater 150.

amperes shall have interchangeable rating plugs or electronic adjustable trip units.

f. Auxiliary Contacts: One, SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.

2.06 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.07 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other

construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NECA 407.

D. Equipment Mounting:

1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in [Section 03 30 00 "Cast-in-Place Concrete."]

2. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount panelboard cabinet plumb and rigid without distortion of box.

G. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.

H. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer’s written instructions.

I. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

J. Install filler plates in unused spaces.

K. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner’s final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section

26 05 53 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.

b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.

c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.

2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.

3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.

4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.06 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION – 26 27 13

ELECTRICITY METERING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes electricity metering work to accommodate utility company revenue meters used to manage the electrical power system.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For electricity-metering equipment.

1. Include elevation views of front panels of control and indicating devices and control stations.

2. Include diagrams for power, signal, and control wiring.

1.03 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit evidence that meters are compatible with connected monitoring and control devices and systems.

B. Field quality-control reports.

C. Sample warranty.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metering equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Cost to repair or replace any parts for five years from date of Substantial Completion.

2. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years, that failed in service due to transient voltage surges.

1.06 COORDINATION

A. Electrical Service Connections: Coordinate with utility companies and utility-furnished components.

PART 2 – PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 916.

2.02 UTILITY METERING INFRASTRUCTURE

A. Install metering accessories furnished by the utility company, complying with its requirements.

B. Utility-Furnished Meters: Connect data transmission facility of metering equipment installed by the Utility.

C. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.

D. Meter Sockets:

1. Comply with requirements of electrical-power utility company.

2. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.

E. Arc-Flash Warning Labels:

1. Labels: Comply with requirements for "Self-Adhesive Equipment Labels" and "Signs" in Section 26 05 53 "Identification for Electrical Systems." Apply a properly sized self-adhesive label for each work location included in the analysis. Labels shall be machine printed, with no field-applied markings.

a. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1) Location designation.

2) Nominal voltage.

3) Flash protection boundary.

4) Hazard risk category.

5) Incident energy.

6) Working distance.

7) Engineering report number, revision number, and issue date.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install meters furnished by utility company. Install raceways and equipment according to utility company’s written instructions. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

C. Install arc-flash labels as required by NFPA 70.

D. Wiring Method:

1. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

2. Minimum conduit size shall be 1/2 inch.

E. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

END OF SECTION

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SECTION – 26 27 26

WIRING DEVICES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. GFCI receptacles.

2. Wall plates.

1.03 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.

2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.

3. Leviton: Leviton Mfg. Company, Inc.

4. Pass & Seymour: Pass & Seymour/Legrand.

B. EMI: Electromagnetic interference.

C. GFCI: Ground-fault circuit interrupter.

D. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

E. RFI: Radio-frequency interference.

F. UTP: Unshielded twisted pair.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Retain "Samples" Paragraph below if products have critical features needing hands-on appraisal.

D. Samples: One for each type of device and wall plate specified, in each color specified.

1.05 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 – PRODUCTS

2.01 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 GFCI RECEPTACLES

A. General Description:

1. 125 V, 20 A, straight blade, non-feed-through type.

2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.

3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. GFCI, Tamper-Resistant and Weather-Resistant Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and UL 943 Class A.

2.03 WALL PLATES

A. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant die-cast aluminum with lockable cover.

2.04 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 – EXECUTION

3.01 INSTALLATION

A. NECA 1 referenced in first paragraph below includes device mounting-height requirements. See "Mounting Heights and Locations" Article in the Evaluations for device mounting heights in that standard.

B. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

C. See "Device Configurations, Ratings, and Grades" in the Evaluations for timing and sequencing of construction to help avoid contamination of devices during construction.

D. Coordination with Other Trades:

1. Protect installed devices and their boxes.

2. Keep outlet boxes free cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

E. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.

b. Straighten conductors that remain and remove corrosion and foreign matter.

c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

F. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

G. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

3.02 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.03 IDENTIFICATION

A. Comply with Section 26 05 53 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.04 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.

2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Wiring device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION

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SECTION – 26 27 43

ELECTRIC-VEHICLE SERVICE EQUIPMENT – AC LEVEL 2

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and Division 01 Specification Sections, apply to the Work of this Section.

1.02 SUMMARY

A. Section includes EVSE that provides AC Level 2 EV charging.

1.03 DEFINITIONS

A. EV: Electric vehicle.

B. EV Cable: The off-board cable containing the conductor(s) to connect the EV power controller to the EV that provides both power and communications during energy transfer.

C. EV Charger or EV Charging Equipment: See "EVSE."

D. EV Connector: A conductive device that, when electrically coupled to an EV inlet, establishes an electrical connection to the EV for the purpose of power transfer and information exchange. This device is part of the EV coupler.

E. EV Coupler: A mating EV inlet and connector set.

F. EV Inlet: The device in the vehicle into which the EV connector is inserted, and a conductive connection is made for the transfer of power and communication. This device is part of the EV coupler.

G. EVSE: Electric-Vehicle Supply Equipment. It includes the EV charging equipment and conductors, including the ungrounded, grounded, and equipment grounding conductors and EV cables, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for transferring energy between the premise wiring and the EV.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for EV charging equipment.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For EVSE.

1. Include plans, elevations, sections, and mounting details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Detail fabrication and assembly of mounting assemblies for EV charging equipment.

4. Include diagrams for power, signal, and control wiring.

5. Include verification of wireless communications service at each location of EVSE.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Area plans and details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Communications service including wireless communications equipment.

B. Qualification Data: For factory-authorized service representative.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For EVSE to include in operation and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.09 FIELD CONDITIONS

A. Wireless Survey: Complete wireless survey to determine if wireless provider signals meet or exceed manufacturer's recommended minimum values.

B. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not exceeding minus 22 to plus 122 deg F

2. Altitude: Not exceeding 6600 feet

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of EVSE that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. EV-Box or approved equal

B. Source Limitations: Obtain EVSE from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Ambient Temperature: 5 to 104 deg F

B. Relative Humidity: Zero to 95 percent.

C. Altitude: Sea level to 1000 feet

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

E. Surge Withstand: 6 kV at 3000 A

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

G. EV Charging Levels:

1. Dual vehicles, AC Level 2 at up to 7.4 kW per vehicle.

2.03 EVSE DESCRIPTION

A. Comply with NFPA 70.

B. Comply with:

1. UL 2231-1.

2. UL 2594.

3. SAE J1772 for SAE combo chargers.

C. Comply with ADA-ABA Accessibility Guidelines.

D. Input Power:

1. Two 32 A, 208V ac, 60 Hz, single-phase services per charger

E. EVSE Mounting: Pole mount

F. Enclosures:

1. Rated for environmental conditions at installed location.

a. Outdoor Locations: NEMA 250, NEMA 4X Enclosures

b. Polycarbonate

c. Lockable.

d. Tamper resistant

G. EV Cable and Connectors:

1. SAE J1772 connector.

2. Double connectors with locking holster.

3. 18-foot cable with cable management system.

4. Field-replaceable connector and cable assembly.

H. Status Indicators:

1. LEDs to indicate power, charging, charging complete, system status, faults, and service.

I. Display Screen:

1. Daylight viewable, UV-protected display with human-machine interface capability.

2. Displays power, charging, charging complete, remote control, system status, faults, and service.

J. Networking:

1. WAN Communications: Cellular GSM/GPRS.

2. Capable of remote configuration and reporting.

K. Payment System:

1. RFID reader.

2. PCI compliant.

L. Charging Network: Compatible with the EV charging network.

1. Multiple units shall independently connect to charging network.

2.04 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by utilizing cushioning materials or foam or by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for EVSE electrical conduit to verify actual locations of conduit connections before equipment installation.

C. Examine pavement for suitable conditions where EVSE will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with NECA 1 and NECA 413.

B. Pole Mounting:

1. Allow a minimum of 24 inches of clearance around EVSE.

2. EVSE receptacles or holders shall be mounted on pole supplied with the equipment in accordance with manufacturer installation details.

3. Mount EVSE plumb and rigid without distortion of enclosure.

4. Secure EVSE according to manufacturer’s written instruction

3.03 CONNECTIONS

A. Connect wiring according to Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables."

B. Comply with grounding requirements in Section 26 05 26 "Grounding and Bonding."

C. Comply with requirements for installation of conduit in Section 26 05 33 "Raceways and Boxes for Electrical Systems." Drawings indicate general arrangement of conduit, fittings, and specialties.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

E. Verify that all electrical connections have been made according to the manufacturer's instructions. Remove all burrs, shavings, and detritus from inside the enclosure.

F. After confirming all connections, install covers and tighten fasteners to according to manufacturer's instructions.

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. For each unit of EVSE, perform the following tests and inspections:

a. Unit self-test.

b. Operation test with EV.

c. Network communications test.

C. EVSE will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.06 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions

3.07 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain EV charging equipment.

END OF SECTION

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SECTION – 26 43 13

SURGE PROTECTIVE DEVICES (SPD)

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: The work specified in this Section consists of materials for furnishing, installing, connecting, energizing, testing, cleaning and protecting enclosed surge protective devices.

B. Related Sections:

1. Section 26 05 00 – Common Work Results for Electrical
2. Section 26 05 26 – Grounding and Bonding
3. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables
4. Section 26 05 33 – Raceway and Boxes for Electrical Systems
5. Section 26 24 16 - Panelboards

1.02 REFERENCES

A. American National Standards Institute/Underwriters Laboratories (ANSI/UL):

1. ANSI/UL 1449 Surge Protective Devices (Third Edition)
2. UL 1283 Electromagnetic Interference Filters

B. National Fire Protection Association (NFPA):

1. NFPA 70 National Electrical Code (NEC) Article 285.

C. Institute of Electrical and Electronic Engineers/American National Standards Institute (IEEE/ANSI):

1. ANSI/IEEE C62.41.1-2002 IEEE Guide on the Surge Environment in Low Voltage (1000 V and Less) AC Power Circuits
2. ANSI/IEEE C62.41.2-2002 IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
3. ANSI/IEEE C62.41.2-2002 IEEE Recommended Practice on Surge Testing Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.

1.03 SUBMITTALS

A. Make all submittals in accordance with Section 26 05 00.

B. Testing Agency/Quality Verification: Provide with all product data evidence of testing agency/quality verification, listing, and labeling either by printed mark on the data or by a separate listing card. Provide from product manufacturers a written statement indicating why an item does not have a quality assurance verification. Such statements are subject to the approval of the Owner and the Engineer.

C. Product Data and Catalog Cuts: Provide product data within 60 days of contract award for all products provided.

D. Shop Drawings: Submit shop drawings for all Surge Protective Devices.

E. Provide manufacturer's instructions for all Surge Protective Devices.

F. Project Record Documents: Record actual installed elevation and locations of equipment and wiring on record contract and shop drawings as specified in Section 26 05 00.

G. Project Closeout: Include record drawings, shop drawings and product data with Installation and Maintenance Manuals and submit at project closeout in accordance with Section 26 05 00.

1.04 SHORT CIRCUIT, ARC-FLASH, PROTECTIVE DEVICE COORDINATION AND HARMONIC DISTORTION STUDY

A. The computerized short-circuit, arc-flash, protective coordination and harmonic study will be performed and submitted as outlined in Section 26 05 00 of these specifications.

B. The Contractor is responsible for supplying the necessary and required information in order that this study may be completed and submitted at least two full calendar weeks prior to submitting Shop Drawings for equipment included the respective studies, submit the preliminary studies and corresponding computer printouts and annotated one-line distribution diagram to the Engineer for review and comment.

1.05 QUALITY ASSURANCE

A. Conform all quality control work to Section 26 05 00.

B. Provide products that are listed and labeled by Underwriters Laboratory, approved by Factory Mutual or certified as meeting the standards of United Laboratories by the Electrical Testing Laboratory for the location installed in and the application intended unless products meeting the requirements of these testing laboratories are not available or unless standards do not exist for the products.

C. Unless products meeting the requirements of nationally recognized testing laboratories are not readily available for a category of products, provide products that are:

1. Listed and labeled by Underwriters Laboratory.

2. Approved by Factory Mutual.

3. Certified as meeting the standards of Underwriters Laboratory by the Electrical Testing Laboratory.

D. Conform all work to regulatory requirements of all state, local, and national governing codes and requirements, NFPA 70, National Electrical Code, and the requirements of Section 26 05 00.

E. Installer Qualifications: Firm specializing in installing work of this Section with minimum three years documented experience.

F. Install work by or under supervision of licensed electricians.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protect items from damage during delivery, storage and handling in accordance with Section 26 05 00 and as detailed below.

B. Store all products indoors in heated warehouses on blocking or pallets.

1.07 WARRANTY

A. SPD shall have a ten-year warranty. Warranty shall be the responsibility of the electrical distribution equipment manufacturer and shall be supported by their respective field service division.

PART 2 – PRODUCTS

2.01 SURGE PROTECTIVE DEVICES EQUIPMENT

A. General Requirements:

1. Provide only products satisfying the applicable requirements for testing and reporting as established herein. Devices proposed for use on this project shall be tested in accordance with ANSI/UL 1449 Third Edition, as prescribed by ANSI/IEEE C62.45 – 2002. The voltage protection rating (VPR) or "clamping" voltages shall be recorded for all applicable mode of operation and for each of the test standard waveforms referenced. The results of these tests shall be submitted to the Engineer with the product data sheets as outlined under in this Section.

2. Products furnished for use on this project are to incorporate protective elements in all applicable modes, unless specifically indicated otherwise.

3. Install SPD equipment where so indicated on the Drawings. Voltage class and type of unit to be compatible with distribution voltage being protected.

2.02 INTEGRAL SURGE PROTECTIVE DEVICES:

1. SPD shall be Listed in accordance with ANSI/UL 1449 Third Edition, Standard for Safety, Surge Protective Devices.

2. All SPDs installed on the line side of the service entrance disconnect shall be a Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be a Type 1 or 2 SPD.

3. SPD shall be modular in design. Each protection element shall be a user replaceable surge current diversion Thermally Protected unimodule (MOV based). Each surge current diversion module shall have a short circuit current rating (SCCR) of 240 kA. Each surge current diversion module shall include solid state status indicator lights.

4. SPD shall provide redundant surge current diversion modules for each mode of Protection. Modes of Protection shall be L-N, L-G, N-G in WYE systems, and L- L, L-G in DELTA systems.

5. SPD shall incorporate copper bus bars for the surge current path. Small gauge round wiring or plug-in connections shall not be used in the path for surge current diversion. Surge current diversion modules shall use bolted connections to the bus bars for reliable low impedance connections.

6. Nominal Discharge Current (In) – SPD applied to the distribution system shall have a minimum 20kA.

7. 240 kA SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41.2 - 2002 Category C (Type 1) environments.

8. SPD shall meet or exceed the following criteria:
   a. Minimum surge current rating per mode shall be:
      1) L-N 120 kA
      2) L-G 120 kA
      3) N-G 120 kA
      4) Per phase 240 kA
9. SPD shall be equipped with onboard visual LED lights and audible diagnostic monitoring. Red and green LED indicator lights shall provide full time visual diagnostic monitoring of the operational status of each phase as well as each surge current diversion module. Audible diagnostic monitoring shall be by way of audible alarm. This alarm shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm. An alarm push to test switch shall be provided. The diagnostic monitoring circuits shall continually monitor the operational status of the surge current diversion modules. No other test equipment shall be required for SPD monitoring or testing before or after installation.
10. SPD shall be connected to the power bus through a dedicated circuit breaker or disconnect.
11. SPD shall include Form C dry contacts to monitor the performance of each phase and provide a summary alarm.
12. SPD shall include an event surge counter. The counter shall be equipped with a manual reset and a battery or flash memory to retain memory upon loss of AC power. The surge counter display and reset switch shall be mounted on the front of the SPD enclosure.
13. Acceptable Manufacturers:
    a. Eaton Electric
    b. Square D Company.
    c. General Electric.
    d. Siemens Industry for LV Power Distribution.
    e. Advanced Protection Technologies Inc.
    f. LEA International
    g. Or Approved Equal.

2.03 MATERIALS

A. Grounding Materials: Conform to Section 26 05 26

B. Wiring, External to Equipment and Connectors: Conform to Section 26 05 19

C. Conduit Materials: Conform to Section 26 05 33

PART 3 – EXECUTION

3.01 PREPARATION

A. Painted surfaces, which will be covered by items of this Section, shall have a prime and finish coat of paint.

3.02 INSTALLATION

A. Install all Surge Protective Devices in accordance with the manufacturer's instructions.

B. Ground all Surge Protective Devices in accordance with Section 26 05 26, and the manufacturer's instructions using wire as specified in Section 26 05 19, of size No. 6 AWG or larger if otherwise indicated, recommended, or specified.

C. Surge Protective Devices for incoming services shall be factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1. Refer to Specification Section 26 24 16 Panelboards.

3.03 PROTECTION

A. During painting mask all nameplates, all plastic parts, pushbuttons, operating shafts and all items not to be painted.

B. Protect all items during work of other trades including welding and cutting.

C. Protect Surge Protective Devices against short circuits and improper operation.

END OF SECTION

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SECTION – 26 56 13

LIGHTING POLES AND STANDARDS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and Division 01 Specification Sections, apply to the Work of this Section.

1.02 SUMMARY

A. Section Includes:

1. Poles and accessories for support of luminaires.

B. Related Sections:

1. Section 26 05 00 – Common Work Result for Electrical
2. Section 26 05 26 – Grounding and Bonding
3. Section 26 05 43 – Underground Ducts and Raceways for Electrical Systems
4. Section 26 05 53 – Identification for Electrical Systems
5. Section 26 56 19 – LED Exterior Lighting

1.03 DEFINITIONS

A. EPA: Equivalent projected area.

B. Luminaire: Complete luminaire.

C. Pole: Luminaire-supporting structure, including tower used for large-area illumination.

D. Standard: See "Pole."

1.04 ACTION SUBMITTALS

A. Product Data: For each pole, accessory, and luminaire-supporting and -lowering device, arranged as indicated.

1. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.

2. Include finishes for lighting poles and luminaire-supporting devices.

3. Anchor bolts.

4. Manufactured pole foundations.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Detail fabrication and assembly of poles and pole accessories.

4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.

5. Anchor bolt templates keyed to specific poles and certified by manufacturer.

6. Method and procedure of pole installation. Include manufacturer's written installations.

C. Samples: For each exposed lighting pole, standard, and luminaire-supporting device and for each color and texture specified.

1.05 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.

B. Qualification Data: For Installer and testing agency.

C. Material Test Reports:

1. For each foundation component, by a qualified testing agency.

2. For each pole, by a qualified testing agency.

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample Warranty: Manufacturer's standard warranty.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Pole repair materials.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for foundation testing.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch deep. Do not apply tools to section of pole to be installed below finished grade.

D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

E. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.09 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of pole(s) and luminaire-lowering device(s) that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

2. Warranty Period for Corrosion Resistance: Five years from date of Substantial Completion.

3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 ALUMINUM POLES

A. Poles: extruded structural tube complying with ASTM B 221, Alloy 6063-T6, with access handhole in pole wall.

B. Mast Arms: Aluminum type, continuously welded to pole attachment plate. Material

and finish same as plate.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with stainless -steel bolts.

2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

E. Grounding and Bonding Lugs: Bolted 1/2-inch threaded lug, complying with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

F. Fasteners: Stainless steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as to substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.

2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

G. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

H. Prime-Coat Finish: Manufacturer’s standard prime-coat finish ready for field painting.

I. Aluminum Finish: Comply with NAAMM’s "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.

3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I clear coating of 0.018 mm or thicker), complying with AAMA 611.

4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium; Chemical Finish: Etched, medium matte; Anodic Coating:

Architectural Class I integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.

2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.

3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color: Match Architect's sample.

K. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.

2. Powder coat shall comply with AAMA 2604.

a. Electrostatic applied powder coating; single application with a minimum 2.5- to 3.5-mils dry film thickness; cured according to manufacturer's instructions. Coat interior and exterior of pole for equal corrosion protection.

b. Color: Match Architect's sample.

2.02 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.

B. Transformer-Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and to accept indicated accessories. Include removable flanged access cover secured with bolts or screws.

2.03 MOUNTING HARDWARE

A. Anchor Bolts: Manufactured to ASTM F 1554, Grade 55, with a minimum yield strength of 55,000 psi.

1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.

2. [Bent] [Headed] rods Threading: [Uniform National Coarse] [Uniform National 8], Class 2A.

B. Nuts: ASTM A 563, Grade A, Heavy-Hex

1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.

2. Two nuts provided per anchor bolt, shipped with nuts pre-assembled to the anchor bolts.

C. Washers: ASTM F 436, Type 1.

1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.

2. Two washers provided per anchor bolt.

2.04 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.

C. Examine roughing-in for foundation and conduit to verify actual locations of installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 POLE FOUNDATION

A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base

flange. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 03 30 00 "Cast-in-Place Concrete."

B. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories.

1. Baseplate: Stamped with manufacturer's name, date of production, and cable entry.

C. Direct-Buried Foundations: Install to depth indicated on Drawings, but not less than as indicated. Add backfill in 6-inch to 9-inch layers, tamping each layer before adding the next. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.

D. Direct-Buried Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than as indicated. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.

1. Make holes 6 inches in diameter larger than pole diameter.

2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi at 28 days and finish in a dome above finished grade.

3. Use a short piece of 1/2-inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

4. Cure concrete a minimum of 72 hours before performing work on pole.

E. Anchor Bolts: Install plumb using manufacturer-supplied steel template, uniformly spaced.

3.03 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on drawing.

1. Fire Hydrants and Water Piping: 60 inches.

2. Water, Gas, Electric, Communications, and Sewer Lines: 10 feet.

3. Trees: 15 feet from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.

2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.

3. Install base covers unless otherwise indicated.

4. Use a short piece of 1/2 -inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inch- wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch below top of concrete slab.

F. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.04 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum using insulating fittings or treatment.

B. Steel Conduits: Comply with requirements in Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

3.05 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.

2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.07 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Inspect poles for nicks, mars, dents, scratches, and other damage.

2. System function tests.

END OF SECTION

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SECTION – 26 56 19

LED EXTERIOR LIGHTING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and Division 01 Specification Sections, apply to the Work of this Section.

1.02 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.

2. Luminaire supports.

B. Related Sections:

1. Section 26 05 00 – Common Work Result for Electrical

2. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables

3. Section 26 05 26 – Grounding and Bonding

4. Section 26 05 53 – Identification for Electrical Systems

5. Section 26 56 13 – Lighting Poles and Standards

1.03 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.

2. Include data on features, accessories, and finishes.

3. Include physical description and dimensions of luminaire.

4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.

5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.

   a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.

   b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

6. Wiring diagrams for power, control, and signal wiring.

7. Photoelectric relays.

8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.

C. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.

D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For luminaire supports.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.

2. Structural members to which equipment and luminaires will be attached.

3. Underground utilities and structures.

4. Existing underground utilities and structures.

5. Above-grade utilities and structures.

6. Existing above-grade utilities and structures.

7. Vertical and horizontal information.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Product Certificates: For each type of the following:

1. Luminaire.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Source quality-control reports.

F. Sample warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.

2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.

2. Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.

3. Diffusers: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.08 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

E. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

F. Mockups: For exterior luminaires, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.

2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.10 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.11 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including luminaire support components.

b. Faulty operation of luminaires and accessories.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. UL Compliance: Comply with UL 1572, UL1598 and listed for wet location.

E. Lamp base complying with ANSI C81.61 or IEC 60061-1.

F. Bulb shape complying with ANSI C79.1.

G. CRI of 80. CCT of 3000 K.

H. L70 lamp life of 35,000 hours.

I. Lamps dimmable from 100 percent to 0 percent of maximum light output.

J. Internal driver.

K. Nominal Operating Voltage: 120 V ac.

L. In-line Fusing: On the primary for each luminaire

M. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

N. Source Limitations: Obtain luminaires from single source from a single manufacturer.

O. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.02 LUMINAIRE TYPES

A. Area and Site:

1. Luminaire Shape: Square.

2. Mounting: Pole with aluminum round arm – Refer to drawings.

3. Luminaire-Mounting Height: Refer to drawings.

4. Distribution: See Catalog number on drawings.

5. Diffusers: Clear polycarbonate

6. Housings:

a. Extruded-aluminum housing and heat sink.

2.03 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Form and support to prevent warping and sagging.

C. Diffusers:

1. Glass: Annealed crystal glass unless otherwise indicated.

2. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

E. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.

2. Provide filter/breather for enclosed luminaires.

F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.

b. Lamp diameter, shape, size, wattage and coating.

c. CCT and CRI for all luminaires.

G. Enclosures shall be Vandal-proof.

2.04 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:

1. Sized and rated for luminaire weight.

2. Able to maintain luminaire position after cleaning and relamping.

3. Support luminaires without causing deflection of finished surface.

4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wiring Method: Install cables in raceways. Conceal raceways and cables.

G. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.

H. Coordinate layout and installation of luminaires with other construction.

I. Adjust luminaires that require field adjustment or aiming.

J. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 05 33 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.04 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.05 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.06 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

2. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

   a. IES LM-5.

   b. IES LM-50.

   c. IES LM-52.

   d. IES LM-64.

   e. IES LM-72.

2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train. Owner's maintenance personnel to adjust, operate, and maintain luminaires**.**

END OF SECTION

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SECTION – 31 10 00

SITE CLEARING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and Division 01 Specification Sections, apply to the Work of this Section.

1.02 RELATED SECTIONS

A. Section 01 50 00 – Temporary Facilities and Controls.

1.03 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Disconnecting, capping or sealing, removing site utilities, and abandoning site utilities in place.
4. Temporary erosion and sedimentation control.

1.04 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches (50 mm) in diameter; and free of weeds, roots, toxic materials, or other non-soil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction within the drip zone and indicated on Drawings.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.05 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site – 12 Croton Falls Road, Croton Falls, NY 10519.

1.06 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.07 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.

2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Rock stockpiling program.

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

E. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.08 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

B. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.09 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Project Site.

D. Utility Locator Service: Notify Dig Safely New York for area where Project is located

before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and tree protection measures are in place.

F. Tree- and Plant-Protection Zones: Protect according to requirements in Section 02 56 39 "Temporary Tree and Plant Protection."

G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 – EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 02 56 39 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.03 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 02 56 39 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements

in Section 02 56 39 "Temporary Tree and Plant Protection."

3.04 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

B. Verify that utilities have been disconnected and capped before proceeding with site clearing.

C. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Contractor shall arrange with utility companies to shut off indicated utilities.

D. Locate, identify, and disconnect utilities indicated to be abandoned in place.

E. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Architect's written permission.

F. Excavate for and remove underground utilities indicated to be removed.

G. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 02 41 16 "Demolition."

3.05 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Burning tree, shrub, and other vegetation waste is subject to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited.

C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION

SECTION – 31 17 26

TACTILE WARNING SURFACE

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The manufacture shall furnish and delivery the thermoplastic warning material (tactile) in compliance with this specification including any and all required surface preparation operations.

1.02 CITED STANDARDS

A. American Society for Testing and Materials (ASTM):

B. ASTM D 638 Tensile strength

C. ASTM D638 Min elongation 20%.

D. ASTM D570 Water absorption of plastic max 0.5%.

E. ASTM E303 Skid resistance min 45 in units (British Pendulum)

F. ASTM C482-02 Bond strength of ceramic tile to Portland cement.

G. ASTM G155 Operating Xenon arc light apparatus for exposure of nonmetallic materials – Fade resistance (weathering)

H. ASTM D1148-07a Rubber deterioration-Discoloration from ultraviolet (UV) and heat exposure of light colored surfaces.

I. ASTM D1148 Xenon arc resistance/color min maintains 70% contrast.

J. ASTM F 1679 Slip resistance (0-2700 F) average .81

K. ASTM C 501 Wear resistance.

L. ASTM B117 Salt and Spray performance

M. ASTM C 1026 Freeze, Thaw, Heat performance

N. NYSBC – New York State Building Code 2010 or latest addition.

O. Americans with Disabilities Act (ADA). 2010 Standards for State and Local Government facilities: Title II

1.03 NOTED RESTRICTIONS

A. The manufacture shall provide training for panel installation and replacement, technical services in site for at least one (1) day.

B. The site installation will be provided by MNR.

C. Mechanical fasteners shall not be part of material.

D. The material and adhesive system shall be solvent free and contain no volatile organic compounds (VOCs)

1.04 QUALITY CONTROL

A. The manufacturer must be ISO certified and provide proof of current certification.

B. The Contractor shall demonstrate familiarity with the installation system by providing a sample installation acceptable to MNR per manufacturer instruction.

1.05 SUBMITTALS

A. Submittals to be provided with Bid documents:

B. Working drawings, showing the following:

1. Manufacturer installation instruction on new and existing concrete surface, new and existing pavements.

2. Drawings and details showing typical dimensions, pattern, thickness and surface geometry.

C. Documentation of all aspects of detectable warning strips and their installation not described by the shop drawings, including, but not limited to the method of surface preparation of the tactile warning strips.

D. Recommended methods of maintenance and repair of the installed detectable warning tactile.

E. Estimated service life and units replacement cost for all replaceable components of the warning material.

F. Product data: Manufacturer's catalog cuts, specifications, and installation procedures, adhesive and sealant material. Provide any and all applicable MSDS sheets for all products used.

G. Product data for all type of product indicated and recommended by the tile manufacture.

H. Certified material test reports: submit certified test report from a qualified independent testing laboratory.

I. Warning material properties: result of test of the properties of the tactile under condition simulating those of the actual installation such as water absorption. Salt and spray performance, accelerated weathering, chemical resistance, freeze/thaw/heat, slip resistance, stain resistance, and wear resistance.

J. Samples:

1. One full size 24"x48" samples of the thermoplastic detectable warning panel.

2. Sealing and bonding material for each application.

K. Application instruction for product installation on new and existing concrete surface.

L. Warranty as requested in Section 1.07.

1.06 WARRANTY

A. Provide a minimum of manufacturer's five (5) years limited warranty against defective materials and workmanship, and chipping of panels.

B. Provide a minimum of manufacturer's one (1) years limited warranty against panel damaging, dome braking and panel quality.

PART 2 – PRODUCTS

2.01 GENERAL

A. The preformed thermoplastic detectable warning material (tactile) shall meet the

latest Public Rights-of-Way Accessibility Guidelines as published by the U.S. Access Board requirements, this specification and be approved for use by the MNR.

2.02 WARNING PANELS

A. The material must be impervious to degradation by motor fuels, salt, chemical, etc. The truncated domes must be an integral part of the preformed thermoplastic material. The material shall consist of one preformed thermoplastic part and adhesive only. Mechanical fasteners shall not be part of the material.

B. Panel sizes shall be 24”x36” and 24”x48”.

C. Size: The truncated domes in a detectable warning surface shall have a base diameter of 0.9 inches minimum to 1.4 inches maximum, a top diameter of 50% of the base diameter minimum to 65% of the base diameter maximum, and a height of 0.2 inches.

D. Alignment: Domes shall be in staggered pattern for warning panel installed at platform and could be aligned on a square grid in the predominant direction of travel to permit wheels to roll between domes for detectable warning panel installed on ramps or curb ramps.

E. Spacing: Truncated domes in a detectable warning surface shall have a center-to-center spacing of 1.6 inches minimum and 2.4 inches maximum, and a base-to-base spacing of 0.65 inches minimum, measured between the most adjacent domes on square grid.

F. Color: The color of the tiles shall be safety yellow to match tactile material currently used by the MNR. The tile shall be substantially the same color throughout the thickness of the tile material.

G. The material shall differ in sound and feel from adjacent platform surface in “sound-on-crane” and resiliency.

2.03 CONFIGURATION

A. The detectable warning material shall be supplied as kit that contains the domed preformed thermoplastic material and an adhesive system.

2.04 EQUIPMENT

A. The equipment used for the installation of the detectable warnings panels shall be recommended by the tile manufacture.

B. Propane Heat Torch: As recommended by tile manufacturer. MNR will purchase the propane heat torch with fan-shaped nozzle under a separate order.

C. Roller: As recommended by tile manufacturer. MNR will purchase the propane heat torch under a separate order.

D. Holed corrugated inserts: As recommended by tile manufacturer shall be provided with detectable warning tiles in an amount recommended by manufacturer.

PART 3 – EXECUTION

3.01 GENERAL

A. Transmit submittals and deliverables required by this Section.

B. Allow fifteen (15) days for review of submittals by MNR.

C. Furnish products as indicated.

D. Ensure substrates are in suitable condition to receive the Work of this Section.

3.02 PROTECTION, DELIVERY AND MISCELLANEOUS

A. Deliver material to the site where instructed by MNR, in good condition and properly protected against damage to tactile.

B. Detectable warning material shall be placed in a box with cardboard stiffeners and impact absorbers to prevent damage in transit. The cartons in which packed shall be non-returnable, and be labeled for ease of identification size and quantity.

C. The MNR reserves the right to inspect all delivered product.

D. Defective finished products shall be rejected. Manufacture shall be responsible for the cost of corrections and replacement.

E. Furnished panels and other related materials shall be delivered at a location designated by MNR and confirm times 48 hours in advance.

3.03 USE AND INSTALLATION

A. Install panels within the Railroad's Right-of-Way platform, ramp and ADA access route.

B. The material must be pliable during the application process to be capable of fully conforming to access route contours and geometries.

C. The material must be able to be cut to match access route geometries (such as radius) using a pair of heavy duty scissors only. To facilitate faster application and to avoid potentially hazardous airborne fiber particles, diamond cutting blades and carbon-tipped saw blades shall not be required for cutting the material.

D. To overcome the low tensile strength of substrate surfaces without exposed aggregates (such as concrete laitance), the adhesive system must include a two component sealer with a max. viscosity of 300cP, and to ensure sufficient film thickness the adhesive system must also include an overlaying two component bonder paste with a minimum viscosity of 400,000 cP. Viscosities determined in accordance. Viscosities determined in accordance ASTM D4440 (250C; 1Hz; 10% stain).

E. The required (two-components if required) adhesive materials must be supplied in ready-to-use, self-mixing, dispensing systems that shall not require the applicator to perform measuring or mixing operations.

F. To facilitate optimized contact surface between the thermoplastic detectable warning material and the adhesive system, the entire underside of the thermoplastic detectable warning material must be uniformly roughened.

G. To facilitate optimized contact surface between the thermoplastic detectable warning material and the adhesive system, the thermoplastic detectable warning material must have air evacuation holes spaced no more than 2.4 in. apart when measured in square grid.

H. The material shall not require the use of mechanical fasteners, which can turn into potential tripping hazards.

I. The regular application process shall not include the use of flammable liquids such as acetone, where skin contact causes drying and cracking of the skin.

J. The regular application process shall not require mechanical preparation of the application, such as scouring with a dust generating diamond cup grinder.

K. The material must be able to be applied in ambient temperature down to 450F or rising surface temperature. If substrate surface temperatures exceed 90°F do not attempt to apply more than a 4 ft. x 2 ft. section at one time.

L. The facilitate simpler and faster application, the regular application process shall not require separate application of perimeter sealing or caulking, or the use of masking or duct tape.

M. The applied material, including adhesive, shall have a combined thickness of max 0.17 in. (excluding the truncated domes).

N. The minimize air borne particle generation it shall not be necessary to scuff the underside of the material with a grinding cup or diamond blade, even when applying material in a non-linear pattern, such as a radius.

O. The texture shall contrast with that of the surrounding surface.

P. To facilitate ease of mobilization and avoid heavy lifting, the regular application process shall not require the use of sandbags.

END OF SECTION

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SECTION – 31 20 00

EARTH MOVING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and Division 01 Specification Sections, apply to the Work of this Section.

1.02 RELATED SECTIONS

A. Section 01 32 00 – Construction Progress Documentation.

B. Section 01 32 33 – Photographic Documentation.

C. Section 31 10 00 – Site Clearing.

D. Section 31 50 00 – Excavation Support and Protection.

1.03 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.

1.04 UNIT PRICES

A. Rock Measurement: Volume of rock removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.

1. 24 inches (600 mm) outside of concrete forms other than at footings.
2. 12 inches (300 mm) outside of concrete forms at footings.
3. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
5. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
6. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

1.05 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

C. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations

or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Bulk Excavation: Excavation more than 10 feet (3 m) in width and more than 30 feet (9 m) in length.

3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

D. Fill: Soil materials used to raise existing grades.

E. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for bulk excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- (1065-mm-) maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp (103-kW) flywheel power with bucket-curling force of not less than 28,700 lbf (128 kN) and stick-crowd force of not less than 18,400 lbf (82 kN) with extra-long reach boom.

2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp (172-kW) flywheel power and developing a minimum of 47,992-lbf (213.3-kN) breakout force with a general-purpose bare bucket.

F. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that exceed a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm) when tested by a geotechnical testing agency, according to ASTM D1586.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

H. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.06 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct pre-excavation conference at Project Site – 12 Croton Falls Road, Croton Falls, NY 10519.

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

a. Personnel and equipment needed to make progress and avoid delays.

b. Coordination of Work with utility locator service.

c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.

d. Extent of trenching by hand or with air spade.

e. Field quality control.

1.07 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.

2. Controlled low-strength material, including design mixture.

3. Geofoam.

4. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches (300 by 300 mm).

2. Warning Tape: 12 inches (300 mm) long; of each color.

1.08 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D2487.

2. Laboratory compaction curve according to ASTM D1557.

C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.09 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.10 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify Dig Safely New York for area where Project is located

before beginning earth-moving operations.

D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 31 10 00 "Site Clearing" are in place.

E. Do not commence earth-moving operations until plant-protection measures specified in Section 02 56 39 "Temporary Tree and Plant Protection" are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. S Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least

90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of crushed stone or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and zero to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and zero to 5 percent passing a No. 4 (4.75-mm) sieve.

J. Sand: ASTM C33/C33M; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Survivability: As follows:
    a. Grab Tensile Strength: 157 lbf (700 N); ASTM D4632.
    b. Sewn Seam Strength: 142 lbf (630 N); ASTM D4632.
    c. Tear Strength: 56 lbf (250 N); ASTM D4533.
    d. Puncture Strength: 56 lbf (250 N); ASTM D4833.
3. Apparent Opening Size: No. 40 (0.425-mm) sieve, maximum; ASTM D4751.
4. Permittivity: 0.5 per second, minimum; ASTM D4491.
5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Survivability: As follows:
    a. Grab Tensile Strength: 247 lbf (1100 N); ASTM D4632.
    b. Sewn Seam Strength: 222 lbf (990 N); ASTM D4632.

c. Tear Strength: 90 lbf (400 N); ASTM D4533.

d. Puncture Strength: 90 lbf (400 N); ASTM D4833.

3. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D4751.

4. Permittivity: 0.02 per second, minimum; ASTM D4491.

5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

2.03 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:

1. Red: Electric.

2. Yellow: Gas, oil, steam, and dangerous materials.

3. Orange: Telephone and other communications.

4. Blue: Water systems.

5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.

2. Yellow: Gas, oil, steam, and dangerous materials.

3. Orange: Telephone and other communications.

4. Blue: Water systems.

5. Green: Sewer systems.

PART 3 – EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

3.02 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding

on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.03 EXPLOSIVES

A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.

a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches (600 mm) outside of concrete forms other than at footings.

b. 12 inches (300 mm) outside of concrete forms at footings.

c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.

d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.

f. 6 inches (150 mm) beneath pipe in trenches and the greater of 24

inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

3.05 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.06 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.07 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, damproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.08 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.09 GEOFOAM FILL

A. Do not use geofoam fill.

3.10 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.11 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm**)** in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 92 percent.

3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.12 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus, or minus 1 inch (25 mm).

2. Walks: Plus, or minus 1 inch (25 mm).

3. Pavements: Plus, or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2-inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.13 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.

2. Determine that fill material classification and maximum lift thickness comply with requirements.

3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab but in no case fewer than three tests.

2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length but no fewer than two tests.

3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.14 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction

due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

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SECTION – 31 23 23

COMPACTION TESTING AND INSPECTION

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Provide laboratory gradation testing.

1.02 RELATED SECTIONS

A. Section 01 43 00 – Quality Assurance

B. Section 31 20 00 – Earth Moving

1.03 REFERENCES

A. ASTM D422 – Particle Size Analysis of Soils

B. ASTM D698 – Moisture – Density Relations of Soils and Soil Aggregate Mixtures using 5.5 lb. Rammer and 12-inch Drop

C. ASTM D1556 – Density of Soil in Place by the Sand-Cone Method

D. ASTM D1557 – Test Methods for Moisture – Density Relations of Soils ad Soil Aggregate Mixtures Using 10 lb. Rammer and 18-inch Drop

E. ASTM D6938-10 – Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)

1.04 TESTING SERVICES

A. Metro North will pay for all testing services.

B. The test services shall include:

1. Review and check/test the Contractor's proposed materials for compliance with the specifications.

2. Compaction tests of materials modified or placed by the Contractor including asphalt paving for compliance with the applicable specifications.

3. Qualifications of the proposed materials and portions.

4. Any additional testing required due to the failure of material to meet the specification requirements.

5. Any additional testing required due to the changed in the materials or proportions by the Contractor.

1.05 RESPONSIBILITIES OF THE CONTRACTOR

A. Submit to the Engineer the materials and portions for use with a request for approval. This submittal shall include the results of the testing performed to qualify the material.

B. Inform approved testing agency sufficiently in advance to allow reasonable mobilization time.

1.06 TESTING PROCEDURES

A. Determine the moisture-density curve for each material in accordance with ASTM D1557 or AST D698.

B. Determine the gradations above the number 200 sieve of each material in accordance with ASTM 422.

C. Determine the Liquid Limit and Plastic Limit, where applicable.

1.07 ACCEPTANCE CRITERIA

A. Compaction results must meet or exceed the minimum values specified. Any material or area that tests below the specified values shall be corrected and retested until it passes. All correction work shall be performed at no additional cost to Metro-North.

B. Gradation results shall meet all requirements specified.

PART 2 – PRODUCTS

2.01 NOT USED.

PART 3 – EXECUTION

3.01 NOT USED

END OF SECTION

SECTION – 31 25 00

EROSION AND SEDIMENTATION CONTROLS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section specifies Contract requirements for controlling soil erosion, sedimentation, and minimizing the discharge of pollutants.

B. The requirements of this section apply to all Work activities on the site and all conditions within the work area during the construction period.

C. The Contractor shall comply with all Federal, State, or local laws, codes, ordinances and regulations that govern the control of sediment, erosion and stormwater during construction activities.

D. Notwithstanding the specific requirements specified herein, the Contactor shall at all times minimize the discharge of pollutants and prevent any violations of the New York State Water Quality Standards in accordance with the New York State Department of Conservation (NYSDEC) State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity (General Permit).

1. With Contractor's Bid, Contractor represents knowledge and understanding of the General Permit's terms and conditions, and has considered the implications to the Work required under this section with respect to Contractor's proposed means and methods of construction.

2. Provide all Work and employ all practices necessary to conform to the terms and conditions of the General Permit including, but not limited to those indicated on the Contract Drawings and specified in this section.

   a. Excluded from this requirement are the selection, design, installation or maintenance of post-construction stormwater management practices per the General Permit Part III.C. except where specifically indicated on Contract Drawings.

3. Prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) in accordance with the General Permit.

4. Provide all personnel and subcontractors having necessary qualifications to prepare and implement the SWPPP, including but not limited to Trained Contractor(s), Qualified Inspector(s), and Qualified Professional(s).

5. Prepare and submit on behalf of the Owner to NYSDEC a Notice of Intent (NOI) for coverage under the General Permit.

1.02 DEFINITIONS / EXPLANATION OF TERMS

A. General Permit: The New York State Department of Conservation (NYSDEC) State Pollutant Discharge Elimination System (SSPDES) General Permit for Stormwater Discharges from Construction Activity, Permit No. GP-0-15-002, Modified July 14, 2015 or current version.

B. NYS Standards: "New York State Standards and Specifications for Erosion and

Sediment Control", New York State Department of Environmental Conservation, et. al., November 2016, or latest version).

C. All definitions in Appendix A of the General Permit are hereby incorporated into this section.

D. Practices: Physical, structural, and/or managerial practices that, when used singly or in combination, prevent or reduce pollution of water, and are described in the NYSDEC "Standards and Specifications for Erosion and Sediment Control".

E. Erosion: The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as geological creep, detachment, movement of soil or rock fragments by water, wind, ice, or gravity.

F. Erosion/Sediment Control: Any temporary or permanent measures taken to reduce erosion, control siltation and sedimentation, and ensure that sediment-laden water does not leave the Site.

1.03 REFERENCES

A. Comply with applicable provisions and recommendations of the following except as otherwise shown on Contract Drawings or specified herein.

1. General Permit
2. NYS Standards
3. New York State Stormwater Management Design Manual (January 2015, or latest version)

1.04 SUBMITTALS

A. Shop drawings: Submit the following items to the Engineer.

1. Details, product information and installation instructions of all practices to be employed at the site.

B. Submit a SWPPP meeting all requirements of the General Permit. Include SWPPP certifications signed by the Contractor and all Subcontractors.

1. Resubmit any subsequent amendments to the SWPPP as required to keep the SWPPP current per Part III A. 4. of the General Permit.

C. Submit all Inspection Reports and other documentation necessary to comply with the General Permit.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Sediment and erosion control practices shall be operational at all times during the Work, specifically during excavation, backfilling and restoration, and decontamination operations. The sediment and erosion control system shall be capable of handling stormwater during construction. Damage to excavation slopes and the migration of contaminated soil to downstream areas resulting from storm events shall be repaired or remediated by the Contractor, at the Contractor's expense.

B. Stormwater: At no time shall the Contractor allow stormwater runoff from soil excavation/stockpiling operations, or effluent from decontamination operations to migrate off to contaminate soils in other areas or percolate into the groundwater.

The Engineer will monitor any overflow or leakage that occurs, and may require the Contractor to perform soil sampling within all areas affected by such overflow. Any soils that have been contaminated by such overflow shall be removed, tested and analyzed if necessary, and disposed of by the Contractor at no additional cost to the Owner.

C. Silt and Sediment Disposal: All silt and sediment which accumulates behind any practices used on the site (i.e., straw bale berms or silt fences) shall be removed and disposed of off-site in accordance with all applicable Federal, State and local regulations.

D. Removal of all waste shall be in accordance with the General Permit and Division 01 of the Contract Specifications.

E. The Contractor shall clean the Site and equipment consistent with requirements of the SWPPP and the current New York State Standards and Specifications for Erosion and Sediment Control. Where appropriate, truck washes/decontamination stations should be installed to minimize the migration of sediment off-site.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All components/controls must be designed in conformance with the most current version of the NYS Standards, and the New York State Stormwater Management Design Manual. Where erosion and sediment control practices are not designed in conformance with these technical standards, the Contractor must demonstrate equivalence to the technical standard.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All installation of all practices shall be consistent with the most current version of the NYS Standards, and the New York State Stormwater Management Design Manual. Where erosion and sediment control practices are not designed in conformance with these technical standards, the Contractor must demonstrate equivalence to the technical standard.

B. Maintenance: The Contractor shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition at all times consistent with the most current version of the NYS Standards, and the New York State Stormwater Management Design Manual.

3.02 MINIMUM PRACTICES

A. At minimum, the Contractor shall employ the following practices, as set forth in the NYS Standards, pursuant to complying with the General Permit in accordance with this section:

1. Planning and Management

a. Dust Control – see NYS Standards, Page 2.25

b. Protecting Vegetation During Construction – see NYS Standards, Page 2.26

c. Stabilized Construction Access – see NYS Standards, Page 2.30

2. Soil Stabilization

a. Anchored Stabilization Matting – see NYS Standards, Page 4.5

b. Mulching – see NYS Standards, Page 4.39Recreation Area Seeding – see NYS Standards, Page 4.45

c. Topsoiling – see NYS Standards, Page 4.59

3. Sediment Control

a. Silt Fence – see NYS Standards, Page 5.54

b. Storm Drain Inlet Protection, Type IV Paved Surface – see NYS Standards, Page 5.57

B. The Contractor shall meet all inspection and maintenance requirements of the General Permit, including but not limited to the following:

1. Ensure that all erosion and sediment control practices identified in the SWPPP are inspected and maintained per Part IV. A. of the General Permit.

2. Provide a Trained Contractor who shall inspect the practices and measures being implemented to ensure that they are effective, and implement any corrective measures per Part IV. B. of the General Permit.

3. Provide a Qualified Inspector who shall conduct all site inspections and prepare all reports required by Part IV. C. of the General Permit.

END OF SECTION

SECTION – 31 50 00

EXCAVATION SUPPORT AND PROTECTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and Division 01 Specification Sections, apply to the Work of this Section.

1.02 RELATED SECTIONS

A. Section 01 32 00 – Construction Progress Documentation.

B. Section 01 32 33 – Photographic Documentation.

C. Section 01 43 00 – Quality Assurance.

D. Section 31 20 00 – Earth Moving.

1.03 SUMMARY

A. Section includes temporary excavation support and protection systems.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site – 12 Croton Falls Road, Croton Falls, NY 10519.

1. Review geotechnical report.
2. Review existing utilities and subsurface conditions.
3. Review coordination for interruption, shutoff, capping, and continuation of utility services.
4. Review proposed excavations.
5. Review proposed equipment.
6. Review monitoring of excavation support and protection system.
7. Review coordination with waterproofing.
8. Review abandonment or removal of excavation support and protection system.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, performance properties, and dimensions of individual components and profiles, and calculations for excavation support and protection system.

B. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.

1. Include plans, elevations, sections, and details.
2. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and

protection system according to engineering design.

3. Indicate type and location of waterproofing.

4. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

C. Delegated-Design Submittal: For excavation support and protection systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Land surveyor.

2. Professional Engineer: Experience with providing delegated-design engineering services of the type indicated, including documentation that engineer is licensed in New York State.

B. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

1.07 CLOSEOUT SUBMITTALS

A. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.08 FIELD CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility-serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of utility.

2. Do not proceed with interruption of utility without Owner's written permission.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 – PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section

01 43 00 – Quality Assurance, to design excavation support and protection systems to resist all lateral loading and surcharge, including but not limited to, retained soil, groundwater pressure, adjacent building loads, adjacent traffic loads, construction traffic loads, material stockpile loads, and seismic loads, based on the following:

1. Compliance with OSHA Standards and interpretations, 29 CFR 1926, Subpart P.
2. Compliance with AASHTO Standard Specification for Highway Bridges or AASHTO LRFD Bridge Design Specification, Customary U.S. Units.
3. Compliance with requirements of authorities having jurisdiction.
4. Compliance with utility company requirements.
5. Compliance with railroad requirements.

2.02 MATERIALS

A. Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A36/A36M, ASTM A690/A690M, or ASTM A992/A992M.

C. Steel Sheet Piling: ASTM A328/A328M, ASTM A572/A572M, or ASTM A690/A690M; with continuous interlocks.

1. Corners: Roll-formed corner shape with continuous interlock.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application].

E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

F. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.

G. Tiebacks: Steel bars, ASTM A722/A722M.

H. Tiebacks: Steel strand, ASTM A416/A416M.

PART 3 – EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

3.02 INSTALLATION - GENERAL

A. Locate excavation support and protection systems clear of permanent construction, so that construction and finishing of other work is not impeded.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required

by authorities having jurisdiction.

C. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.

3.03 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation.

1. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement.

2. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging.

3. Accurately align exposed faces of flanges to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds.

1. Trim excavation as required to install lagging.

2. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.04 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.

B. Accurately place the piling using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer.

1. Limit vertical offset of adjacent sheet piling to 60 inches (1500 mm).

2. Accurately align exposed faces of sheet piling to vary not more than 2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment.

C. Cut tops of sheet piling to uniform elevation at top of excavation.

3.05 TIEBACKS

A. Drill, install, grout, and tension tiebacks.

B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.

C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.06 BRACING

A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary, to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Engineer.
2. Install internal bracing if required to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.07 MAINTENANCE

A. Monitor and maintain excavation support and protection system.

B. Prevent surface water from entering excavations by grading, dikes, or other means.

C. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

3.08 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks weekly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open.

1. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions.
2. Promptly notify Engineer if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.

C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.09 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures.

1. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
2. Remove excavation support and protection systems to a minimum depth of 48 (1200) inches (mm) below overlying construction and abandon remainder.
3. Fill voids immediately with approved backfill compacted to density specified in Section 31 20 00 "Earth Moving."
4. Repair or replace, as approved by Engineer, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place.

END OF SECTION

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SECTION – 32 11 00

BASE COURSES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and Division 01 Specification Sections, apply to the Work of this Section.

B. Related Sections include the following:

1. Section 01 33 00 – Submittal Procedures.
2. Section 01 41 00 – Regulatory Requirements.
3. Section 01 43 00 – Quality Assurance.
4. Section 31 10 00 – Site Clearing.
5. Section 31 20 00 – Earth Moving.
6. Section 32 12 00 – Flexible Paving.

1.02 SUMMARY

A. This Section specifies requirements for furnishing, placing, and compacting:

1. Subbase courses.
2. Base Courses.

1.03 REFERENCES

A. Abbreviations and Acronyms:

1. BUD: NYSDEC beneficial use determination.
2. NYSDEC: New York State Department of Environmental Conservation.
3. NYSDOT: New York State Department of Transportation.
4. RAP: Reclaimed asphalt pavement.
5. RCA: Recycled concrete aggregate.

B. Definitions:

1. Elongated Particle: A flat or elongated particle is one that has its greatest dimension more than 3 times its least dimension.

C. Reference Standards:

1. American Association of State Highway Transportation Officials (AASHTO):
   a. AASHTO T 89 – Standard Method of Test for Determining the Liquid Limit of Soils.
   b. AASHTO T 90 – Standard Method of Test for Determining the Plastic Limit and Plasticity Index of Soils.
   c. AASHTO T 99 – Standard Method of Test for Moisture-Density

Relations of Soils Using a 2.5-kg (5.5-1b) Rammer and a 305-mm (12-in.) Drop.

d. AASHTO T 146 – Standard Method of Test for Wet Preparation of Disturbed Soil Samples for Test.

e. AASHTO T 191 – Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method.

f. AASHTO T 224 – Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test.

2. ASTM International (ASTM):

a. ASTM C88 –- Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

b. ASTM C117 – Standard Test Method for Materials Finer than 75-µm (No.200) sieve in Mineral Aggregates by Washing.

c. ASTM C131 – Standard Test Method for Resistance to Degradation of Small- Size coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

d. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

e. ASTM D75 – Standard Practice for Sampling Aggregates.

f. ASTM D448 – Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

g. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN- m/m3)).

h. ASTM D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

i. ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

j. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

3. State of New York:

a. Official Compilation of the Rules and Regulations of the State of New York (NYCRR).

1) 6NYCRR Part 360 – Solid Waste Management Facilities.

2) 16 NYCRR Part 753 – Protection of Underground Facilities.

b. New York State Department of Transportation (NYSDOT):

1) NYSDOT Standard Specifications (U.S. Customary Units). https://www.dot.ny.gov/main/business-center/engineering/specifications.

2) New York State Standard Sheets (U.S. Customary Units).

https://www.dot.ny.gov/main/business-center/engineering/cadd-info/drawings/standard-sheets-us.

4. United States Government:

a. Occupational Safety and Health Administration (OSHA):

1) 29 CFR 1910 Occupational Health and Safety Standards.

2) 29 CFR 1926 Safety and Health Regulations for Construction.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Notify utilities prior to all excavations.

2. Do not interfere with persons, firms, corporations, or utilities, removing, changing, replacing, or employing protective measures at their property or structures.

a. Allow these persons, firms, corporations, or utilities to take such measures as they may consider necessary or advisable under the circumstances.

b. Cooperate fully with the owners of underground and overhead utilities when utility removal or rearrangement operations are in progress to ensure reasonable progress, minimize duplication of operations, and eliminate unnecessary interruption of services.

c. Measures employed or not employed by these entities do not relieve the Contractor of his responsibilities.

1.05 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:

1. Special Inspections:

a. Under the Building Code of New York State, special inspections by the code-required Approved Agency may be necessary to obtain approval of the Work of this Section.

b. Code-Required Approved Agency for Performing Special Inspections:

1) To perform the special inspections required by the Building Code of New York State, the Engineer acting as Metro-North's agent will employ an independent Approved Agency.

2. Testing and Inspection Agency:

a. To perform testing and inspections not considered special inspections by the Building Code of New York State, employ an independent Testing Laboratory.

B. Qualifications:

1. Testing Laboratory's Qualifications:

a. To perform testing and inspections required by this Section, employ a Testing Laboratory having the qualifications specified in Section 01 43 00, Quality Assurance.

b. Submit the Testing Laboratory's qualifications to the Engineer for approval.

C. Certifications:

1. Subbase Certificate of Compliance:

a. Submit certification from the source of subbase materials indicating that the subbase material meets NYSDOT requirements for Type 1 or Type 2 subbase.

1.06 SUBMITTALS

A. Action Submittals:

1. Submit the following to the Engineer for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:

a. Product Data:

1) Subbase course material.

2) Subbase gradation.

b. Certificates:

1) Subbase Certificate of Compliance.

c. Qualification Statements:

1) Testing Laboratory's qualifications.

B. Informational Submittals:

1. Submit the following to the Engineer for information in accordance with the requirements of Section 01 33 00, Submittal Procedures:

a. Source Quality Control Submittals:

1) Source of subbase material.

2) Samples of for each material for preliminary testing or certificates.

b. Site Quality Control Submittals:

1) Plasticity Index Test Results.

2) Magnesium Sulfate Soundness Test Results.

3) Relative Compaction Test Results.

4) Gradation Test Results.

5) Moisture Density Test Results.

6) Compaction Test for Crushed Aggregate Results.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:

1. Transport aggregate base in suitable vehicles with covers to prevent stray particles from falling off the vehicles onto the streets.

B. Storage and Handling Requirements:

1. Stockpiling:

a. Stockpile subbase material except as specified herein.

1) Stockpile gravel.

b. Stockpiling reclaimed bituminous material for Type 1 Subbase Alternate C is not required.

1.08 SITE CONDITIONS

A. Ambient Conditions:

1. Do not perform excavating, backfilling, or compacting operations when either weather conditions or the condition of the materials are such, in the opinion of the Engineer, that the work cannot be performed satisfactorily.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Suitable Material:

1. Provide suitable material conforming to the material requirements of Section 203 of the NYSDOT Standard Specifications and to the requirements specified herein.

a. If glass is furnished, furnish glass conforming to the requirements of Section 203.

b. If recycled concrete aggregate (RCA) is furnished, submit documentation showing that the material obtained is from a New York State Department of Environmental Conservation (NYSDEC) registered or permitted construction and demolition (C&D) debris processing facility as specified in section 360-16.1 of 6NYCRR Part 360.

c. If blast furnace slag is furnished, submit documentation showing that the material has undergone a NYSDEC beneficial use determination (BUD) prior to its use as specified in section 360-1.15 of 6NYCRR Part 360.

B. Subbase:

1. Provide subbase courses consisting of either NYSDOT Type 1 or NYSDOT Type 2 subbase as specified in section 304 of the NYSDOT Standard Specifications and herein.

2. NYSDOT Type 1 Subbase:

a. Furnish materials consisting of approved blast furnace slag, stone, sand, and gravel, or blends of these materials with not more than 30 percent by weight of glass; or one of the following alternates:

1) Type 1 Subbase Alternate A:

a) Furnish subbase consisting of at least 95 percent, by weight, of recycled concrete aggregate (RCA), and free from organic and other deleterious material.

b) This Type 1 Subbase material may contain up to 5 percent, by weight, of asphalt and/or brick.

2) Type 1 Subbase Alternate B:

a) Furnish subbase consisting of a mixture of recycled concrete aggregate (RCA) complying with the requirements specified for Type 1 Subbase Alternate A mixed with stone, sand, gravel, or blast furnace slag.

b) This Type 1 Subbase material may contain up to 5 percent, by weight, of asphalt and/or brick.

3) Type 1 Subbase Alternate C:

a) Furnish subbase consisting of at least 95 percent, by weight, of bituminous material reclaimed from bituminous pavement and/or shoulders (RAP), well-graded from coarse to fine so at the time of placement it has a maximum top size of 50 mm, and free from organic or other deleterious material, including tar.

b) The gradation requirements specified in this Section do not apply when the material consists of RAP.

c) No soundness or Plasticity Index testing is required for this Type 1 Subbase Alternate C.

3. NYSDOT Type 2 Subbase:

a. Furnish NYSDOT Type 2 Subbase materials consisting of approved blast furnace slag or of stone that is the product of crushing or blasting ledge rock, or a blend of blast furnace slag and of stone.

b. If, in the opinion of the Engineer, the NYSDOT Type 2 Subbase material becomes unstable during construction, it may be necessary to add a mixture of natural suitable material to the RAP at no increase in the Contract Price.

1) Acceptance of the final product will be based on an evaluation by the Engineer.

4. Gradation (Job Mix):

a. Provide material consisting of particles where not more than 30 percent, by weight, of the particles retained on a 1/2-inch sieve is flat or elongated.

1) Acceptance for this requirement will normally be based on a visual inspection by the Engineer.

2) If the Engineer elects to test the subbase, greater than 30 percent flat or elongated material will be rejected.

b. Provide continuously and well graded subbase material when tested in accordance with ASTM C117 and ASTM C136, and having the gradation indicated in Table 32 11 00-1.

Table 32 11 00-1 Subbase Gradation

Sieve Size Designation (Square Openings)	Design Range Percentage by Weight Passing Sieve	
	NYSDOT Type 1	NYSDOT Type 2
4-inch	-	-
3-inch	100	-
2-inch	90 – 100	100
1/4-inch	30 – 65	25 - 60
40	5 – 40	5 - 40
200	0 – 10	0 - 10

5. Plasticity Index:

   a. Furnish subbase so its material passing the 40-mesh sieve has a Plasticity Index of 5.0 or less when tested in accordance with the requirements of AASHTO T 146 Method A (Wet Preparation), AASHTO T 89, and AASHTO T 90.

6. Soundness:

   a. Unless material meeting the requirements of Type 1 Subbase Alternate C is used, furnish subbase having 20 percent or less magnesium sulfate soundness loss after 4 cycles in the Los Angeles abrasion machine as determined in accordance with Grading B as specified in ASTM C131.

7. Submit the gradation and Product Data for material furnished in the subbase to the Engineer for approval.

   a. If glass, blast furnace slag, and/or recycled asphalt product (RAP) is provided, submit Product Data documentation to the Engineer for approval.

C. Base Course:

1. Aggregate:

   a. Provide crushed aggregate complying with the requirements specified herein unless the use of a different type of material is

specifically authorized on the Contract Drawings.

b. Crushed Aggregate:

1) Provide clean, hard, sound, and durable crushed stone, rock, or gravel or a combination thereof; and which has the following additional properties:

2) Provide crushed aggregate uniform in quality, and free of soft, friable, thin elongated, or laminated pieces; disintegrated material; organic material; oil, alkali, and other deleterious substances.

a) Gradation (Job Mix):

(i) Provide continuously and well graded crushed aggregate when tested in accordance with ASTM C117 and ASTM C136, and having the gradation indicated in Table 32 11 00-2.

Table 32 11 00-2 Crushed Aggregate Gradation

Sieve Sizes (Square Openings)	Design Range Percentage by Weight Passing Sieve		
	Type A	Type B	Type C
3 inches	100	-	-
2 inches	-	-	-
1-1/2 inches	-	100	-
1-1/4 inches	-	-	100
1 inch	-	-	-
3/4 inch	-	-	-
Number 4	30-75	30-70	38-65
Number 8	20-60	20-60	25-60
Number 30	10-40	10-40	10-40
Number 200	0-12	0-12	3-12

(ii) Special Gradation Requirements:

b) When crushed rock is required, provide material with

at least one rough, angular surface produced by crushing; and a gradation complying with the requirements of ASTM D448.

c) For sizes 3/4 inch or larger maximum sizes, the portion of the material retained on a No. 4 sieve must be 50 percent by weight.

d) For sizes less than 3/4 inch, the portion of the material retained on a No. 8 sieve must be 50 percent by weight.

(i) When gravel is required, provide material having particles that are fully or partially rounded and water-worn.

e) Crushed rock obtained by crushing rock which exceeds the maximum gradation sizes specified in ASTM D 448 may be combined with gravel provided it is uniformly distributed throughout and blended with the gravel.

f) Plasticity Index:

(i) Unless otherwise indicated, provide material having a plasticity index not more than 5 when tested in accordance with the requirements of AASHTO T 146 Method A (Wet Preparation), AASHTO T 89, and AASHTO T 90.

g) Soundness:

(i) Provide crushed aggregate having a percentage of wear not exceeding 40 after 500 revolutions in the Los Angeles abrasion machine as determined in accordance with Grading B as specified in ASTM C131.

2.02 SOURCE QUALITY CONTROL

A. Tests and Inspections:

1. Except when materials will be provided from a previously approved source, notify the Engineer of the source of aggregate in writing at least 10 Days in advance of delivering the material to allow sufficient time for required material acceptance testing.

a. Submit the source of subbase material to the Engineer for approval.

2. Prior to the start of production, at the start of production, and at intervals during production, submit Samples of each material for preliminary testing to the Testing Laboratory for testing and as the basis for approval of specific lots of aggregates.

a. The Engineer will determine the sampling points and intervals.

3. In lieu of material testing, the Engineer may accept certified test results

from the State that indicate the aggregate complies with the specified requirements.

B. Non-Conforming Work:

1. Correct deficiencies uncovered by the measurements or Samples.

C. Coordination of Other Tests and Inspections:

1. Notify the code-required Approved Agency responsible for performing special inspections when aggregate base for this Contract is being placed and/or tested.

2. Cooperate with the code-required Approved Agency when they are performing required material verifications and other special inspections.

a. Provide full access to the Work.

PART 3 – PRODUCTS

3.01 EXAMINATION

A. Verification of Conditions:

1. Inspect the Site to verify existing conditions, and take field measurements to ensure the proper fit of the finished Work.

2. Underground Utilities:

a. Comply with applicable requirements of OSHA, the State of New York statutes, especially NYCRR 16 Part 753 regarding Underground Utilities, and the Local General Construction Code.

1) At least 2 to 10 days prior to the start of digging or excavation Work not counting the day of the call prior to the start of digging or excavation Work, contact Dig | Safety New York at 1-800-962-7962 or 811 to arrange for underground utility owners to locate and mark their underground utilities.

B. Pre-Installation Testing:

1. Ensure that substrates are in suitable condition to receive the work.

2. If it is evident that the subgrade is pumping at any time prior to placing overlying material onto the subgrade, the Engineer may at no increase in Contract Price require proof rolling with a pneumatic-tire roller or other approved equipment in order to identify the limits of the unacceptable area.

3. After completion of excavations other than utility excavations, and prior to scarification and compaction of the subgrade, proof-roll the excavation surface to detect soft or loose zones.

a. Notify the Engineer if any soft or loose zones are encountered during the proof-rolling.

C. Evaluation and Assessment:

1. Notify the Engineer of unexpected subsurface conditions, and discontinue working in the affected area until notified to resume work.

2. If unexpected active underground facilities are encountered during the performance of the Work, immediate notify the Engineer.

3.02 PREPARATION

A. Protection of In-Place Conditions:

1. Exercise extreme caution to prevent debris from falling into manholes or other structures.

a. In the event that debris should fall into a structure, remove it immediately.

2. Dust Control:

a. Comply with the requirements specified in the Fugitive Dust Plan specified in Section 01 41 00 for protecting adjacent properties.

b. Provide effective dust control measures on the Site to prevent the spread of dust during earth moving operations.

c. Thoroughly moisten excavation areas by dampening the soil, or employ other similar methods as approved by the Engineer.

B. Surface Preparation:

1. Subgrade:

a. With the exception of areas where new construction is required and compacted fills have been constructed, adjust the moisture content of the subgrade to that required for compaction by adding water, by adding and blending in dry suitable material, or by drying the existing material as required.

1) Maintain the proper subgrade moisture content until the subgrade is compacted and the overlying material is placed.

b. Correct ruts and soft yielding places caused by improper drainage conditions, hauling, or other causes before placing the base course.

C. Demolition / Removal:

1. Strip and properly dispose of unsuitable material in the area of the required subgrade including removing existing pavement and obstructions such as stumps, roots, rocks, and similar items from the subgrade area.

a. Clear and grub unpaved subgrade area in accordance with the requirements of Section 31 10 00, Site Clearing.

b. Demolish existing pavement where indicated on the Contract Drawings, and properly dispose of demolition debris off-site unless otherwise allowed by the Engineer.

1) Remove existing pavement under proposed median islands.

3.03 INSTALLATION

A. Subbase:

1. Furnish, place, and compact the subbase course of the proper Type to the lines, grades, thicknesses, and typical sections indicated in the Contract

Documents.

a. Provide subbase material the Contractor is capable of placing and fine grading to the required tolerances.

2. Should the subbase course become unstable at any time prior to the placement of the overlying course, correct the unstable condition to the satisfaction of the Engineer at no increase in the Contract Price.

a. Perform any required modification prior to placing the material on the grade.

3. Relative Compaction:

a. Remove soft, loose, and disturbed materials; replace them with acceptable materials; and compact the replacement material as directed by the Engineer.

1) If soft or loose zones are found under proposed slab, pavement, or foundation areas, excavate the soft or loose material to a depth reviewed in advance by the Engineer, then fill with structural fill as specified in Section 31 20 00, Earth Moving, and compact as specified for such fill.

2) After adjusting the moisture content to that required for compaction, scarify and loosen the subgrade to a depth of at least 6 inches.

3) Below future slabs, pavements, and foundations, scarify the exposed native and pre-existing fill subgrade soils to a depth of 8 inches.

4) In areas where fill material is required, a layer of approximately 3 inches of the fill material may be spread and compacted with the subgrade material to provide a better bond.

b. Compact the material to the relative density specified.

1) Construct the cut and fill areas to achieve a uniform soil structure having the minimum dry density specified in Table 32 11 00-3 when the compaction is tested in accordance with Method A in AASHTO T 99 and AASHTO T 191, or with ASTM D2922 and ASTM D3017.

c. Adjust the minimum dry density percent obtained from AASHTO T 99 in accordance with the coarse particle correction procedures specified in AASHTO T 224 for maximum density determination, to compensate for the rock content larger than that which will pass a Number 4 sieve.

Table 32 11 00-3 Minimum Dry Density Required	
Location	**Minimum Dry Density**
Subgrade under pavement	100 percent
Subgrade under curbs, gutters, and sidewalks	90 percent

4. Grading in Areas Not to be Paved:
   a. Where grade only is called for on the Contract Drawings, grade the area to meet the tolerances for the subgrade where subbase or base material is to be placed.
   b. Construct the surface to a straight grade from the finished pavement elevations shown on the Contract Drawings to the elevation of the existing ground at the extremities of the area to be graded.
5. Grading in Areas to be Paved:
   a. Where pavement or structures are called for on the Contract Drawings, grade the area in an orderly sequence, placing base course directly following the grading.
   b. Do not allow grading operations to precede base course placement by more than 1200 feet unless otherwise specifically approved by the Engineer.
   c. At the end of each day's operations, place the first lift of base course no more than 300 feet behind the finished subgrade area.
      1) Do not allow drop-offs on opposite sides of pavement at the same time.
      2) When excavating for concrete work, such as curb, gutter, or sidewalk, place the excavated material in uniform windrows that do not interfere with property access or traffic flow in streets.

B. Base Course:
1. Prior to placing aggregate base course materials, properly prepare the subgrade as specified herein.
   a. Verify that the subgrade has been properly prepared to receive the aggregate base course.
2. Place base course material in lifts to provide a course to the lines, grades, dimensions, moisture, density, and typical sections as indicated in the Contract Documents.
   a. Aggregate base course measuring 6 inches or less in compacted thickness may be placed in a single layer.

b. Deliver the aggregate to the roadbed as a uniform mixture, and spread the aggregate in one operation.

c. Avoid segregation of the material into pockets of fine and coarse material.

3. Aggregate base course measuring more than 6 inches in compacted thickness must be built up from successive layers, each of approximately equal compacted thickness not to exceed 6 inches per layer.

a. Clean previously constructed layers of loose and foreign material prior to placing the next layer.

4. After distributing the aggregate base course, water the material and, immediately thereafter, blade the material to a uniform layer that will net the required thickness after compaction.

a. Apply a quantity of water that will assist compaction, taking care to avoid wetting the subgrade or any lower base course during the watering operation to an extent that is detrimental to the Work.

1) Moisture condition the material within the range of plus or minus 2 percent of optimum moisture, and compact the material to a dry density greater than 95 percent of maximum dry density as determined in accordance with the requirements of ASTM D 1557.

b. Keep the surfaces of the compacted material in lower layers moist until the material is covered by the next layer.

c. If the materials deposited are not uniformly blended together, continue the blading operation as necessary to eliminate segregation.

5. Compact the material to assure a compacted relative density of 100 percent as determined using the methods and other criteria defined in this Section.

6. Upon completion of the entire operation, the base surface must be true, even, uniform, and conform to the grade and cross-section specified or shown on the Contract Drawings.

a. Finish the base course by blading the surface of the aggregate base course using equipment designed especially for this purpose.

C. Special Techniques:

1. Excavation Safety:

a. Sole responsibility for making all excavations in a safe manner is the Design- Builder's.

b. Provide suitable protection against bodily injury.

D. Tolerances:

1. Subgrade Tolerances

a. Subgrade upon which pavement, sidewalk, curb and gutter, driveways, or other structures are to be directly placed may not vary

more than 1/4 inch from the specified grade and cross-section.

b. Subgrade upon which subbase or base material is to be placed may not vary more than 3/4 inch from the specified grade and cross-section.

c. Variations within these specified tolerances must be compensating so that the average grade and cross-section specified are met.

2. Base Course Tolerances:

a. Finished Surface Tolerance:

1) The finished surface of the aggregate base course may not vary more than 1/2 inch above or below required grade and cross-section when tested with a 16-foot straightedge applied parallel with and at right angles to the centerline.

2) Do not add thin layers of material to the top layer of base course to meet the specified grade.

3) If the elevation of the top layer is 1/2 inch or more below grade, scarify the top layer of the base to a depth at least 3 inches, add new material, and blend and re-compact the material to bring it to grade.

4) If the finished surface is above the design grade, cut the material back to grade and re-roll the surface.

b. Thickness Tolerance:

1) The completed thickness of the aggregate base course may not vary more than 1/2 inch of the design thickness.

c. Moisture Content Tolerance:

1) During placing operations, the moisture content of the material may not vary by more than 1-1/2 percentage points from the optimum moisture content as determined in accordance with the requirements specified in ASTM D 1557.

3.04 REPAIR/RESTORATION

A. Restore to their original condition those portions of the Site not designated for alteration.

3.05 SITE QUALITY CONTROL

A. Site Tests and Inspections:

1. During the period when aggregate base is being placed, the Testing Laboratory and the code-required Approved Agency must perform routine and other testing of materials.

a. Advise the Testing Laboratory and code-required Approved Agency sufficiently in advance of operations to allow testing personnel to be assigned and to provide sufficient time for quality tests to be performed and completed.

b. The Testing Laboratory and the code-required Approved Agency will perform additional materials testing due to changes in materials or proportions requested by the Contractor or testing required due to failure of material to meet specified requirements.

c. Failure of the Testing Laboratory or the code-required Approved Agency to detect defective work will not prevent its rejection later when the defect is discovered, neither does it obligate the Engineer or Metro-North to grant final acceptance of the Work.

2. Keep testing results on file at the Site, and submit copies of the test results to the Engineer for information.

B. Site Tests:

1. Plasticity Index Test:

a. Test Procedure:

1) Have the Testing Laboratory test the Plasticity Index of the materials performed in accordance with the method specified in ASTM D4318.

b. Acceptance Criteria:

1) Materials complying with the requirements specified are acceptable.

2. Magnesium Sulfate Soundness Test:

a. Test Procedure:

1) Have the Testing Laboratory test the Magnesium Sulfate Soundness of the subgrade performed in accordance with the method specified in ASTM C88.

b. Acceptance Criteria:

1) Materials complying with the requirements specified are acceptable.

3. Relative Compaction Test:

a. Test Procedure:

1) Have the Testing Laboratory test the relative density of the subgrade compaction performed in accordance with Method A in AASHTO T 99 and AASHTO T 191, or with ASTM D 2922 and ASTM D 3017.

b. Acceptance Criteria:

1) Subgrade compaction having the at least the minimum dry density specified in Table 32 11 00-3 is acceptable.

4. Gradation Test:

a. Test Procedure:

1) Have the Testing Laboratory perform Gradation Tests on samples taken from material delivered to the Site at a rate

of 1 test for each 300 tons placed, or once a day, whichever is greater.

2) Sampling will be performed in accordance with the requirements specified in ASTM D 75.

3) Testing will be performed in accordance with the requirements specified in ASTM C 117 and ASTM C 136.

b. Acceptance Criteria:

1) The average value of individual gradation tests for all sieve size determinations must comply with the specified gradations within plus or minus 8 percent for sieves larger than No. 4, within plus or minus 5 percent for sieves No. 30, and within plus or minus 3 percent for sieves No. 200.

5. Moisture Density Test:

a. Test Procedure:

1) Have the Testing Laboratory perform Moisture Density Tests on samples taken from material delivered to the Site at a rate of 1 test for each 300 tons placed, or once a day, whichever is greater.

b. Acceptance Criteria:

1) Material represented by the samples will be acceptable if the compaction meets the specified moisture density criteria.

6. Compaction Test for Crushed Aggregate:

a. Test Procedure:

1) Have the Testing Laboratory perform Compaction Tests at a rate of 1 test for each 500 square yards per lift placed.

2) Testing will be performed as specified in ASTM D 2922 and ASTM D 3017

b. Acceptance Criteria:

1) Areas represented by the tests will be acceptable if the compaction meets the specified compaction criteria.

7. Inspections:

a. When it is believed a deficiency in thickness, or an excess of plasticity exists, take measurements or samples in the same pattern as that defined in Section 32 12 00, Flexible Paving.

C. Non-Conforming Work

1. Correct deficiencies uncovered by the measurements or Samples.

a. Rework and retest areas represented by noncompliant tests.

b. Do not add thin layers of material to the top layer of base course to meet the specified grade.

1) If the elevation of the top layer is 1/2 inch or more below grade, scarify the top layer of the base to a depth at least 3 inches, add new material, and blend and re-compact the material to bring it to grade.

c. If the finished surface is above the design grade, cut the material back to grade and re-roll the surface.

3.06 PROTECTION

A. Limit traffic on compacted aggregate base course to final surfacing traffic and vehicles applying moisture control.

1. Equipment used to construct adjoining sections may be routed over completed portions of the base course provided no damage results and the equipment is routed over the full width of the base course so rutting or uneven compaction is avoided.

B. Maintain the base course in a condition complying with specified requirements until the Work is accepted.

END OF SECTION

SECTION – 32 12 00

FLEXIBLE PAVING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and Division 01 Specification Sections, apply to the Work of this Section.

1.02 SUMMARY

A. This Section specifies requirements for existing ground preparation and asphaltic concrete paving.

1.03 REFERENCES

A. Reference Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
    a. AASHTO T 168 – Standard Method of Test for Sampling Bituminous Paving Mixtures.
    b. AASHTO T 245 – Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
2. ASTM International (ASTM):
    a. ASTM D 29 – Standard Test Methods for Sampling and Testing Lac Resins [withdrawn 2005 without replacement].
    b. ASTM D 36 – Standard Test Method for Softening Point of Bitumen (Ring-and- Ball Apparatus).
    c. ASTM D 464 – Standard Test Methods for Saponification Number of Naval Store Products Including Tall Oil and Other Related Products.
    d. ASTM D 465 – Standard Test Methods for Acid Number of Naval Stores Products Including Tall Oil and Other Related Products.
    e. ASTM D546 – Standard Test Method for Sieve Analysis of Mineral Filler for Bituminous Paving Mixtures
    f. ASTM D692 – Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures
    g. ASTM D946 – Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction
    h. ASTM D1073 – Standard Specification for Fine Aggregate for Bituminous Paving Mixtures
    i. ASTM D1188 – Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
    j. ASTM D 2041 – Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.

k. ASTM D2726 – Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures

l. ASTM D2950 – 09 Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods

m. ASTM D3549 – Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens

3. American Wood Preserver's Association (AWPA):

a. AWPA P5 Standard for Waterborne Preservatives.

b. AWPA C1 Pressure Treatment.

c. AWPA C14 Pressure Treatment – Highway.

4. State of New York:

a. New York State Department of Transportation (NYSDOT):

1) NYSDOT Standard Specifications (U.S. Customary Units). https://www.dot.ny.gov/main/business-center/engineering/specifications.

2) New York State Standard Sheets (U.S. Customary Units). https://www.dot.ny.gov/main/business-center/engineering/cadd-info/drawings/standard-sheets-us

b. Official Compilation of the Rules and Regulations of the State of New York (NYCRR).

1) 12 NYCRR Part 23 – Protection in Construction, Demolition and Excavation Operations.

2) 16 NYCRR Part 753 – Protection of Underground Facilities.

1.04 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:

1. Testing Laboratory:

a. Metro-North will engage a qualified testing agency to perform tests and inspections.

1.05 SUBMITTALS

A. Action Submittals:

1. Submit the following to the Engineer for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:

a. Product Data:

1) Design mix formula to be used.

2) Sources of all ingredient materials, copies of all aggregate tests, penetration of the asphaltic cement, and percentages by weight and number of pounds of each of the materials making up the batch.

b. Certificates:

1) NYSDOT certified mixing plant to be used. Provide proof of certification.

c. Special Procedure Submittals:

1) Specifications of equipment to be used for paving operations.

B. Informational Submittals:

1. Submit the following to the Engineer for information in accordance with the requirements of Section 01 33 00, Submittal Procedures:

a. Site Quality Control Submittals:

1) Test reports, trip tickets, temperature records and other certifications that show materials are in compliance with specifications.

b. Final density and smoothness test results.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:

1. Transport asphaltic mixtures in tight vehicles having clean and smooth metal beds.

a. When necessary, insulate truck bodies.

b. Just before the vehicles are loaded, lightly coat the inside surface of the vehicles with a whitewash of lime and water, soap solutions, or detergents as approved by the Engineer; or with fuel oil applied by a high pressure fog system.

2. Cover each load with canvas or other suitable material to protect the mixture from the weather.

3. Deliver stone at a temperature not exceeding 350°F.

B. Storage and Handling Requirements:

1. Heating and Storing Asphaltic Paving Mixture Ingredients:

a. Heat asphaltic cement in approved receptacles to a temperature between 275°F and 350°F.

b. Keep asphaltic cement uniform in composition and consistency.

c. Heat aggregate in approved revolving driers.

2. Hot Asphaltic Mixture Holding Bins:

a. Store hot asphaltic mixtures at the mixing plant or satellite sites in bins that are currently approved by NYSDOT.

b. After storage, maintain the mixture as indicated in Table 32 12 00-1.

Table 32 12 00-1 Hot Asphaltic Mixture Storage Requirements	
Test Property	**Allowable Variation**
Temperature	± 20°F from pug mill discharge temperature
Gradation	Within job mix formula tolerance
Asphalt Content	Within job mix formula tolerance
Asphalt Cement Recovered from Mixtures:	
Penetration @ 77°F	Loss not to exceed 50% of the penetration of the asphalt sampled prior to mixing.
Viscosity @ 140°F	Viscosity not to exceed 4 times the viscosity of the asphalt sampled from the plant prior to mixing.

1.07 SITE CONDITIONS

A. Ambient Conditions:

1. Spread and compact mixtures during daylight.
2. Schedule the placement of asphaltic paving material when the Precipitation Probability from the U.S. Weather Bureau, obtained within 3 hours prior to the start of such operations is less than 50 percent.
   a. Notify the Engineer of the exact time at which the above information was obtained.
3. Do not lay mixtures in wet weather.
4. Do not lay permanent asphaltic mixtures when surface temperatures are below those listed in Table 32 12 00-2:

Table 32 12 00-2 Minimum Surface Temperatures for Laying	
Compacted Lift Thickness	**Minimum Surface Temperature**
3 inches or greater	40° F
Between 1 inch and 3 inches	45° F
1 inch or less	50° F

a. Take surface temperatures at 3 locations in the area being paved.

b. The controlling temperature are the average of the 3 readings.

5. Temporary pavements are not subject to the above requirements, but must be placed as approved by the Engineer.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Asphalt Cement:

1. Furnish viscosity grade AC-20 asphalt cement complying with the requirements specified for material designation 702-03 in Section 702 of the NYSDOT Standard Specifications, and with the requirements specified for Penetration Grade 60-70 specified in ANSI/ASTM D946.

B. Coarse Aggregates:

1. Furnish coarse aggregates complying with the requirements specified in ASTM D692 as amended or supplemented by the requirements specified in Section 401-2.02 of the NYSDOT Standard Specifications.

2. Furnish coarse aggregates having the gradation specified in Table 32 12 00-1.

C. Mineral Filler:

1. Furnish finely divided mineral matter, such as rock dust, hydrated lime, hydraulic cement, fly ash, loess, or another material as determined and approved by the Engineer.

2. Furnish mineral filler sufficiently dry to flow freely and essentially free from agglomerations, organic impurities, and other objectionable materials.

D. Sand:

1. Conform to the requirements for fine aggregate in ASTM D-1073 and as amended or supplemented by Section 401-2.02 of the NYSDOT Standard Specification.

E. Aggregate Base:

1. Conform to NYSDOT Standard Specifications Section 304, Type 2.

F. Wood Header:

1. Preservative: Wolman CCA Type C in accordance with AWPA Standard P5.

2. Pressure treated to conform to AWPA Standard C1 and C14.

2.02 MIXES

A. Asphaltic Paving Mixture:

1. Provide a bituminous plant mix composed of a mixture of aggregate, filler and bituminous material.

a. Thoroughly coat the aggregate with asphaltic cement.

2. Provide a bituminous plant mix complying with the requirements indicated

in Table 32 12 00-3.

Table 32 12 00-3 Plant Mix Composition				
Use	**Asphaltic Binder**		**Asphaltic Surface Course**	
Screen Sizes	**General Limits % Passing**	**Job Mix Tolerance %**	**General Limits % Passing**	**Job Mix Tolerance %**
1-1/2-inch	100	-		-
1-inch	95-100	-		-
1/2-inch	70-90	±6		±7
1/4-inch	48-74	±7		±7
1/8-inch	32-62	±7		±7
No. 20	15-39	±7		±7
No. 40	8-27	±7		±4

Table 32 12 00-3 Plant Mix Composition				
Use	**Asphaltic Binder**		**Asphaltic Surface Course**	
Screen Sizes	**General Limits % Passing**	**Job Mix Tolerance %**	**General Limits % Passing**	**Job Mix Tolerance %**
No. 80	4-16	±7		±2
No. 200	2-8	±7		
Asphalt Content %	4.5-6.5±0.4		5.8-7.0±0.4	
Mixing and Placing Temperature Range °F	250°-325°		250°-325°	

3. Base aggregate tolerances on the total weight of the aggregate and the bitumen tolerances on the total weight of the mix.

2.03 SOURCE QUALITY CONTROL

A. Tests:

1. Gradation Test:

a. Test Procedure:

1) Have the Testing Laboratory perform Gradation Tests in accordance with the method specified in ASTM D546.

b. Acceptance Criteria:

1) Coarse aggregate and mineral filler meeting the gradation requirements indicated in Table 32 12 00-4 pass the Gradation Test.

Table 32 12 00-4 Coarse Aggregate and Mineral Filler Gradation

Sieve Size	Percent Passing (by Weight)
No. 30	100
No. 80	85-100
No. 200	65-100

B. Non-Conforming Work:

1. Do not furnish coarse aggregate and mineral filler that fail the Gradation Tests.

PART 3 – PRODUCTS

3.01 PREPARATION

A. Ensure substrates are in suitable condition to receive the work.

1. Contractor shall clean all existing joints/cracks of all deleterious material in accordance to NYSDOT Section 633, Conditioning Existing Pavement.

2. Contractor shall seal all existing cracks with a joint and crack filler prior to asphalt overlay in accordance to NYSDOT Section 633, Conditioning Existing Pavement and NYSDOT Section 702, Materials and Manufacturing.

3. Contractor shall mill/grind a minimum 3'x3' area of existing asphalt pavement to a depth of 1½" below existing manhole cover elevations at locations where rims are flush with existing pavement prior to asphalt overlay installation.

4. Contractor shall mechanically sweep pavements surfaces immediately prior to commencement of asphalt overlay installation.

B. Protection of In-Place Conditions:

1. Temporary Pavement:

a. Furnish and lay temporary pavement wherever required to properly maintain traffic over backfilled trenches and at such other locations as may be directed by the Engineer.

b. Temporary pavement shall consist of asphaltic binder mixtures, laid to adequate thickness and compaction.

3.02 INSTALLATION

A. Equipment:

1. Mixing Plants:

a. Furnish mixing plants approved by NYSDOT for use in NYSDOT construction.

b. Ensure that the plant and plant operations are in accordance with the requirements of Section 401-3.01 "Quality Control" of the NYSDOT Standard Specifications.

2. Asphaltic Pavers:

a. Furnish self-power pavers having an activated screed or strike-off assembly capable of spreading and finishing courses in widths approved by the Engineer.

b. Furnish pavers capable of spreading and finishing narrow widths of pavement.

c. Furnish pavers equipped with a receiving hopper with sufficient capacity for uniform spreading operation and automatic flow controls.

d. Furnish pavers having a heated screed or strike-off assembly to produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

e. Furnish pavers equipped with approved automatic transverse slope and longitudinal grade screed controls to automatically adjust the screed and increase or decrease the mat thickness to compensate for irregularities in the surface being paved.

1) Provide controls capable of maintaining the proper transverse slope and readily adjustable for transitions.

3. Rollers:

a. Furnish tandem type power driven rollers capable of providing a pressure not less than 225 pounds per inch width of the main roll.

1) Furnish smooth true rolls without flat spots or other imperfections.

b. Furnish self-propelled, pneumatic rubber-tired rollers with wheels mounted, grouped, and spaced to provide uniform coverage with each pass.

1) Furnish rollers with rear group wheels that do not follow in the tracks of forward group wheel.

2) Furnish rollers with a maximum wheel load of 5600 pounds.

3) Furnish rollers with a tire compression on pavement, where the area of contact is measured on a hard, unyielding surface, of 80 psi, plus or minus 5 psi, for each wheel; and having a total maximum load per axle, whether single axle or a group of axles in the same alignment, of 22,400 pounds.

4) Control wheel loads and tire pressures to produce the required degree of compaction without rutting of the surface to be rolled.

B. Headers:

1. Install wood headers where indicated. Brace headers to support ballast until paving is installed.

C. Placing:

1. Place surface courses and binders over aggregate base using an approved mechanical spreader.

a. Keep the number of longitudinal joints to a minimum.

b. Limit hand placement of asphaltic material to those areas where machine spreading and finishing is not practical.

2. Ensure the temperature and consistency of the mix at time of application comply with the specified requirements.

D. Spreading:

1. Do not allow the asphaltic mixture to be placed in a continuous strip exceeding 800 feet long.

2. Lay adjacent strips immediately after each previous strip is placed until the full width of the roadway surface has been covered.

E. Binder Mixture:

1. Using an asphaltic paver, lay the binder mixture to a depth which after final compaction is equal to the specified depth.

a. In areas where the use of the paver is impractical, as determined by the Engineer, other approved means of spreading and compaction may be permitted.

2. Hand Laying Binder Mixture:

a. Uniformly spread binder mixture using hot iron rakes with tines not less than 1/2 inch longer than the loose depth of the mixture, or using a mechanical spreader, to a depth which, after final compaction, is equal to the specified depth.

b. Thoroughly compact the binder mixture using approved tamping irons adjacent to curbs, manholes, rails, and similar structures; and with approved rollers to a surface that is parallel to and below the finished grade and crown of the finished surface.

c. If the binder mixture breaks up, shows lack of bond, or other defects

before the surface mixture is laid, take it up, and remove and replace it with suitable material at no increase in the Contract Price.

F. Surface Course Mixture:

1. Before the surface mixture is laid, paint the contact surfaces of curbs, gutters, headers, and manholes with a thin uniform coating of approved hot asphaltic cement, liquid asphalt, or emulsified asphalt.

2. Using an asphaltic paver, lay the surface course mixture to a depth which after final compaction is equal to the specified depth.

a. In areas where the use of the paver or mechanical spreader is impractical, other approved means of spreading and compaction may be permitted.

3. Hand Laying Surface Mixture:

a. Uniformly spread surface course mixture using hot iron rakes with tines not less than 1/2 inch longer than the loose depth of the mixture to a depth which, after final compaction, is equal to the specified depth.

b. No walking will be permitted on the surface mixture during the laying operations.

c. After spreading and raking the surface mixture, carefully lute surface course mixture from the sides before compaction.

G. Compaction:

1. Rolling:

a. Proceed rolling continuously at the following rates:

1) For binder, base course, and drainage medium mixtures, when spread by hand, not in excess of 400 square yards per hour per roller.

2) For binder, base course, and drainage medium mixtures, when spread by machine, not in excess of 600 square yards per hour, per roller.

3) For asphaltic concrete surface mixtures, when spread by hand, not in excess of 300 square yards per hour per roller.

4) For asphaltic concrete surface mixtures, when spread by machine, not in excess of 400 square yards per hour per roller.

b. Immediately after spreading the mixture, using approved tamping irons thoroughly compact the mixture adjacent to curbs, manholes, and rails; and by rolling using approved rollers continuously from commencement to final completion at a speed not exceeding 3 mph.

c. Make the initial rolling using steel-wheeled, power-driven, tandem type rollers parallel to the center line of the paved surface beginning at the curbs or edges of the paved surface and working toward the

center, overlapping on successive trips by one-half the rear wheel of the roller.

d. Immediately following the initial rolling, further compact the mixture by using pneumatic rubber-tired rollers for a minimum of eight passes.

1) Smooth shallow ruts and ridges with tandem rollers immediately following the rubber-tired rolling.

2. Final Roll:

a. Continue rolling until no further compression results; the mixture has cooled; no marks show under the roller; and the surface is smooth and free from depressions, waves, bunches and unevenness.

b. After the mixture has been rolled, test the surface with an approved straight edge and surface testing machine laid parallel to the center line of the paved surface.

3. Vibratory Compaction:

a. When permitted by the Engineer, use vibratory compaction in accordance with Section 402-3.07 "Option 2" of NYSDOT Standard Specifications and Section 402-3.04 "Rollers" of NYSDOT Standard Specifications.

b. Compaction testing requirements are to conform to NYSDOT Standard Specifications Section 402-3.07.

H. Joints:

1. Lay the surface mixture in a continuous operation, and pass the roller over the unprotected end of the freshly laid mixture only when the lying of the course is to be discontinued for such length of time as to permit the mixture to become chilled.

a. Provide for a proper bond with the new mixture by cutting or trimming back the joint to expose an unsealed or granular surface for the full-specified depth of the course.

2. At the end of each day's work, form joints by laying and rolling against boards of the thickness of the compacted mixture, placed across the entire width of the pavement.

3. When the laying of the mixture is resumed, paint the exposed edge of the joint with a thin coat of approved hot asphaltic cement or liquid asphalt, rake a fresh mixture against the joint, thoroughly tamp and roll.

4. Hot smoothing irons may be used for sealing joints.

3.03 SITE QUALITY CONTROL

A. Site Tests:

1. Test final density and smoothness after rolling and before acceptance.

2. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

3. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

4. In-place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to AASHTO T 168.

   a. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job- mix specifications.

   b. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM 2726.

      1) One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.

      2) Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

5. Replace and compact hot-mix asphalt where core tests were taken.

6. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

7. Site Inspections:

B. Non-Conforming Work:

1. Portions of the completed wearing course that are defective in finish, compression, composition or density, shall be taken up, removed and replaced with suitable material properly laid in accordance with these specifications.

3.04 PROTECTION

A. Traffic:

1. No traffic of any kind will be allowed on the pavement until permitted by the Engineer.

END OF SECTION

SECTION – 32 13 13

CONCRETE PAVING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Concrete sidewalks.
2. Concrete integral curbs and gutters.
3. Concrete base and surface for parking areas and roads.
4. Small miscellaneous slabs.

B. Related Sections:

1. Section 31 23 23 – Excavation and Fill.
2. Section 32 12 00 – Flexible Paving.
3. Section 32 16 00 – Curbs, Gutters, Sidewalks, and Driveways
4. Section 32 17 23 – Pavement Markings.
5. Section 33 40 00 – Storm Drainage Utilities.

1.02 REFERENCES

A. American Association of State Highway Transportation Officials (AASHTO)

1. AASHTO M 31 – Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
2. AASHTO M 32 – Steel Wire, Plain for Concrete Reinforcement.
3. AASHTO M 282 – Joint Sealants, Hot Poured, Elastomeric-Type, for Portland Cement Concrete Pavements.

B. American Concrete Institute:

1. ACI 301 – Specifications for Structural Concrete.
2. ACI 304 – Guide for Measuring, Mixing, Transporting, and Placing Concrete.

C. ASTM International:

1. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
2. ASTM A 497 – Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
3. ASTM A 615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
5. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and

Resilient Bituminous Types).

6. ASTM D1752 – Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

D. NYSDOT Standard Specifications:

1. Standard Specifications, 2020, published by the New York State Department of Transportation.

1.03 SUBMITTALS

A. Submittal Procedures: Requirements for submittals.

B. Concrete Mix Design: Submit concrete mix design 30 days prior to use of concrete.

C. Product Data: Submit data on joint materials, admixtures, and curing compounds.

D. Manufactures Certification: Certify products are produced at a plant approved by NYSDOT and that products meet or exceed specified requirements.

E. Installer Certification: Certify installer is on list of NYSDOT prequalified contractors with an approved Quality Control Plan.

F. Process Control Plan: Submit process control plan for delivering and placing concrete.

G. Samples: Submit two sample panels, 2 inch x 12 inch in size, illustrating exposed aggregate finish.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with NYSDOT Standard Specifications, except as modified herein.

B. Maintain one copy of document on site.

C. Obtain cementitious materials from same source throughout.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section and prequalified by NYSDOT.

B. Installer: Company specializing in performing Work of this Section and prequalified by NYSDOT.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature or air temperature in the shade is 40 degrees F and falling or surface is wet or frozen.

B. Do not place concrete when air temperature in the shade is 95 degrees F and rising or when concrete temperature is greater than 95 degrees F.

PART 2 – PRODUCTS

2.01 FORM MATERIALS

A. Slip Form Methods: Use slip form methods wherever possible.

B. Fixed Form Materials: Metal conforming to NYSDOT Standard Specifications.

2.02 JOINT MATERIALS

A. General: Conform to NYSDOT Standard Specifications.

B. Joint Filler: Sponge rubber or cork type conforming to ASTM D1751 (AASHTO M213) orbituminous, non-extruding, resilient type conforming to ASTM D1752 (AASHTO M 153), Type 1; thickness as indicated on Drawings.

C. Silicone Sealant: Low modulus, cold applied, single component, chemically curing silicone material.

1. Type NS: Non-sag silicone, toolable.

2. Type SL: Self-leveling silicone, tooling not required.

D. Rubber Asphalt Sealant: Hot poured rubber asphalt joint sealer conforming to AASHTO M282 (ASTM D3406).

E. Bond Breaker:

1. General: Product that does not stain or adhere to the sealant and is chemically inert and resistant to oils, gasoline, solvents, and primer.

2. For On-Grade Pavements: Circular backer rod, diameter 25 percent larger than joint width.

a. Type L, For Cold Pour Sealants Only: Closed cell expanded polyethylene foam. Use with Type NS silicone only.

b. Type M, For Cold or Hot Pour Sealants: Closed cell polyolefin with closed skin over an open cell core.

F. For Bridge Decks Only: Bond breaking tape, extruded polyethylene with pressure sensitive adhesive on one side, minimum 0.005 inches thick.

2.03 REINFORCEMENT

A. General: Conform to NYSDOT Standard Specifications.

B. Reinforcing Steel: ASTM A615 (AASHTO M 31); 60 ksi yield grade; deformed billet steelbars; galvanized.

C. Dowels and Tie Bars: ASTM A615 (AASHTO M 31); 60 ksi yield grade, plain steel, galvanized.

D. Welded Wire Fabric Steel: Deformed type, ASTM A18 and A767/A767M; galvanized.

2.04 CONCRETE MATERIALS

A. Concrete Materials: Provide fine aggregate, coarse aggregate, Portland Cement, fly ash, ground granulated blast furnace slag, water, air entraining agent, and chemical admixtures in accordance with NYSDOT Standard Specifications.

2.05 ACCESSORIES

A. Curing Compound: ASTM C309 (AASHTO M-148), Type 1 clear or translucent or Type 2 white pigmented.

2.06 CONCRETE MIX

A. Mix and deliver concrete in accordance with NYSDOT Standard Specifications.

B. Roadway and Area Pavement concrete: Air entrained conforming to the following criteria:

1. Flexural Strength: 650 psi at 28 days.
2. Slump: 1.5 inch maximum for slip form method, 3 inches maximum for fixed form hand methods.
3. Minimum Cement Content: 526 pounds/cubic yard.
4. Maximum Water/Cement Ratio: 0.559.
5. Air Entrainment: Between 4.5 and 5.5 percent.

C. Class A Concrete for sidewalk, curb, curb and gutter, and other incidental site concrete:

D. Air entrained, vibrated conforming to the following criteria:

1. Compressive Strength: 4,000 psi at 28 days.
2. Maximum Slump Vibrated: 3.5 inches.
3. Minimum Cement Content: 564 pounds/cubic yard.
4. Maximum Water/Cement Ratio for Angular Aggregate: 0.532.
5. Maximum Water/Cement Ratio for Rounded Aggregate: 0.488.
6. Air Entrainment: 6.0 percent plus or minus 1.5 percent.

E. Use accelerating admixtures in cold weather only when approved by the Engineer in writing. Use of admixtures will not relax cold weather placement requirements.

F. Use calcium chloride only when approved by the Engineer in writing.

G. Use set retarding admixtures during hot weather only when approved by the Engineer in writing.

2.07 SOURCE QUALITY CONTROL AND TESTS

A. Section 01 40 00 – Quality Requirements: Testing and Inspection Services.

B. Submit proposed mix design of each class of concrete to independent firm for review prior to commencement of Work.

C. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.

D. Test samples in accordance with ACI 301 for compressive strength (cylinders) and flexural strength (beams.)

PART 3 – EXECUTION

3.01 EXAMINATION

A. Section 01 32 00 – Construction Progress Documentation: Verification of existing conditions before starting work.

B. Verify compacted base course is acceptable and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

D. Verify utility structure frames and lids are installed in correct position and elevation.

3.02 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole, catch basin, and other utility structure frames with oil to prevent bond with concrete pavement.

C. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.03 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.04 REINFORCEMENT

A. Place reinforcement as indicated on Drawings.

B. Interrupt reinforcement at contraction and expansion joints.

C. Place dowels to achieve pavement and curb alignment as detailed.

D. Provide doweled joints 18 inches on center at transverse joints with one end of dowel set in capped sleeve to allow longitudinal movement.

3.05 PLACING CONCRETE

A. Place concrete in accordance with NYSDOT Standard Specifications.

B. Place concrete using the slip form technique wherever possible.

C. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive placements such that cold joints occur.

E. Place concrete to pattern indicated on Drawings.

3.06 PAVEMENT JOINTS

A. Provide expansion, contraction, and construction joints as indicated on Drawings.

B. Place expansion joints at 60 foot maximum intervals. Place contraction joins at 20-foot maximum intervals. Align pavement joints with curb, gutter, and sidewalk joints.

C. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/2 inch for backer rod and sealant placement.

D. Saw cut contraction joints 3/16 inch wide or as indicated at an optimum time after finishing. Cut 1/3 into depth of slab.

3.07 SIDEWALK, CURB, AND CURB AND GUTTER JOINTS

A. Provide sawn joints at 5–foot intervals. Provide 1/2 inch wide expansion joint at 20 feet maximum and between sidewalks and curbs and structures.

B. Align sidewalk, curb and gutter joints with pavement joints.

3.08 FINISHING

A. Area Paving: Heavy broom.

B. Sidewalk Paving: Light broom. [Brush to 6 inch radius with smooth trowel joint edges.]

C. Median Barrier: Light broom and trowel joint edges.

D. Curbs and Gutters: Light broom.

E. Inclined Vehicular Ramps: V-grooves with mechanical equipment and spring tines, perpendicular to slope.

3.09 EXPOSED AGGREGATE

A. Apply surface retarder where exposed aggregate finish is indicated.

B. Wash exposed aggregate surface with clean water and scrub with stiff bristle brush exposing aggregate to match sample panel.

C. Sand blast concrete surfaces to achieve aggregate exposure surface to match sample panel.

3.10 CURING

A. Place curing compound on concrete surfaces immediately after finishing.

B. Cover with burlap or polyethylene film to protect from cold weather and rain.

3.11 JOINT SEALING

A. Separate pavement from vertical surfaces with 1/2 inch thick joint filler.

B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

C. Extend joint filler from bottom of pavement to within 1/2 inch of finished surface.

3.12 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 feet.

B. Maximum Variation From True Position: 1/2 inch.

C. Maximum Variation in thickness: 1/2 inch.

3.13 FIELD QUALITY CONTROL

A. Section 01 43 00 – Quality Assurance: Field inspecting, testing, adjusting, and balancing.

B. Prepare three concrete test beams for every 1,333 or less square yards of pavement for each class of concrete placed each day.

C. Prepare one additional test beam during cold weather and cured on site under same conditions as concrete it represents.

D. One slump test will be taken for each set of test cylinders taken.

E. Maintain records of placed concrete items. Record date, location of placement, quantity, air temperature, and test samples taken.

F. Take one 4-inch diameter core for every 1,333 square yards or less of pavement for each class of concrete placed each day.

3.14 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian or vehicular traffic over pavement for 7 days minimum after finishing.

3.15 SCHEDULES

A. Concrete Sidewalks: Class A Concrete, compressive strength of 4,000 psi at 28 days, 4 inches thick, buff color Portland cement, light broom finish.

B. Roadway Pavement Concrete: Non-reinforced, flexural strength of 650 psi at 28 days, 8 inches thick, wood float finish.

C. Utility Cabinet Slab: Class AA Concrete, 4,500 psi 28 day concrete, 6 inches thick, 6/6–6 x 6 inch mesh reinforcement, light broom finish.

END OF SECTION

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SECTION – 32 16 00

CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Conditions, Supplementary Conditions, and Division 01 Specification Sections, apply to the Work of this Section.

B. Related Sections include the following:

1. Section 03 10 00 – Concrete Forming and Accessories.
2. Section 03 20 00 – Concrete Reinforcing.
3. Section 03 30 00 – Cast-In-Place Concrete.
4. Section 31 20 00 – Earth Moving.
5. Section 32 13 13 – Concrete Paving.

1.02 SUMMARY

A. This Section specifies requirements for:

1. Various types of curb, gutter, sidewalk, sidewalk ramps, driveways, and alley intersections.
2. Contraction joints and expansion joints in curb, gutter, sidewalk, sidewalk ramps, driveways, and alley intersections.

1.03 REFERENCES

A. Abbreviations and Acronyms:

1. NYSDOT: New York State Department of Transportation.

B. Reference Standards:

1. American Concrete Institute (ACI):
   a. ACI 305R – Guide to Hot Weather Concreting.
   b. ACI 306R – Guide to Cold Weather Concreting.
2. ASTM International (ASTM):
   a. ASTM C33 – Standard Specification for Concrete Aggregates.
   b. ASTM C150 – Standard Specification for Portland Cement.
   c. ASTM D 1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
   d. ASTM D 1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Filler for Concrete Paving and Structural Construction.
   e. ASTM D 2628 – Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

3. http://www.cityofwhiteplains.com/dataimages/dpw_standard_constState of New York:
   a. New York State Department of Transportation (NYSDOT):
      1) NYSDOT Standard Specifications (U.S. Customary Units). https://www.dot.ny.gov/main/business-center/engineering/specifications
      2) New York State Standard Sheets (U.S. Customary Units). https://www.dot.ny.gov/main/business-center/engineering/cadd-info/drawings/standard-sheets-us
4. United States Government:
   a. Americans with Disabilities Act. (Pub. L. 101–336, 104 Stat. 327, 42 U.S.C. 12101–12213 and 47 U.S.C. 225 and 611) [ADA].
   b. Buy America Act (Pub. L. 103–429, 49 U.S.C. 5323(j))
   c. Department of Justice:
      1) 2010 ADA Standards for Accessible Design,
      2) 28 CFR 35 – Nondiscrimination on the Basis of Disability in State and Local Government Services
      3) 28 CFR 36 – Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities.
   d. Federal Transit Administration (FTA):
      1) 49 CFR 661 Buy America Requirements.
   e. United States Code:
      1) 42 U.S.C. Sections 12101–12213.
         a) Equal Opportunity for Individuals with Disabilities.
            (i) Americans with Disabilities Act of 1990 (ADA) [P.L. 101-336].
            (ii) ADA Amendments Act of 2008 [P.L. 110–325]
      2) 49 U.S.C. Section 5323(j).
         a) Buy America Act [P.L. 103–429].

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Depending on where the curb, gutter, sidewalk, sidewalk ramp, driveway, or alley entrance construction is to occur and the owner of the right-of- way, coordinate with and obtain the required approvals from the appropriate State and municipal departments, including but not limited to, the following:
   a. New York State Department of Transportation (NYSDOT).
   b. Local authority having jurisdiction over public streets.
   c. Metro North.

2. Adhere to each owner's specifications and/or permits, and comply with additional requirements of the owners, regarding the Work of this Section.

3. If the owner of the right-of- way is other than the Metro North, the identity of the owner of the right-of- way will be provided on the Contract Drawings.

B. Sequencing:

1. Include provisions for traffic control during concreting operations in the Traffic Control Plan required by Section 01 50 00, Temporary Facilities and Controls, including provisions for the placement and maintenance of barriers required to protect the curbs, gutters, sidewalks, sidewalk ramps, driveways, and alley entrances from traffic for a minimum of 7 days after concrete placement.

1.05 QUALITY ASSURANCE

A. Certifications:

1. Expansion Joint Filler Certificates of Compliance:

a. Prepare Certificates of Compliance for the expansion joint filler that include the following information:

1) Description of material supplied.

2) Quantity represented by the Certificate.

3) A means of identifying the material, such as a label, lot number, or marking.

4) A statement certifying the material complies with the requirements of specifications cited.

5) The name, title and signature of a person having the authority to bind the manufacturer or Supplier of the material.

b. Submit the Certificates of Compliance for the expansion joint filler to the Engineer for approval.

1.06 SUBMITTALS

A. Action Submittals:

1. Submit the following to the Engineer for approval in accordance with the requirements of Section 01 33 00, Submittal Procedures:

a. Product Data:

1) Concrete.

2) Expansion joint filler.

3) Detectable warnings on sidewalks.

b. Shop Drawings:

1) Working Drawings for the curb, gutters, sidewalks, sidewalk ramps, driveways, and alley entrances.

2) Detectable warnings on sidewalks.

c. Certificates:

1) Certificates of Compliance for expansion joint filler.

d. Special Procedure Submittals:

1) Manufacturer's data for machinery used in lieu of conventional concrete forms.

B. Informational Submittals:

1. Submit the following to the Engineer for information in accordance with the requirements of Section 01 33 00, Submittal Procedures:

a. Special Procedure Submittals:

1) Sidewalk, Curb, or Driveway Permits.

b. Manufacturer's Reports:

1) Manufacturer's data for machinery used in lieu of conventional forms.

1.07 SITE CONDITIONS

A. Ambient Conditions:

1. Cold Weather Concreting:

a. Perform cold weather concrete work in accordance with the requirements of ACI 306R.

2. Hot Weather Concreting:

a. Perform hot weather concrete work in accordance with the requirements of ACI 305R and the following additional requirements:

1) Do not deliver concrete having a temperature exceeding 90 degrees Fahrenheit to the Work Site.

2) Cool the mix's ingredients before mixing to prevent the temperature of the mix from exceeding 90 degrees Fahrenheit.

3) Furnish windbreaks, shading, fog spraying, sprinkling, or wet covering when necessary.

PART 2 – PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Buy America Act:

1. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

2.02 DESIGN CRITERIA

A. Paving for Parking Areas and Access Drives

1. In accordance with the local Construction Code, provide paving for parking areas and access drives capable of withstanding a wheel load of at least 4,000 pounds unless otherwise indicated in the Contract Documents.

a. Construct the base course of non-absorbent approved material rolled or compacted to grade.

b. Bring the wearing surface to a smooth but non-slip, non-dusting finish; and maintain it in this condition.

c. Provide finished pavement composed of 1-1/2-inch trap rock penetrated with 1-1/2 to 2 gallons of asphaltic oil per square yard of paved area, and equal to at least a 4-inch compacted thickness of bituminous macadam.

B. Stamped Brick Concrete Sidewalk:

1. Provide concrete having a minimum compressive strength of 4000 psi at 28 days, and a maximum slump of 5 inches, for stamped brick concrete sidewalk.

C. Pedestrian Ramps:

1. Provide pedestrian ramps complying with Americans with Disabilities Act (ADA), the local authority having jurisdiction, and New York State Department of Transportation (NYSDOT) standards.

D. Submit Product Data for the materials proposed for the Work of this Section to the Engineer for approval.

E. Submit Working Drawings for the curb, gutters, sidewalks, sidewalk ramps, driveways, and alley entrances to the Engineer for approval.

2.03 MATERIALS

A. Caulking Compound:

1. Provide a colored caulking compound matching the concrete color.

2. Caulking Compound Manufacturers:

a. Euclid Chemical Company, http://www.euclidchemical.com/.

b. Manufacturer providing an equivalent product approved by the Engineer.

B. Concrete and Concrete Reinforcing:

1. Provide concrete reinforcing complying with the requirements specified in Section 03 20 00, Concrete Reinforcing.

2. Provide concrete complying with the requirements specified in Section 03 30 00, Cast-In-Place Concrete.

C. Concrete Color Admixtures:

1. Provide water-reducing, set-controlling concrete color admixtures that produce durable and structurally sound architectural colored concrete.

2. Integral Concrete Color Manufacturers:

a. L. M. Scofield Company, http://www.scofield.com/lkch_cchart.html.

1) CHROMIX P (powdered).

2) CHROMIX L (mixed liquid in buckets and totes).

b. Manufacturer providing an equivalent product approved by the Engineer.

D. Concrete Color Hardener:

1. Provide dry-shake concrete color hardeners capable of forming a high-performance concrete skin that improves surface durability.

2. Concrete Hardener Manufacturers"

a. L. M. Scofield Company, LITHOCHROME® Color Hardener, http://www.scofield.com/lkch_cchart.html.

b. Manufacturer providing an equivalent product approved by the Engineer.

E. Concrete Release Agent:

1. Provide a liquid or powdered release agent.

a. Powdered Release Agent: Provide a clear or pigmented water-repellent powder capable of forming a lubricant barrier between fresh concrete and mat stamping tools for easy release.

b. Liquid Release Agent: Provide a parting agent capable of keeping stamping tools from sticking to wet concrete.

2. Liquid Concrete Release Agent Manufacturers:

a. Super Stone Inc., http://www.superstone.com/.

1) Super Stone Release Powder.

2) Super Stone Bubble Gum Liquid Release®.

b. Manufacturer providing an equivalent product approved by the Engineer.

F. Concrete Sealer:

1. Provide a waterproofing concrete sealer that will become a permanent part of the concrete matrix itself.

2. Concrete Sealer Manufacturers:

a. Endur-O-Seal USA, Inc., http://enduroseal.com/index.html.

b. Manufacturer providing an equivalent product approved by the Engineer.

G. Detectable Warnings:

1. Provide detectable warnings tiles manufactured from a colorfast and UV-stable, homogenous glass and carbon composite.

2. Surface Applied Detectable Warnings:

a. Provide 1/8-inch thick surface applied detectable warnings tiles with beveled edges, fiberglass truncated domes, and designed to be secured with color matched fasteners and structural adhesive or pressed into place in freshly placed concrete.

3. Cast-In-Place Detectable Warnings:

a. Provide nominal 1/4-inch thick cast-in-place tiles having embedment ribs 3 inches apart on center through the entire length of tile.

4. Detectable Warnings Manufacturers:

a. ADA Solutions, Inc., http://www.adatile.com/.

1) For new construction, provide 24"x60"Cast-in-Place Composite Tactile with 2.35" dome spacing.

2) For retrofitting existing ramps, provide 24"x60" Surface Mount Composite Tactile with 2.35" dome spacing.

b. Manufacturer providing an equivalent product approved by the Engineer.

5. Submit Shop Drawings and Product Data for detectable warnings to the Engineer for approval.

H. Expansion Joint Filler:

1. Provide expansion joint filler complying with the material requirements specified in NYSDOT Standard Specification Section 705 Joint Materials and ASTM D 1751, ASTM D 1752, or ASTM D 2628.

2.04 MIXES

A. Stamped Brick Sidewalk Concrete Mix:

1. Provide concrete color admixtures to provide an integral red color in the concrete mix.

2. Provide Portland cement conforming to the requirements specified for Type I, II or V concrete in ASTM C150, depending on soil conditions

3. Provide aggregate conforming to the requirements specified in ASTM C33.

4. Provide fresh, clean, and potable mixing water

5. Provide a mix containing the integral color, Portland cement, aggregate, water, water reducer, between 4 to 7percent entrained air, and accelerator and retarders as approved by the Engineer.

6. Do not allow chloride additives in the mix.

2.05 ACCESSORIES

A. Concrete Formwork:

1. Provide concrete formwork complying with the requirements specified in Section 03 10 00, Concrete Forming and Accessories.

PART 3 – PRODUCTS

3.01 EXAMINATION

A. Verification of Conditions:

1. Inspect the locations intended to receive cast-in-place concrete for deficiencies which would prevent proper execution of the concretework.

B. Evaluation and Assessment:

1. Do not proceed with concrete placement until deficiencies discovered by inspection are corrected to the satisfaction of the Engineer.

3.02 PREPARATION

A. Protection of In-Place Conditions:

1. Obstructions to Access:

a. Do not place excavated material where it will interfere with access to property or traffic flow in the street.

2. Pedestrian and Vehicular Traffic:

a. Adequately protect pedestrian and vehicular traffic by furnishing suitable protective barricades and lighted red lanterns around the work, and arrange the work so inconvenience, delay, and hazard to pedestrian and vehicular traffic is minimized.

1) Erect and maintain suitable barricades and fences around the work area while excavation or other work is in progress.

2) The local authority may require that the Work be arranged to make it possible to completely remove obstructions to traffic on Saturdays, Sundays, holidays, and at the discretion of the authority, during periods of unusually heavy traffic volume.

a) If this requirement is not complied with, the local authority may backfill and temporarily resurface all or part of the work covered by the Street Opening Permit using its own forces, or another contract, or otherwise; and the Contractor will be completely responsible for reimbursing the local authority for expenses incurred thereby.

3) Provide warning flags or signs and suitably lighted flashing lights.

4) Provide a watchman if so ordered by the local authority.

5) If interference with the free flow of traffic occurs, designate competent persons to direct and expedite traffic by means of lights or flags.

6) Unless otherwise authorized by the Local authority, maintain vehicular traffic at all times during the progress of the work being performed under the Street Opening Permit.

3. Existing Structures:

a. At least 24 hours before commencing street openings or work to be done under the provisions of a street opening permit, give written notice of street opening to any company whose pipes, conduits, or other structures are laid in the street in which the work is.

b. Carefully support, maintain in operation, and protect from injury pipes, conduits, or other structures; and, in case of injury, restore the pipes, conduits, or other structures to as good a condition as

they were before the beginning of such opening or work.

B. Surface Preparation:

1. Construct and compact the subgrade true to grades and lines shown on the Contract Drawings and as specified in Section 31 20 00, Earth Moving.

a. Remove soft or unsuitable material to a depth not less than 6 inches below the subgrade elevation, and replace it with material acceptable to the Engineer.

b. If the Engineer determines that the existing subgrade consists of soils with swelling characteristics, bring the moisture content as close as possible to the optimum required for compaction.

1) Obtain optimum moisture content by the addition of water, by the addition and blending of dry suitable material, or by drying the existing material.

c. Compact the subgrade to a relative density of 90 percent minimum.

C. Demolition / Removal:

1. Sidewalk, Curb, and Driveway Removal:

a. Cut existing pavements and concrete joined to new construction.

1) Smoothly saw cut concrete to neat, straight, vertical, true lines so the adjoining surface will not be damaged.

a) The minimum depth of cut is 1-1/2 inches or 1/4 of the thickness (D/4), whichever is greater.

b) Clean-cut asphalt concrete only with approved equipment and methods

(i) Paint trimmed edges with a light coating of asphalt cement or emulsified asphalt immediately prior to constructing the new abutting asphalt concrete.

c) Do not rip or root outside the limits of cuts.

2) Remove existing concrete sidewalks and driveways that abut the new sidewalks and driveway entrances to a distance required to maintain the slope, or where sidewalks are concerned not to exceed 1-inch per foot.

3) Saw cutting is required at the match lines.

b. Do not place material displaced by the construction on the base and/or surfacing material already in place on adjacent roadways.

2. Excavation:

a. Store excavated material in neat piles, placed so interference with the use of the roadway or sidewalks is minimized.

b. If so ordered by the Local authority, promptly remove excavated material from the site of the work.

3.03 SIDEWALK, CURB, AND DRIVEWAY CONSTRUCTION

A. Construct or replace sidewalks, curbs, and driveways in accordance with the grades and specifications determined or promulgated by the local authority having jurisdiction; and perform the Work so it meets the grade and alignment of the adjoining sidewalk, curb, and driveway and/or established lines and grades.

1. Follow the current standard specifications of, and obtain prior approval from the local authority having jurisdiction .

B. Sheathing and Shoring:

1. Except where the excavation is in rock or otherwise authorized by the local authority having jurisdiction, in trenches in excess of 3 feet deep place tight sheathing at least 2 inches thick and securely fasten it in place with whalers and braces for the duration of the work

a. Drive the sheathing to the same depth as the lowest part of the pipe, conduit, or structure proposed to be installed.

b. Carry sheathing down so the bottom of the sheathing is not more than one foot above the bottom of the excavation.

c. If the horizontal distance from the edge of a proposed excavation to the nearest edge of the pavement, water main, or other surface or subsurface structure is more than the vertical depth of the proposed excavation measured from the highest point of the pavement, water main, or other surface or subsurface structure, the Authority may authorize omitting the sheathing and shoring in whole or in part.

2. Whenever conditions make it necessary, the Authority may require that the sheathing be driven ahead of the excavation as the excavation proceeds.

3. Unless otherwise authorized in writing by the Authority, leave sheathing and shoring in place with a cutoff line 18 inches below the ground surface.

C. Portland Cement Concrete Curbs, Gutters, Sidewalks, and Driveways:

1. Concrete Formwork:

a. Furnish conventional concrete forms as specified in Section 03 10 00, Concrete Forms and Accessories, unless otherwise approved.

1) Carefully set forms that conform to the dimensions of the curb, gutter, sidewalk, sidewalk ramp, driveway, or alley entrance to line and grade, and securely stake them into position.

2) Water the forms and subgrade immediately in advance of placing concrete.

3) Clean forms thoroughly each time they are used.

4) Coat forms with a light oil or other releasing agent which will not discolor the concrete.

b. Construct concrete curbs and gutters by using conventional concrete forms, or when approved by the Engineer by means of an appropriate machine.

1) If applicable, submit the manufacturer's data for machinery used in lieu of conventional forms to the Engineer for approval of the equipment.

c. All construction requirements applicable to the use of conventional forms also apply to the use of the machines.

1) If machines approved by the Engineer and specifically designed for such Work are used, the results must be equal to or better than those produced by the use of conventional forms.

2) If the results are unsatisfactory to the Engineer, discontinue using the machines and make necessary repairs at no increase in Contract Price.

2. Placing Concrete:

a. Place the concrete in the forms.

b. Spade concrete away from the forms so there will be no rock pockets next to the forms.

c. Compact concrete using mechanical vibrators approved by the Engineer.

d. Continue tamping or vibrating the concrete until mortar flushes to the surface, and the coarse aggregate is below the concrete surface.

3. Finishing and Curing Concrete:

a. Finish and cure the concrete as specified in Section 03 30 00, Cast-In-Place Concrete.

D. Formwork Removal:

1. Exercise care to prevent damage when removing concrete forms.

2. Do not remove the front face form before the concrete has taken initial set and has sufficient strength to carry its own weight.

3. Do not remove gutter forms and rear forms until the concrete has hardened sufficiently to prevent damage to the edges.

E. Expansion Joints:

1. Unless otherwise specified or shown, construct expansion joints in accordance with the local authority and New York State Department of Transportation (NYSDOT) standards.

2. Construct expansion joints in a straight line and vertical plane perpendicular to the longitudinal line of the sidewalk, curb, or gutter except, in the case of a curved alignment, construct expansion joints along radial lines of the curve.

3. Construct expansion joints to the full depth and width of the concrete, and match the joints in the adjacent pavement, sidewalk, curb, or gutter.

4. Extend the expansion joint material through the concrete from the surface to one inch into the subgrade.

5. Construct expansion joints at all radius points, driveways, alley entrances, and at adjoining structures.

    a. Construct expansion joints with a maximum interval of 100 feet between joints.

F. Contraction Joints:

1. Unless otherwise specified, construct contraction joints in accordance with the local authority and New York State Department of Transportation (NYSDOT) standards.

2. Construct contraction joints in a straight line and vertical plane perpendicular to the longitudinal line of the sidewalk, curb, or gutter, except, in the case of a curved alignment, construct contraction joints along radial lines of the curve.

3. Construct contraction joints to a depth of 1-1/2 inches at 20 foot intervals on all sidewalks regardless of the width.

4. Unless an expansion joint is required, construct contraction joints to coincide with each form joint.

5. Provide sidewalk score marks at least 1/2 inch deep at the mid-point of the contraction joint.

G. Edges:

1. Shape all edges with a suitable tool formed to round the edges to a radius as indicated on the local authority and New York State Department of Transportation (NYSDOT) standard drawings.

H. Depressed Curbs for Driveway Entrances:

1. If approved in writing by the local authority, existing curbs may be cut or lowered to provide driveway entrances or exits.

    a. If authorized by the Engineer, concrete curbs may be cut provided the cutting can be satisfactory done.

2. Do not cut or lower existing curbs, or construct new depressed curbs, to provide driveway entrances or exits unless in each case an adequate driveway ramp or apron is provided and installed between the curb and the abutting property line, and extends over the entire width of the existing or proposed driveway.

3. Satisfactory surface the driveway ramp or apron with 7-inch thick reinforced concrete, or macadam at least 4 inches thick, or at least 2 inches of bituminous surfacing material laid over 4 inches of crushed stone.

4. The depressed curb cannot be longer than the limits established by the Local authority.

5. Unless otherwise authorized, construct the portion of the driveway ramp or apron common with the sidewalk from 7-inch thick reinforced concrete.

6. Where depressed curbs or portions of depressed curbs are no longer used or needed for driveway entrance purposes, raise and restore the depressed curbs or portions thereof to their full height to conform with adjoining curbs or

to the grade established by the Local authority.

I. Sidewalks:

1. Provide concrete sidewalk, including pedestrian ramps, at the locations shown on the Contract Drawings or as directed by the Engineer.

a. Locate expansion joints at existing joints of adjacent sidewalks, at street light and utility pole bases, and other structures where possible.

1) Space expansion joints no more than 20 feet apart.

2. Promenade Style Concrete Sidewalks:

a. Reinforce promenade style concrete sidewalk with WWF 6 x 6 - W6 x W6 welded wire fabric.

b. Finish the sidewalks to have a broomed finish in one direction, normally at right angles to the adjacent form work.

1) Finish the sidewalks using a magnesium float instead of a wood float.

c. To cure the concrete, in lieu of linseed oil apply a curing material immediately after finishing the concrete, and cover the concrete with polyethylene sheeting for 3 days.

1) Spray 2 coats to apply a combined coverage of 250 square feet per gallon, or roll 1 coat at the rate of 250 square feet per gallon, in accordance with the manufacturer's recommendations.

2) Curing Material Manufacturers:

a) Durok Building Materials, Inc.

b) Manufacturer providing an equivalent product approved by the Engineer.

d. Where directed by the Engineer, saw cut sidewalks to a minimum depth of 2 inches and having neat and sharp edges using a power unit having single or multiple rotary blades.

3. Stamped Brick Concrete Sidewalk:

a. Provide a 5-inch thick integrally colored concrete slab.

1) Add the approved integral color into the revolving drum mixing truck at the Site to obtain a uniformly colored concrete.

b. Screed and bullfloat the concrete.

c. After the concrete has been screeded and bullfloated, broadcast color hardener of the prescribed color into the plastic surface at a rate of 60 pounds per 100 square feet in accordance with the color hardener manufacturer's directions and.

1) Apply the color hardener at this dosage in two applications broadcast perpendicular to each other, and float the

concrete after each application.

2) During this first application, approximately 2/3 of the total color hardener dosage will be steel troweled into the concrete.

3) Submit the color hardener manufacturer's directions to the Engineer for information.

d. Once the concrete has attained the correct plasticity, release and imprint the slab.

1) Immediately prior to the imprinting of the concrete, apply a liquid or powdered release agent in accordance with the manufacturer's directions.

a) Submit the liquid or powdered release agent manufacturer's directions to the Engineer for information.

2) Upon attainment of full concrete strength, remove excess release agent by power washing, acid washing as necessary to blend color variations, or a combination the two.

e. 6 to 8 hours after the concrete has been placed, follow the manufacturer's application instructions attached to sealer container to apply the first wet coat of concrete sealer using a garden variety sprayer until the surface of the concrete becomes shiny wet but has not puddled in any area.

1) Ensure that the surface is semi-dry before each application of concrete sealer, and do not apply concrete sealer in freezing weather.

2) Place a small amount of powdered release agent into the sealer to enhance its color.

3) Spread puddled or excess sealer over the surrounding surface using a soft nylon household broom.

4) After the first application, allow a minimum of 7 days for the hydration and curing of the concrete.

f. Prior to applying the final application of concrete sealer, hose offthe surface to remove any contaminants from the surface.

1) Do not allow the concrete sealer to puddle.

g. Fill the void from the top of the expansion joint to the finished grade of the concrete by applying a colored caulking compound matching the concrete color.

4. Standard Concrete Sidewalk:

a. Finish the sidewalks to have a broomed finish in one direction, normally at right angles to the adjacent form work.

1) Finish the sidewalks using a magnesium float instead of a

wood float.

b. To cure the concrete, in lieu of linseed oil apply a curing material immediately after finishing the concrete, and cover the concrete with polyethylene sheeting for 3 days.

1) Spray 2 coats to apply a combined coverage of 250 square feet per gallon, or roll 1 coat at the rate of 250 square feet per gallon, in accordance with the manufacturer's recommendations.

2) Curing Material Manufacturers:

a) Durok Building Materials, Inc.

b) Manufacturer providing an equivalent product approved by the Engineer.

c. Where directed by the Engineer, saw cut sidewalks to a minimum depth of 2 inches and having neat and sharp edges using a power unit having single or multiple rotary blades.

5. Detectable Warnings on Sidewalks:

a. Provide detectable warnings on sidewalk curb ramps and other locations as detailed in the Contract Documents or as directed by the Engineer.

1) On pedestrian curb ramps and blended transitions include detectable warnings surfaces in complying with the latest ADA Standards for Accessible Design, local authority, and New York State Department of Transportation (NYSDOT) standards.

J. Backfilling:

1. Do not backfill until the work being done has first been inspected, and the backfilling has been authorized by the local authority having jurisdiction.

a. If backfilling occurs before the work has been inspected, the Engineer can require the Contractor to uncover the work at no increase in the Contract Price so proper inspections can be made.

2. Unless otherwise specified, backfill behind the curbs, sidewalk, or sidewalk ramps with soil native to the area and to the lines and grades shown on the Contract Drawings.

3. To backfill the bottoms of trenches, provide clean earth, sand, or rock dust containing no broken rock, stone, or frozen earth up to 2 feet above the completed pipe or other structure.

a. For the backfill placed 2 feet and higher above the top of a completed pipe or other structure, provide approved material containing no frozen earth, consisting of less than one-third broken rock, and having no stones exceeding 1/2 cubic foot in size.

4. Pack the space between and the bottom and sides of the trench and the pipe or other structure by hand until full, and thoroughly tamp the material as fast as it is placed up to the top of the pipe or other structure; then by

hand carefully deposit and tamp the backfill cover material in layers not more than 6 inches thick to at least 3 feet higher than the top of the pipe or other structure.

a. Furnish a light tamper weighing from 6 to 8 pounds for tamping, and perform the tamping so compacted backfill is secured without injuring or disturbing the completed pipe or structure.

b. Use at least one worker for tamping for each worker engaged in backfilling.

5. Backfill above the 3 feet above the top of the pipe or other structure in successive horizontal layers not exceeding 6 inches in depth, and thoroughly compact each layer using approved pneumatic tamping equipment or other means approved by the local authority.

6. Do not use power equipment or other mechanical means for backfilling unless measures for adequately compacting the backfill material have been furnished, and then only with the prior written authorization of the local authority.

7. Except with the prior written authorization of the local authority, do not use flooding or puddling with water to compact the backfill.

K. Special Techniques:

1. Identification:

a. Stamp the Contractor's name and the year the Work is performed on curb, gutter, sidewalk, and driveway Work done by the Design-Builder.

b. Locate this information on each end of the curb, gutter, sidewalk, or sidewalk ramp with letters not less than 3/4 inch in height.

2. Tunneling:

a. Tunneling under pavements or sidewalks is not permitted.

3. Driving Small Pipes or Conduits:

a. Small pipes or conduits having a dimension of 6 inches or less may be driven beneath pavements or sidewalks if the surface is not disturbed or injured provided that:

1) Prior written approval from the local authority is obtained.

2) No excavation is closer than one foot to the edge of a sidewalk or 18 inches to the edge of a pavement.

3) The pipes or conduits are enclosed in sleeves or larger pipes so the required replacements or repairs may be made in the future without disturbing or injuring to the pavement or sidewalk.

4) If a pavement, sidewalk, or subsurface pipe or structure is damaged by driving the pipe or conduit, repair and make good the damage at no increase in Contract Price.

L. Tolerances:

1. Curb and Gutter: 1/4 inch when measured with a 10 foot straight edge.
2. Sidewalk and Sidewalk Ramps: 1/8 inch when measured with a 5 foot straight edge.

3.04 REPAIR/RESTORATION

A. Repair sidewalks, curbs, and driveways in accordance with the grades and specifications determined or promulgated by the local authority; and perform the Work so it meets the grade and alignment of the adjoining sidewalk, curb, and driveway and/or established lines and grades determined by the local authority.

1. Follow the current standard specifications of the local authority, subject to the prior approval of the local authority.

B. Repair any portion of concrete damaged while stripping forms; or if the damage is severe, replace the concrete at no additional increase in Contract Price.

C. Remove and replace any section of the Work deficient in depth or not conforming to the Contract Drawings or Specifications at no additional increase in Contract Price.

D. Temporary Resurfacing:

1. Immediately after backfilling excavations, place an acceptable temporary resurfacing on them.

a. Maintain temporary resurfacing even with the roadway or other surface as directed until permanent restoration of the surface is completed and approved by the Local authority having jurisdiction.

2. Provide temporary resurfacing consisting of not less than 2 inches of approved premixed bituminous paving material, or if permitted by the local authority provide 6 inches of temporary concrete flush to surface; except where top soil, seeded areas, or sod have been disturbed by the excavation or other work, restore the entire ground area to the same condition as existed before the work began.

E. Permanent Restoration:

1. Do not permanently restore the surface over a street opening excavation until satisfactory settlement of the backfill has taken place and approved by the local authority having jurisdiction and Construction Commission.
2. Complete the permanent pavement no later than the date indicated on the Street Opening Permit.

F. Concrete Pavement Restoration:

1. Before proceeding with concrete pavement resurfacing, neatly cut the existing concrete pavement back a distance not less than 18 inches beyond the edges of the excavation, taking care not to remove any existing steel reinforcement.

a. Do not reduce this distance without prior approval of the local authority having jurisdiction.

b. Under the following conditions, increase this distance:

1) Where existing pavement has been undermined by the excavation or by other work, or where spalled or scaled surface areas of existing pavement adjoin the area to be resurfaced, remove additional pavement beyond the distance specified as ordered by the Engineer.

2) If a portion of the proposed concrete resurfacing, as finally determined by the Engineer, is nearer than 4 feet from a joint, extend the removal to the joint.

3) The smallest horizontal dimension of the concrete resurfacing cannot less than 4 feet.

2. Do not disturb exposed subgrade unless, in the opinion of the Engineer, the subgrade is unstable.

   a. If the subgrade is unstable, remove the unstable material as ordered, and replace it with approved stable material in layers not exceeding 4 inches thick, and thoroughly compact and tamp each layer.

3. Uniformly plumb and tool the upper edges of the existing concrete pavement to a depth no more than one inch leaving the remaining depth with straight but rough edges.

4. Place deformed steel bar reinforcement, not less than 3/8-inch in size, 2 inches above the subgrade, spaced as ordered, and adequately tied in with the existing reinforcement, if any.

5. Immediately prior to the placing of the new concrete resurfacing, thoroughly wash, wire brush, dampen, and paint the edges of the existing concrete pavement with a 1:1 neat cement coating.

6. Proportion, mix, place, finish, and cure the concrete as ordered.

   a. The Engineer may require using an approved, high early- strength, cement placed under approved methods.

   b. Using admixtures and work in freezing weather is allowed only with the Engineer's prior approval and as directed.

7. Install approved joints where directed.

8. Do not open the resurfaced area to traffic until so ordered by the Engineer.

G. Bituminous Pavement Restoration:

1. Prior to replacing bituminous pavements, properly prepare the subgrade and place a reinforced concrete foundation of the required thickness and proportions on it in accordance with the requirements for concrete pavements specified herein.

2. Neatly cut the existing bituminous pavement back a distance not less than 6 inches from the edges of the new concrete foundation.

   a. Thoroughly clean the entire exposed foundation in an acceptable manner, place a new bituminous pavement surface of approved type and thickness on the foundation, and roll the bituminous pavement in an acceptable manner.

H. Macadam Pavement Restoration:

1. Cut back the existing macadam pavement not less than one foot beyond the edges of the excavation.

   a. Do not reduce this distance without prior approval of the Local authority having jurisdiction.

   b. If the existing pavement has been undermined by excavation or by other work, the Local authority having jurisdiction may increase this distance.

2. Place 4 inches of approved crushed stone of the required size, properly tamp the crushed stone, then place 2 inches of asphaltic concrete on the subgrade, and compact and finish the asphaltic concrete in an acceptable manner.

I. Removed Trees:

1. If in order to construct, replace, or repair a sidewalk or driveway, it is necessary to remove a tree on city property, furnish and plant a new tree for each tree removed, of a species and size acceptable and in an approved location, in front of or adjoining the property.

3.05 SITE QUALITY CONTROL

A. Site Tests:

1. Curb and Gutter Tolerance Test:

   a. Test Procedure:

      1) With a 10-foot straight edge or curve template, the face, top, back, and flow line of the curbs and gutters will be checked longitudinally along the surface to verify they are constructed as indicated on the Contract Drawings within the allowable tolerances.

   b. Acceptance Criteria:

      1) Curbs and gutters having deviations within the specified allowable tolerance are acceptable.

2. Sidewalk and Sidewalk Ramp Tolerance Test:

   a. Test Procedure:

      1) With a 5-foot straight edge, the sidewalks and sidewalk ramps will be checked to verify they are constructed as indicated on the Contract Drawings within the allowable tolerances.

   b. Acceptance Criteria:

      1) Sidewalks and sidewalk ramps having deviations within the specified allowable tolerance are acceptable.

3. Gutter Drainage Test:

   a. Test Procedure:

1) Gutters that have a slope of 0.8 foot per hundred feet or less and gutters having unusual or special conditions that cast doubt on the capability of the gutters to drain may be tested by applying water from a hydrant, tank truck, or other source to establish the flow in the length of gutter to be tested on a dry day.

2) 1 hour after the supply of water is shut off, the gutter will be inspected for evidence of ponding or improper shape.

b. Acceptance Criteria:

1) Ponded water in the gutter or on adjacent asphalt pavement to a depth of more than 1/2 inch is unacceptable.

B. Site Inspections:

1. Granite curbing will be inspected for dimensional compliance at the Site by the Engineer.

C. Non-Conforming Work

1. Correct any deviations in curbs, gutters, sidewalks, and sidewalk ramps in excess of the specified allowable tolerances at no increase in Contract Price.

2. If water is found ponded in gutters or on adjacent asphalt pavement to a depth of more than 1/2 inch, correct the defect or defects in a manner acceptable to the Engineer at no increase in Contract Price.

3. Permitted Work by Local Authority:

a. The local authority having jurisdiction may, at his discretion, cause work contemplated in this Section that is covered by City permits to be done by the City's own forces, by contract, or otherwise, in which case the City must be reimbursed for any expense thereby incurred, and the Contractor may make no claim against the City for loss of anticipated profits or other losses.

3.06 CLEANING

A. Waste Management:

1. Haul demolished surface materials away from the Site as soon as practical, and do not use them as backfill.

3.07 PROTECTION

A. Plates:

1. Furnish plates over open excavations for the minimum possible time, and only when specifically requested when applying for Street Opening Permits, or at other times when directed by the local authority having jurisdiction.

a. Adequately anchor plates to assure covering the street opening.

b. Do not use vertical projecting lifting devices.

c. The Engineer, in order to reopen a street to the motoring public, has the right to require temporary pavement to be provided in lieu of

plating.

2. From December 1 up to and including March 31 of each year, unless another time period is indicated, comply with the following additional requirements:

   a. Pay a per diem fee to the local authority as may be required.

   b. Place signs as follows.

      1) Provide highly reflective orange diamonds signs that are 2 feet on each side, have black letters and a black border, and are mounted so the lowest point of the sign is 7 feet above the curb or ground surface.

      2) Provide signs that have a 3/8-inch margin and a 5/8-inch border, and 5-inch tall letters placed so that one word is centered over the other.

   c. Facing oncoming traffic and 5 feet before the plate, place a sign reading “RAISE PLOW”.

   d. 200 feet before the plate, and at side streets closer than 50 feet, place signs reading "PLATE AHEAD”.

      1) This sign can be required at any time during the calendar year, or be waived at the discretion of the Engineer.

END OF SECTION

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SECTION – 32 17 13

PARKING BUMPERS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes wheel stops indicated on the Contract Drawings.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 – PRODUCTS

2.01 PARKING BUMPERS

A. Parking Bumpers (wheel stops) shall be steel-reinforced, precast air-entrained concrete having 4000-psi minimum compressive strength, and having the dimensions as shown on the Contract Drawings.

B. Concrete Reinforcing shall conform to Section 03 20 00 “Concrete Reinforcing”.

C. Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.

1. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.

2. Mounting Hardware: Galvanized-steel spike or dowel, 1/2-inch diameter, 10-inch minimum embedment length.

2.02 GROUT – HILTI HT150 INJECTION SYSTEM OR APPROVED EQUAL.

2.03 ANCHORING HARDWARE: GRADE 60 #4 STEEL REINFORCING BARS, CONFORMING TO ASTM DESIGNATION A615.

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PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install wheel stops according to manufacturer's written instructions unless otherwise indicated.

B. Wheel stops shall be set in place on top of the pavement with both ends bearing evenly.

C. Drill the completed pavement through the full depth of asphalt pavement at each anchoring hardware location.

D. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop. Recess head of hardware beneath top of wheel stop.

END OF SECTION

SECTION – 32 17 23

PAVEMENT MARKINGS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. The Contract Drawings and other Contract Documents, including the General Requirements and Supplementary Requirements apply to the Work of this Section.

1.02 SUMMARY

A. This section specification covers the requirements for pavement markings where required.

1.03 REFERENCES

A. Reference Standards:

1. Federal Highway Administration (FHWA):
   a. Manual on Uniform Traffic Control Devices (MUTCD)
2. New York State Department of Transportation (NYSDOT)
   a. New York State Supplement to the Manual on Uniform Traffic Control Devices
   b. Standard Specifications
   c. Standard Details

1.04 ADMINISTRATIVE REQUIREMENTS

A. Schedule system installations after coordination with Engineer, and the local Traffic Engineer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Material and equipment under this section shall be by manufacturer regularly engaged in work of this magnitude and scope for minimum of five years.

B. Acceptance of material will be based on the manufacturer's certificate of compliance with the NYSDOT Standard specification requirements.

C. All pavement markings material shall conform to NYSDOT Standard Specification Section 106 – Control of Material.

D. Deliver all pavement marking material packed and protected for timely installation, minimizing on-site storage time.

E. Pre-installation conference: Closely coordinate tolerances required in this section for completely coordinated and smooth installation.

F. Installer must be regularly engaged in work of this magnitude and scope for minimum of five years.

G. All work shall conform to all applicable codes.

1.06 SUBMITTALS

A. All submittals are to be in accordance with requirements of the Submittal Procedures in SGR 1, Section 1.03.

B. Action Submittals: Product Data, Certificates and Pavement Markings Design Plans shall conform to NYSDOT Standard Specification Section 685 – Epoxy Reflectorized Pavement Markings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Ensure that copy of the manufacturer's Certificates of Compliance with NYSDOT Standard specification requirements is provided with each delivery of materials, components, and manufactured items that are accepted by certification. Only NYSDOT approved materials shall be accepted for the pavement markings.

B. Storage and Handling Requirements: Load, transport, unload, store pavement markings materials so that the material is kept clean and free from all damage in handling.

1.08 SITE CONDITIONS

A. Existing Conditions: If pavement marking placement conflicts with existing conditions, obtain Resident Engineer approval to adjust location.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Comply with NYSDOT Approved List for Materials and Equipment of Manufacturers and /or Suppliers issued by the Materials Bureau.

B. For a list of approved pavement markings materials refer to the NYSDOT Approved List for Materials and Equipment of Manufacturers and /or Suppliers: https://www.dot.ny.gov/divisions/engineering/technical-services/materials-bureau/materials-and-equipment

2.02 DESCRIPTION

A. Epoxy reflectorized pavement markings and all other markings material shall conform to NYSDOT Standard Specification Section 685 – Epoxy Reflectorized Pavement Markings.

B. Regulatory Requirements:

1. Buy America Act:

a. Except for those products which are exempt under the specific statutory waivers stipulated in 49 CFR 661, all other products supplied under this Section must comply with the requirements of the Buy America Act.

b. Items containing steel and /or iron have specified use restrictions under §106-11, Buy America, of the Standard Specifications. The appearance of a material of non-domestic origin on NYSDOT Approved List in no way implies its universal acceptability for use. The Contract documents govern.

2.03 DESIGN CRITERIA

A. Pavement Markings – All pavement markings shall be designed, furnished and

installed in accordance with current NYSDOT Standard Specifications and Standard Details, and the MUTCD, including temporary pavement markings. The Design- Builder shall install street parking space markings and all other street pavement markings in coordination with the local Traffic Engineer. Restriping of parking spaces shall line up with parking meters. All road pavement markings with the exclusion of decorative crosswalks shall be epoxy paint with high visibility glass beads from an approved NYSDOT source.

2.04 PERFORMANCE REQUIREMENTS

A. Epoxy reflectorized pavement markings and all other markings material shall conform to NYSDOT Standard Specification Section 685 – Epoxy Reflectorized Pavement Markings.

PART 3 – PRODUCTS

3.01 EXAMINATION

A. Verification of Conditions: Prior to installing pavement markings, verify their locations and coordinate with other construction work to verify that the pavement markings will fit without interferences.

B. Prior to beginning installation of the pavement markings, verify that all other work affecting the installation of the pavement markings is complete to the extent that the pavement markings may be installed without adversely affecting other construction.

3.02 PREPARATION

A. The Contractor shall coordinate pavement markings work in the public streets with the local Traffic Engineer. At the time of pavement marking application, all pavement surfaces and existing durable markings shall be free of oil, dirt, dust and grease.

3.03 INSTALLATION

A. Pavement markings installation and testing procedures shall conform to the requirements specified in NYSDOT Standard Specification.

B. Pavement markings shall be installed as shown on the NYSDOT standard sheets or as shown on contract documents.

C. Epoxy pavement markings shall only be placed during conditions of dry weather, and dry pavement surfaces at the width, thickness, and pattern designated by the contract documents. Following an application of glass beads, the cured epoxy marking shall be an adherent reflectorized stripe.

D. After the application and curing of pavement markings an inspection by the Engineer shall be made for film thickness, line width and glass bead coverage and retention. Any defects determined by the Engineer shall be repaired or replaced as directed by and to the satisfaction of the Engineer.

END OF SECTION

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SECTION – 32 17 25

TRAFFIC PAINT PAVEMENT MARKINGS – STANDARD PAINT AND WET REFLECTIVE HIGH BUILD PAINT

PART 1 – GENERAL

1.01 SUMMARY

A. This Section specifies requirements for standard and wet reflective high build traffic paint pavement markings.

1.02 REFERENCES

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

American Association of State Highway and Transportation Officials (AASHTO)
AASHTO M 247 Specification for Glass Beads Used in Pavement Markings.
American Society for Testing and Materials International (ASTM)
ASTM D 522 Test Methods for Mandrel Bend Test of Attached Organic Coatings.
ASTM D 562 Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer.
ASTM D 711 Test Method for No-Pick-Up Time of Traffic Paint.
ASTM D 868 Practice for Determination of Degree of Bleeding of Traffic Paint.
ASTM D 1214 Test Method for Sieve Analysis of Glass Spheres.
ASTM D 1535 Practice for Specifying Color by the Munsell System.
ASTM D 2369 Test Method for Volatile Content of Coatings.
ASTM D 2805 Test Method for Hiding Power of Paints by Reflectometry.
ASTM D 3723 Test Method for Pigment Content of Water-Emulsion Paints by Low-Temperature Ashing.
ASTM D 4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
ASTM E 1347 Test Method for Color and Color Difference Measurement by Tristimulus Colorimetry

ASTM WK51648 New Test Method for Determining Refractive Index of Glass Beads by Measurement of Angle of Reflection.
Federal Highway Administration (FHWA)
MUTCD Manual on Uniform Traffic Control Devices. U.S. General Service Administration – Federal Standards
U.S. General Service Administration – Federal Standards
FED-STD-595C Federal Standard No.595C, Colors Used in Government Procurement.
TT-P-1952E Paint, Traffic and Airfield Marking, Waterborne, Section 4.5.7.

1.03 QUALITY ASSURANCE

A. Environmental Requirements – Weather Limitations: Perform painting only when the surface is dry, when the atmospheric temperature is above 50 degrees F (or is 45 degrees F and rising), and when the relative humidity does not exceed 85 percent. Paint shall not be applied if rain is expected within four hours after application or when the weather conditions are foggy or windy.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver no paint until the Engineer has approved the paint manufacturer(s).

B. Deliver paint to the construction site in sealed containers clearly marked with the date of manufacture, expiration date, name of manufacturer and VOC content.

C. Store paint inside at normal room temperature.

1.05 SUBMITTALS

A. See Appendix "A" for submittal requirements.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Paint

1. The paint shall be a waterborne formulation manufactured for use as a pavement marking material from first grade raw materials and shall be free from defects and imperfections that might adversely affect the serviceability of the finished product. The materials shall show no hard settling or gelling upon storage in the sealed containers as delivered that will affect the performance of the product. The paint shall be furnished ready for use. Upon the Engineer's request, the Contractor shall take a one-quart sample of paint, seal the sample and mark it for future reference.

2. Directional Reflectance: The directional reflectance of the white paint (without glass spheres) shall be 84 percent minimum and of the yellow paint shall be 54 percent minimum when tested in accordance with ASTM E 1347.

3. Flexibility: The paint shall show no cracking, chipping or flaking when tested in accordance with ASTM D 522, Method B, when bent 180 degrees.

4. Bleeding: The paint shall have a minimum bleed ratio of 0.95 when tested in accordance with ASTM D 868.

5. Viscosity: The consistency of the paint shall be not less than 75 or more than 95 Krebs Units at 77 degrees F, when tested in accordance with ASTM D 562.

6. Dry Opacity: Test the paint in accordance with ASTM D 2805. The minimum contrast ratio of the paint shall be: White 0.95, Yellow 0.92

7. Field Drying Time

    a. Standard Paint Application: When applied at 15 mils (plus or minus 1 mil) wet film thickness with Type I glass beads dropped on at the specified application rate, the paint shall dry to no pickup in under three minutes when tested by passing with a passenger car.

    b. Wet Reflective High Build Paint Application: When applied at 20 mils (plus or minus 1 mil) wet film thickness with wet reflective bonded core elements and Type I glass beads dropped on at the specified application rates, the paint shall dry to no pickup in under five minutes when tested by passing with a passenger car.

    c. The dry testing requirement shall be considered satisfied when a passenger car crossing the marking shows no visual deposition of the paint to the pavement surface when viewed from a distance of fifty feet.

8. Lab No Pickup: The paint dry time when tested in accordance with ASTM D 711 shall be not greater than 3 minutes.

9. Abrasion Resistance: Maximum weight loss of the paint film shall be 49 mg when tested in accordance with ASTM D 4060.

10. Shelf Life: The paint shall have a usable shelf life of not less than 12 months.

11. The paint shall contain less than 0.06 percent lead when tested in accordance with FS TT-P-1952E, Section 4.3.1.1 and shall be chromium free when tested in accordance with FS TT-P-1952E Section 4.3.1.2.

12. Color: Shall be in accordance with ASTM D 1535.

    a. For New Jersey traffic markings, the dried paint color shall match Fed. Std. 595C, Color Nos. White 37886 and Yellow 33538.

13. Non-Volatile Vehicle: The paint shall have a minimum non-volatile vehicle of 43.0 percent when tested in accordance with ASTM D 3723.

14. Pigment: The paint shall have a pigment content of 58.0 to 62.0 percent by weight when tested in accordance with ASTM D 3723.

15. Total Solids: The paint shall have a minimum solids content of 76 percent when tested in accordance with ASTM D 3723.

16. Volatile Organic Content (VOC): The VOC shall not exceed 150 g/L when

tested in accordance with ASTM D 2369.

B. Glass Beads: Glass beads shall meet the requirements of AASHTO M 247, Type I. The beads shall be in accordance with the following requirements:

1. Composed of glass that is highly resistant to traffic wear and to the effects of weathering.
2. Colorless, clean, transparent, free from milkiness or excessive air bubbles, and free from surface scarring or scratching.
3. Silica Content: 60 percent minimum.
4. Refractive Index: 1.50 when tested by the liquid immersion method at 77 degrees F.
5. Show no tendency to absorb moisture in storage and shall remain free of clusters and hard lumps.
6. Flow freely from the dispensing equipment at any time when surface and atmospheric conditions are satisfactory for painting.
7. Spherical in Shape: 70 percent minimum true spheres.
8. Beads shall be treated with a moisture-resistant coating or a dual purpose type coating (moisture-resistant and adherence).

C. Wet Reflective Bonded Core Elements (Wet Reflective High Build Paint Application only) shall conform to the following requirements:

1. Wet Reflective Bonded Core Elements: The bonded core reflective elements shall contain either clear or yellow tinted microcrystalline ceramic beads bonded to the opacified core. These elements shall not be manufactured using lead, chromate or arsenic.
2. Index of Refraction: All “dry-performing” microcrystalline ceramic beads bonded to the core shall have a minimum index of refraction of 1.70 when tested using the liquid oil immersion method. All “wet-performing” microcrystalline ceramic beads bonded to the core shall have a minimum index of refraction of 2.30 when tested according to ASTM WK51648.

Element Gradations		
Mass Percent Passing (ASTM D1214)		
US Mesh	Micron	“S” Series Elements
12	1700	85 – 100
14	1410	70 – 96
16	1180	50 – 90
18	1000	5 – 60
20	850	0 – 25

Element Gradations		
Mass Percent Passing (ASTM D1214)		
US Mesh	Micron	"S" Series Elements
30	600	0 – 7

3. Surface Treatment: The bonded core elements shall be surface treated to optimize embedment and adhesion to the high build waterborne binder.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General

1. Apply painted pavement markings of the type(s) shown (standard paint or wet reflective high build paint) at the locations shown in accordance with the patterns and dimensions shown on the Contract Drawings and in accordance with the FHWA's MUTCD.
2. Before commencing pavement marking Work, submit a schedule of operations to the Engineer for approval.
3. When painted pavement markings are applied under traffic conditions, provide all necessary qualified personnel, flags, markers and signs to maintain and protect traffic, and to protect marking operations and the pavement markings until thoroughly set. Perform temporary work area closures in accordance with the requirements of "Maintenance of Traffic and Work Area Protection" of Division 1 – GENERAL PROVISIONS when maintenance of traffic and work area protection is shown on the Contract Drawings.
4. Perform painting of pavement markings in the general direction of traffic. Applying pavement markings against the direction of traffic flow will not be permitted.
5. Remove all tracking marks, spilled paint and paint applied in unauthorized areas, to the satisfaction of the Engineer.
6. When necessary, establish marking alignment points at 25-foot intervals throughout the length of the marking area, or as otherwise approved by the Engineer.

B. Cleaning and Preparation of Pavement Surfaces

1. The exact limits for the removal of existing pavement markings shall be as shown on the Contract Drawings and as verified at the construction site and approved by the Engineer.
2. Conduct removal and cleaning work in such a manner as to minimize airborne dust and similar debris.
3. Contain, immediately collect and properly dispose of waste materials resulting from the removal of existing pavement markings. Use a high efficiency particulate air (HEPA) filter equipped vacuum attachment

operated concurrently with the removal operations to collect waste materials unless other collection means are approved by the Engineer.

4. Do not wash wastes and residues resulting from the removal, surface cleaning and preparation operations into catch basins or the street storm drainage system.

5. Remove existing pavement markings no longer needed to the extent that 95 percent removal is achieved without the removal of more than 1/8 inch of pavement.

6. Prior to the start of removal operations, demonstrate the method of removal to the satisfaction of the Engineer. Any method that leaves gouges, ridges or grooves in the pavement will not be permitted.

7. Obliterating markings by painting over them will not be permitted.

8. Immediately before application of the marking material, the surface shall be dry and free from dirt, grease, oil, laitance or other foreign material that would reduce the bond between the marking material and the pavement. Clean the area to be painted by sweeping and mechanical or compressed air blowing as required to remove all dirt and loose materials. Areas which cannot be satisfactorily cleaned by brooming and mechanical or compressed air blowing, shall be scrubbed as directed with a water solution of trisodium phosphate (10 percent Na3PO4 by weight) or an approved equal solution. After scrubbing, rinse off the solution with water and dry the surface prior to painting.

9. Do not apply paint to Portland cement concrete pavement until the concrete in the areas to be painted is clean of curing material. Use abrasive blasting or high- pressure water to remove curing material from concrete surfaces.

C. Application

1. Paint shall be applied in strict accordance with the manufacturer's recommendations for use. In no case shall the paint be heated above 150 degrees F.

2. All equipment for the Work shall be as approved by the Engineer and shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the Work.

3. The mechanical marking machine shall be an atomizing spray-type marking machine suitable for application of traffic paint, at the specified application thickness, as well as placement of wet reflective bonded core elements and glass beads by double drop application. It shall produce an even and uniform film thickness at the required coverage and shall be designed so as to apply markings of uniform cross sections and clear-cut edges without running or spattering and within the limits for straightness set forth herein. The machine shall have a gauge for measuring the quantity of paint used, graduated in gallons, or other approved measuring method. The equipment shall be truck mounted and capable of painting an 18-inch wide line in one pass.

4. Suitable adjustments shall be provided on the sprayer(s) of a single

machine or by furnishing additional equipment for painting the width required.

5. Mobile truck mounted applicators shall be capable of travelling at a uniform, predetermined speed over variable road grades to produce uniform application of marking material, following straight lines and making normal curves in a true arc. The equipment shall be capable of air-blasting the pavement, applying the marking and immediately dropping the wet reflective bonded core elements and/or the glass beads in a single pass at speeds up to eight miles per hour.

6. Walk behind cart applicators shall be capable of uniform application of marking material at walking speeds, following straight lines and making tight turns symbols and legends. Mobile equipment shall be available to air-blast the areas immediately prior to hand cart application. The walk behind cart shall be capable of applying the binder material and immediately dropping the wet reflective bonded core elements and/or the glass beads in a single pass at walking speeds.

7. The truck mounted and walk behind application equipment shall be capable of applying bonded core elements and glass beads to the surface of the pavement markings by double drop installation for wet reflective high build paint applications. The wet reflective element dispenser for the first drop shall be attached to the pavement marking machine in such a manner that the elements are dispensed closely behind the binder application device. The bead dispenser for the second drop shall be attached to the pavement marking machine in such a manner that the beads are dispensed immediately after the first drop.

8. The applicator for the wet reflective bonded core elements and glass beads shall be equipped with an automatic cut-off control that is synchronized with the cut-off of the binder material and shall be capable of delivering a uniform drop rate at required application speeds. Wet reflective bonded core elements and glass beads shall be applied such that they appear uniform on the entire traffic marking.

9. Layout pavement markings as shown on the Contract Drawings, verify the locations, alignments and radii of all existing pavement markings prior to using them as a guide. Space control points at such intervals to ensure accurate location and reproduction of all markings at the tolerances specified herein.

10. Apply markings at the locations and to the dimensions and spacing shown on the Contract Drawings. Do not apply paint until the layout and condition of the surface have been approved by the Engineer.

11. Mix paint in strict accordance with the manufacturer's instructions and apply to the pavement with a mechanical marker as follows:

    a. Standard Paint Application: Wet film thickness of 15 mils.

    b. Wet Reflective High Build Paint Application: Wet film thickness of 20 mils.

    c. Temporary markings shall be placed at one half the thickness of standard paint markings. The addition of thinner will not be

permitted.

12. Type I glass beads shall be uniformly applied to standard paint applications and wet reflective high build paint applications at the rate of six pounds of beads per gallon of paint applied. Bonded core elements shall be uniformly applied to wet reflective high build paint applications at the rate of 2.65 pounds per gallon of paint applied.

13. Allow a period of 30 days, for permanent markings, to elapse between placement of a bituminous surface course or seal coat and application of the paint. For periods less than 30 days, temporary markings shall be installed. The paint shall not bleed excessively, curl or discolor when applied to bituminous surfaces. The paint, when applied at the application rate specified herein, shall dry to no pick-up in under three minutes for a 15 mil standard paint application and under five minutes for a 20 mil wet reflective high build paint application.

14. Paint to achieve neat straight edges. The edges of the markings shall not vary from a straight line by more than 1/2 inch in 50 feet, and marking dimensions and spacings shall be within the following tolerances:

DIMENSION AND SPACING	TOLERANCE
36” or less	±1/2"
>36" - 6'	±1"
>6' - 60'	±2"
>60'	±3"

If the markings do not conform to these requirements, immediately obliterate and correct them as approved by the Engineer and at no additional cost to the Authority.

15. Distribute the glass beads on the surface of the marked areas immediately after application of the paint. Use a dispenser which is properly designed for attachment to the marking machine and suitable for dispensing glass spheres on standard paint applications and glass beads plus wet reflective bonded core elements in a double drop application for wet reflective high build paint applications.

16. Notify the Engineer upon arrival of each shipment of paint to the construction site. Designate a paint storage area. Return all emptied containers to the paint storage area for checking by the Engineer. Remove the containers from the construction site, but only after authorization by the Engineer. Maintain an accurate accounting of the paint materials used in the accepted Work.

17. Apply black paint as a 6-inch wide outline to increase contrast and visibility on concrete surfaces when shown on the Contract Drawings.

18. Glass beads and bonded core elements shall not be applied to temporary markings or black paint installations.

19. After application of the paint, protect all markings from damage until the paint is dry. Erect or place suitable warning signs, flags or barricades, protective screens or coverings, as required. Protect all surfaces from excess moisture and rain, and from disfiguration by spatter, splashes, spillage and drippings of paint.

20. Defective Workmanship or Materials: When any material not conforming to the requirements of this Section or the Contract Drawings has been delivered to the construction site but not yet installed, or has been incorporated in the Work and has been found to be of inferior quality as determined by the Engineer, such material or Work will be considered defective and shall be removed as directed by the Engineer and replaced, at no additional cost to the Authority.

END OF SECTION

SECTION 32 17 25

TRAFFIC PAINT PAVEMENT MARKINGS - STANDARD PAINT AND WET REFLECTIVE HIGH BUILD PAINT

APPENDIX "A"

PART 4 – SUBMITTALS

4.01 SUBMIT THE FOLLOWING IN ACCORDANCE WITH THE REQUIREMENTS OF "SHOP DRAWINGS, CATALOG CUTS AND SAMPLES" OF DIVISION 1 – GENERAL PROVISIONS:

A. Product Data

1. Detailed catalog cuts and manufacturer's specifications of marking materials, wet reflective bonded core elements, reflective glass spheres, primer and test data, demonstrating conformance to the requirements of this Section. Arrange for Material Safety Data Sheets (MSDS) to be part of every shipment and test sample of paint.

2. Catalog cuts and/or manufacturer's specifications for all equipment to be used

B. Samples

1. Product Data Sheet and MSDS. One quart sample of paint actually used in the work, requested by the Engineer.

C. Certificates

1. Certified Product Test Result

D. Construction and Installation Procedures

1. Schedule of operations prior to commencement of work.

2. Details and specifications of pavement marking removal and application equipment.

END OF APPENDIX "A"

END OF SECTION

SECTION – 32 31 13

CHAIN LINK FENCE AND GATES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section includes the work to furnish and install chain link fencing and bollards in the locations shown in the contract documents. The work shall include providing all the labor, materials and equipment necessary to satisfactorily install the type of fencing, gates, and bollards indicated on the plans. The work shall include all necessary clearing and grubbing, excavation and disposal, fill, concrete, gates, gate posts, locks, bracing and all other necessary materials.

1.02 RELATED SECTIONS

A. Section 02 61 00 Sampling, Testing, Handling, Loading, Removal and Disposal of Soils

B. Section 03 30 00 Cast-In-Place Concrete

C. Section 31 20 00 Earth Moving

D. Section 32 13 13 Concrete Paving

1.03 CITED STANDARDS

A. The chain link fencing shall comply with NYSDOT Standard Specification Section 607 and Standard Sheets 607-04 and 607-06. In addition to meeting NYSDOT requirements, all post sections shall be set in concrete or attached to the top of retaining walls as detailed in the plans.

1.04 NOTED RESTRICTIONS

A. Grounding shall be in conformance with Subsection 9 of National Electric Safety Code.

1.05 QUALITY CONTROL

A. (None listed)

1.06 SUBMITTALS

A. Submit shop drawings and catalog cuts for approval. The documents shall show plans, elevations, details for construction of bollards, fencing, gates, posts, rails, frames, post tops, tension wires, bands and bars, bracing ties, clips, gauges, post base attachment to retaining walls, spacing and all other components.

B. Product data and certification of materials.

C. Samples: Mesh panel (6" x 6").

D. Warranty certificate.

1.07 DELIVERABLES

A. (None listed)

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PART 2 – PRODUCTS

2.01 CHAIN LINK FENCE AND GATES

A. Fencing shall be eight feet (6') high galvanized steel chain link fence with top rail. Fence height shall be lower if mounted on top of retaining wall parapet; top of fence shall be 6' above finished grade in all cases.

B. Gates shall be of the type and at the location as shown on the plans. Swing gates shall comply with NYSDOT details. Sliding gates shall be of similar quality.

C. The fencing shall comply with NYSDOT Standard Specification Section 607 and Standard Sheets, including:

1. Vinyl Coated Steel Fence Fabric

    a. Comply with 710-03

    b. Mesh size shall be two (2) inch and 9 gage (0.148").

    c. Color: Black

2. Plastic Coated Steel and Iron Posts, Rails, Braces and Fittings for Chain-Link Fence

    a. Comply with NYSDOT Section 710-12

    b. Posts shall be Schedule 40 Steel Pipe

    c. Color: Black

3. Accessories shall be steel.

2.02 BOLLARDS

A. Bollards shall be 3" diameter, galvanized schedule 80 steel pipe.

B. All bollards shall be covered with a ¼" nominal thickness, low-density, polyethylene thermoplastic (LDPE) bollard cover with the color to be selected by Owner.

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PART 3 – EXECUTION

3.01 PREPARATION

A. Submit shop drawings and catalog cuts.

B. Verify areas to receive fencing are completed to final grades and elevations. Ensure property lines and legal boundaries of work are clearly established.

C. Stake out gate locations for approval by the Engineer. Document in writing what type of gate will be used at each location, and review installation details with Engineer. Coordinate with Engineer as to which way gates will swing/slide and how posts will be installed in relation to proposed curbing. Do not fabricate gates until Engineer approves gate layouts.

3.02 CHAIN LINK FENCE INSTALLATION

A. After approvals, furnish products and stockpile in a safe location to avoid damage. Damaged materials shall not be used.

B. The Contractor shall perform such clearing and grubbing as may be necessary to construct the fence to the required grade and alignment. At locations where breaks in a run of fencing are required, or at intersections with existing fences, appropriate adjustment in post spacing shall be made to conform to the requirements for the type of closure indicated.

C. When the plans require that the posts, braces, or anchors be embedded in concrete, the Contractor shall install temporary guys or braces as may be required to hold the posts in proper position until such time as the concrete has set sufficiently to hold the posts. Unless otherwise permitted, no materials shall be installed on posts or strain placed on guys and bracing set in concrete until seven days have elapsed from the time of placing the concrete.

D. All posts shall be set vertically and to the required grade and alignment. Cutting of the tops of the posts will be allowed only with the approval of the Engineer and under the Engineer's specified conditions.

E. Wire or fencing of the size and type required shall be firmly attached to the posts and braces in the manner indicated. All wire shall be stretched taut and be installed to the required elevations.

F. Fence shall generally follow the contour of the ground, with the bottom of fence fabric no less than 1 inch or more than 6 inches from the ground surface. Grading shall be performed where necessary to provide a neat appearance.

G. Line posts shall be spaced equidistant in the fence line at the spacing shown on the plans, NYSDOT Standard Sheets or as directed by the Engineer. End, corner, and intermediate posts shall be placed at the locations indicated on the plans, NYSDOT Standard Sheets or as directed by the Engineer, and shall be braced as shown on the plans or NYSDOT Standard Sheets. When chain link fence is on a long curve intermediate posts shall be evenly spaced so that the strain of the fence

will not bend the line posts. All end, corner, and intermediate posts shall be set plumb in concrete bases of the depth and diameter shown on the plans or NYSDOT Standard Sheets. The Contractor shall have the option of setting the line posts in concrete bases or using methods of driving and anchoring specified by the fence manufacturer and approved by the Engineer. The concrete bases shall be rough cast in the ground around the posts. The top surfaces shall be domed to shed water and provide a neat workmanlike appearance when completed. Extensions of up 45 minutes for the allowed time for placing the concrete will be permitted.

H. Posts shall be set so they are equidistant with a maximum of 10-foot centers. All top rails shall pass through the base of the post caps and shall form a continuous brace from end to end of each stretch of fence. Top rail lengths shall be joined with sleeve couplings with expansion sleeves provided at 100-foot intervals. Top rails shall be securely fastened to end posts by means of approved rail end connectors. Horizontal braces shall be provided at all intermediate posts, midway between the top rail and ground as shown on the plans or NYSDOT Standard Sheets.

I. Diagonal truss rods shall be installed with the horizontal braces as indicated on the plans or NYSDOT Standard Sheets.

J. Fence fabric shall be installed approximately 2-inch above the ground level and securely fastened along the bottom, and to all braces, top rails, line and pull posts, at the intervals indicated on the NYSDOT Standard Sheets by approved methods. The fabric shall be secured to all end, corner and gate posts with stretcher bars fastened to the posts, with stretcher bands spaced at a maximum of 14 inches and in a manner permitting adjustment of the fabric tension.

K. If the Contractor elects the option of using one piece roll-formed sections, the fence fabric shall be integrally woven into the fabric loops on the end, corner, pull and gate posts. The fabric shall be attached to the top braces and line posts as shown on the NYSDOT Standard Sheets.

L. Install fencing in accordance with NYSDOT Standard Specification Section 607-3 and grounding in accordance with both Subsection 9 of the National Electric Safety Code and the criteria below.

1. Install continuous ground bus bonding each post together. Attach a No. 2 AWG bare stranded copper conductor by exothermically welding to the ground rods and extend underground in the immediate vicinity of the fence post. Secure the grounding conductor to the post with 5/16” self-tapping stainless steel bolt.

2. Space 10’ long, ¾” ground rods, 12” below surface, at 150’ maximum distance.

3. Gates, breaks and openings shall be bonded together and shall have a ground rod installed.

4. Fences shall have a break in continuity every 500'.

5. After grounding connections have been completed, perform a ground resistance test in the presence of the Engineer. The ground resistance shall not exceed 25 OHMS under normal dry conditions. Where resistance requirements cannot be attained, install additional rods no closer than 6' on center. Install no more than two additional rods at each location.

M. Regrade area as necessary to provide a neat appearance

3.03 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary. Install operators on each gate in accordance with manufacturer's recommendations.

3.04 BOLLARD INSTALLATION

A. After approvals, furnish products and stockpile in a safe location to avoid damage. Damaged materials shall not be used.

B. Bollards shall be set in concrete foundations to the lines and grades as shown on the plans and details. Hole shall be excavated with earth auger post hole digger or other approved means. All voids shall be filled concrete.

C. All bollards shall be covered with LDPE bollard cover.

D. Once set, all bollards shall be filled with concrete from top to bottom and slightly mounded over top.

3.05 VINYL AND PLASTIC COATING

A. If any of the resin clad material specified under this item has the protective resin coating damaged so its effectiveness to prevent corrosion of the base material is impaired, the Contractor shall repair such parts by applying one coat of an approved compound of a color to match original material.

END OF SECTION

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SECTION – 32 91 13

SOIL PREPARATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Planting soils specified according to performance requirements of the mixes.

1.02 REFERENCED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Requirements, apply to this Section.

B. Section 31 10 00 "Site Clearing" for topsoil stripping and stockpiling.

C. Section 32 92 00 "Turf and Grasses" for placing planting soil for turf and grasses.

D. Section 32 93 00 "Plants" for placing planting soil for plants.

1.03 DEFINITIONS

A. AAPFCO: Association of American Plant Food Control Officials.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

C. CEC: Cation exchange capacity.

D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

F. Imported Soil: Soil that is transported to Project site for use.

G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

M. SSSA: Soil Science Society of America.

N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete,

or the top surface of a fill or backfill before planting soil is placed.

O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

Q. USCC: U.S. Composting Council.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.05 QUALITY CONTROL

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1. Laboratories: Subject to compliance with requirements, provide testing by one of the following:

a. Physical and Chemical Testing of Soils or Compost: University of Massachusetts West Experiment Station, Amherst MA, 01003, phone 413-545-2311, fax 413-545-1931.

b. Physical Testing of Soils: 3rd Rock LLC, 580 Olean Road, East Aurora, NY, 14052, phone 716-655-4933, fax 716-655-8638.

c. Physical Testing of Soils: Certified Testing Labs, 754 East Fairview Street, Bethlehem, PA 18018, phone 610-865-2674, fax 610-974-9215.

d. Physical Testing of Soils: MT Group, Mid Atlantic Regional Office, 403 County Toad, Unit 1, Cliffwood, NJ 07721, phone 732-725-6177, fax 732-725-6180.

e. Compost Testing: Woods End Research Laboratory, PO Box 297, Mt. Vernon, Maine 04352 (207) 293 2457 – phone; (207) 293 2488.

f. Compost/Biological Testing: Soil Foodweb New York 1645 Washington Avenue, Bohemia, NY 11716, tel.: 631-750-1553, fax 631-750-1554

1.06 ACTION SUBMITTALS

A. Product Data: For each type of Product.

1. Include recommendations for application and use.

2. Include test data substantiating that products comply with requirements.

3. Include sieve analyses for aggregate materials.

4. Material Certificates: For each type of imported soil, soil amendment and fertilizer before delivery to the site, according to the following:

a. Manufacturer's qualified testing agency's certified analysis of standard products.

b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.

c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Samples: For each bulk-supplied material, 1-quart volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

C. Field quality-control reports.

1.08 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil and imported soil.

1. Notify Landscape Architect seven days in advance of the dates and times when laboratory samples will be taken.

B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.09 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by Owner's representative under the direction of the testing agency.

1. Number and Location of Samples: Minimum of eight representative soil samples from varied locations for each soil to be used or amended for landscaping purposes.

2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."

3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.

4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.10 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

   a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.

   b. Hydrometer Method: Report percentages of sand, silt, and clay.

2. Bulk Density: Analysis according to core method and clod method of SSSA's "Methods of Soil Analysis – Part 1-Physical and Mineralogical Methods."

3. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis – Part 1-Physical and Mineralogical Methods."

4. Water Retention: According to SSSA's "Methods of Soil Analysis – Part 1-Physical and Mineralogical Methods."

5. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis – Part 1-Physical and Mineralogical Methods"; at 85 percent compaction according to ASTM D698 (Standard Proctor).

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis – Part 3- Chemical Methods."

2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis – Part 1-Physical and Mineralogical Methods."

3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.

4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil fertility analysis according to standard laboratory protocol of SSSA NAPT NEC-67, including the following:

1. Percentage of organic matter.

2. CEC, calcium percent of CEC, and magnesium percent of CEC.

3. Soil reaction (acidity/alkalinity pH value).

4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm and sodium absorption ratio.
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis – Part 3-Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with

appropriate certificates.

PART 2 – PRODUCTS

2.01 PLANTING SOILS SPECIFIED ACCORDING TO PERFORMANCE REQUIREMENTS

A. Planting-Soil: Imported, naturally formed soil from off-site sources and consisting of loamy sand soil according to USDA textures; and modified to produce viable planting soil. Amend imported soil with materials specified in other articles of this Section to become planting soil complying with the following requirements:

1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from agricultural land, bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass.

2. Additional Properties of Imported Soil before Amending: Minimum of 3 to 8 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration. Clean soil to be of the following:

   a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

   b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 8 percent by dry weight of the imported soil.

   c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches in any dimension.

3. Soil texture: USDA loam, sandy clay loam or sandy loam with clay content between 15% and 25%. And a combined clay/silt content of no more than 55%.

4. pH value shall be between 5.5 and 7.0.

5. Percent organic matter (OM): 2.0-5.0%, by dry weight.

6. Soluble salt level: Less than 2 mmho/cm.

7. Soil chemistry suitable for growing the plants specified.

8. Saturated hydraulic conductivity: Not less than 2 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 86% Standard Proctor, ASTM 698.

9. Imported Topsoil shall be a harvested soil from fields or development sites. The organic content and particle size distribution shall be the result of natural soil formation. Manufactured soils where Coarse Sand, Composted organic material or chemical additives has been added to the soil to meet the requirements of this specification section shall not be acceptable. Retained soil peds shall be the same color on the inside as is visible on the outside.

10. Imported Topsoil for Planting Soil shall NOT have been screened and shall retain soil peds or clods larger than 2 inches in diameter throughout the stockpile after harvesting.

2.02 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through a No. 60 (0.25-mm) sieve.

2. Form: Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through a No. 40 (0.425-mm) sieve.

C. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C33.

2.03 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:

1. pH: 5.5 – 8.0.

2. Soil salt (electrical conductivity): maximum 5 dS/m (mmhos/cm).

3. Moisture content %, wet weight basis: 30 – 60.

4. Particle size, dry weight basis: 98% pass through 3/4 inch screen or smear.

5. Stability carbon dioxide evolution rate: mg CO2-C/ g OM/ day < 2.

6. Solvita maturity test: > 6.

7. Physical contaminants (inerts), %, dry weight basis: <1%.

8. Chemical contaminants, mg/kg (ppm): meet or exceed US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels.

9. Biological contaminants select pathogens fecal coliform bacteria, or salmonella, meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) level requirements.

2.04 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

PART 3 – EXECUTION

3.01 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections and as shown on Contract Drawings.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.02 PLACING MANUFACTURED PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply manufactured soil on-site in its final, blended condition. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 6 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply approximately half the thickness of planting soil over prepared, loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.

C. Application: Spread planting soil to total depth indicated on Drawings, but not less than required to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Lifts: Apply planting soil in lifts not exceeding 12 inches in loose depth for material compacted by compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests:

1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D698. Space tests at no less than one for each 1000 sq. ft. of in-place soil or part thereof.

2. Performance Testing: For each amended planting-soil type, demonstrating

compliance with specified performance requirements. Perform testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

C. Soil will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.04 PROTECTION

A. Heading Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Vehicle traffic.
4. Foot traffic.
5. Erection of sheds or structures.
6. Impoundment of water.
7. Excavation or other digging unless otherwise indicated.

B. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

3.05 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner’s property unless otherwise indicated.

1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION

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SECTION – 32 92 00

TURF AND GRASSES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Turf, grasses, and wildflowers.

B. Erosion-Control material(s).

1.02 REFERENCED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Requirements, apply to this Section.

B. Section 31 10 00 "Site Clearing" for topsoil stripping and stockpiling.

C. Section 31 20 00 "Earth Moving" for excavation, filling and backfilling, and rough grading.

D. Section 32 91 13 "Soil Preparation" for soils.

E. Section 32 93 00 "Plants" for planting vegetation.

1.03 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.05 QUALITY CONTROL

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful meadow establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.

2. Experience: Five years' experience in meadow installation.

3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

4. Pesticide Applicator: State licensed, commercial.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of Product.

1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

1.07 INFORMATIONAL SUBMITTALS

A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

B. Qualification Data: For qualified landscape Installer.

C. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of meadows during a calendar year. Submit before expiration of required initial maintenance periods.

1.08 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Spring Planting: April 15 to May 30.

2. Fall Planting: September 1 to October 15.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.09 MAINTENANCE SERVICE

A. Initial Meadow Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable meadow is established, but for not less than 6 weeks from date of planting

completion.

B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

PART 2 – PRODUCTS

2.01 GRASS SEED

A. Wildflower and Native Grass Seed: Fresh, clean, and dry new seed, complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances, of mixed species as follows:

1. See planting schedule in construction drawings.

a. Seed mix ERNMX-140 shall be by Ernst Conservation Seed, 814-336-5191, 8884 Mercer Pike, Meadville, PA 16335, www.ernstseed.com; or approved equal.

B. Seed Carrier: Inert material, sharp clean sand or perlite, mixed with seed at a ratio of not less than two parts seed carrier to one part seed.

2.02 MULCHES

A. Straw Mulch to be applied only on Metro-North Railroad property: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

2.03 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling

the germination or growth of weeds within planted areas at the uppermost soil level.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.04 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.03 PREPARATION FOR EROSION-CONTROL MATERIALS

A. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

B. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

C. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.04 GRASS SEED

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at a total rate per seed supplier's recommendation.

C. Brush seed into top 1/16 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas from hot, dry weather or drying winds by applying cover crop within 24 hours after completing seeding operations.

E. Water newly planted areas and keep moist until planting is established.

3.05 GRASS SEED MAINTENANCE

A. Maintain and establish seeded areas by watering, weeding, mowing, trimming, replanting, and performing other operations as required to establish a healthy, viable meadow. Roll, regrade, and replant bare or eroded areas. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and grass seed damaged or lost in areas of subsidence.

   In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.

2. Apply treatments as required to keep grass seed and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and grass seed-watering equipment to convey water from sources and to keep grass seed uniformly moist.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2. Water seeded areas with fine spray at a minimum rate of 1/2 inch per week for six weeks after planting unless rainfall precipitation is adequate.

3.06 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.07 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by seeding work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION

SECTION – 32 93 00

PLANTS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Vegetation plantings

B. Planting soil

1.02 REFERENCED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Requirements, apply to this Section.

B. Section 31 10 00 "Site Clearing" for topsoil stripping and stockpiling.

C. Section 31 20 00 "Earth Moving" for excavation, filling and backfilling, and rough grading.

D. Section 32 92 00 "Turf and Grasses" for placing planting soil for turf and grasses.

E. Section 32 91 13 "Soil Preparation" for soils.

F. New York Standards and Specifications for Erosion and Sediment Control, August 2005.

1.03 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

F. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

G. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume

required by ANSI Z60.1 for type and size of plant.

H. Finish Grade: Elevation of finished surface of planting soil.

I. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

J. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

K. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

L. Planting Area: Areas to be planted.

M. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

N. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

O. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

P. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

Q. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

R. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

S. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.05 QUALITY CONTROL

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.

2. Experience: Five years' experience in landscape installation.

3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

4. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect retains right to observe plants further for size and condition root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected plants immediately from Project site.

1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, including soils.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.

3. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to the Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of ten photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.

2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists,

where applicable.

C. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

D. Warranty: Sample of special warranty.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Deciduous Trees and Shrubs:
    a. Spring Planting: March 1 to May 1
    b. Fall Planting: October 15 to December 15
2. Evergreen Trees and Shrubs:
    a. Spring Planting: April 1 to May 15
    b. Fall Planting: September 1 to October 15
3. Groundcovers, Vines, Perennials and Grasses:
    a. Spring Planting: April 15 to May 30
    b. Fall Planting: September 1 to October 15

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.09 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
    b. Structural failures including plantings falling or blowing over.
    c. Faulty performance of live stakes
2. Warranty Periods from Date of Planting Completion:
    a. Trees, Shrubs, Perennials, Vines, groundcover, and Ornamental Grasses: 12 months.
    b. Ground Covers, Biennials, Perennials, Live Stakes, and Other

Plants: 12 months.

3. Include the following remedial actions as a minimum:

   a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.

   b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.

   c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.

   d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.10 MAINTENANCE SERVICE

A. Initial Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

   1. Maintenance Period: Six months from date of planting completion.

B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Bulk Materials:

   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

   3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

C. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

D. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

E. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

PART 2 – PRODUCTS

2.01 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to the Landscape Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

E. Select stock for uniform height and spread, and number the labels to assure symmetry in planting.

F. Container Plants: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

2.02 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Double shredded hardwood mulch
2. Size Range: 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum.
3. Color: Natural.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch (25-mm) sieve; soluble-salt content of [2 to 5] dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 70 percent of dry weight.

2.02 FERTILIZERS

A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake

locations, outline areas, adjust locations when requested, and obtain Engineer's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Landscape Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

E. Apply antidesiccant to trees and shrubs applied only on Metro-North Railroad property using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

3.03 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Section 32 91 13 "Soil Preparation."

B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade or blend planting soil in place.

C. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

D. Application of Mycorrhizal Fungi: At time directed by Landscape Architect, broadcast dry product uniformly over prepared soil at application rate as recommended by soil analysis provided by testing laboratory.

3.04 EXCAVATION FOR TREES AND SHURBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

2. Excavate approximately three times as wide as ball diameter for balled and burlapped and container-grown stock.

3. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.

4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.

5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.

6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other

new or existing improvements.

7. Maintain supervision of excavations during working hours.

8. Keep excavations covered or otherwise protected overnight.

B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.05 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.

2. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

3. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Carefully remove root ball from container without damaging root ball or plant.

2. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

3. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Bare-Root Stock: Set and support each plant in center of planting pit with root flare

flush with adjacent finish grade.

1. Backfill: Planting soil.
2. Spread roots without tangling or turning toward surface. Plumb before backfilling, and maintain plumb while working.
3. Carefully work backfill in layers around roots by hand. Bring roots into close contact with the soil.
4. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

F. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.06 TREE, SHRUB, AND VINE PRUNING

A. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

B. Do not apply pruning paint to wounds.

3.07 GROUNDCOVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.08 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated only on Metro-North Railroad property.

1. Organic Mulch in Planting Areas: Apply average thickness of organic mulch over whole surface of planting area as indicated on contract plans, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.09 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.

2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.

3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.

B. Remove and replace trees that are more than 5 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size as those being replaced for each tree of 4 inches or smaller in caliper size.

2. Provide one new tree(s) of 4-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.

3. Species of Replacement Trees: Same species being replaced.

3.10 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.12 MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep plants free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated past management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.13 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION

SECTION – 33 11 13

NON-POTABLE WATER SUPPLY WELLS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Water well screens.
2. Pack materials.
3. Submersible well pump.

1.03 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. PA: Polyamide (nylon) plastic.

C. PE: Polyethylene plastic.

D. PP: Polypropylene plastic.

1.04 ACTION SUBMITTALS

A. Product Data: Submit certified performance curve and rated capacity of selected well pump and furnished specialties and accessories.

B. Shop Drawings: For well pump. Show layout and connections.

1. Include diagrams for power, signal, and control wiring.
2. Setting Drawings: Include templates and directions for installing foundation bolts, anchor bolts, and other anchorages.

1.05 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports:

1. For well pump, include the following:
   a. Existing Water levels.
   b. Laboratory water analysis.
   c. Well-screen analysis.
   d. Performance test data.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Include in emergency, operation, and maintenance manuals.

PART 2 – PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with AWWA A100 for water supply wells.

C. Pitless Adapter: Fitting, of shape required to fit onto casing, with waterproof seals.

2.02 GROUT

A. Cement: ASTM C150/C150M, Type II.

B. Aggregates: ASTM C33/C33M, fine and coarse grades.

C. Water: Non-potable.

2.03 WATER WELL SCREENS

A. Screen Material: Fabricated of ASTM A666, Type 304 stainless steel tube; with slotted or perforated surface and designed for well-screen applications.

1. Screen Couplings: Butt-type, stainless-steel coupling rings.

2. Screen Fittings: Screen, with necessary fittings, closes bottom and makes tight seal between top of screen and well casing.

3. Maximum Entering Velocity: 0.1 fps.

2.04 PACK MATERIALS

A. Coarse, uniformly graded filter sand, maximum 1/8 inch in diameter.

B. Fine gravel, maximum 1/4 inch in diameter.

C. Pump Accessories:

1. Compression Tanks: Precharged butyl rubber diaphragm, steel shell, fused polymeric lining, and 100-psig (690-kPa) working pressure.

2. Pressure Switches: For pump control; for installation in piping.

3. Water Piping: ASTM A53/A53M, Schedule 40, galvanized-steel pipe with threaded ends.

a. Cast-Iron Fittings: ASME B16.4, threaded, galvanized.

4. Water Piping: ASTM D2239, SIDR Numbers 5.3, 7, or 9 PE pipe; made with PE compound number required to give pressure rating not less than 160 psig.

2.05 SUBMERSIBLE WELL PUMPS

A. Description: Submersible, vertical-turbine well pump.

B. Standards: HI 2.1-2.2 and HI 2.3.

C. Impeller Material: Stainless steel.

D. Motor: Capable of continuous operation under water, with protected submersible power cable.

E. Column Pipe: ASTM A53/A53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel threaded couplings.

F. Discharge Piping: ASTM D2239, SIDR Numbers 5.3, 7, or 9 PE pipe; made with

PE compound number required to give pressure rating not less than 160 psig.

1. Insert Fittings for PE Pipe: ASTM D2609, made of PA, PP, or PVC with serrated, male insert ends matching inside of pipe. Include bands or crimp rings.

G. Capacities and Characteristics:

1. Refer to drawings for Pump Schedule

2.06 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 22 05 13 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in electrical Sections.

PART 3 – EXECUTION

A. Install submersible well pumps according to HI 2.4 and provide access for periodic maintenance.

1. Before lowering permanent pump into well, lower a dummy pump that is slightly longer and wider than permanent pump to determine that permanent pump can be installed. Correct alignment problems.

2. Before lowering permanent pump into well, start pump to verify correct rotation.

3. Securely tighten discharge piping joints.

4. Locate line-shaft well pump near well bottom; locate motor above grade. Install driver plate to correctly align motor and pump.

5. Connect motor to submersible pump and locate near well bottom.

a. Connect power cable while connection points are dry and undamaged.

b. Do not damage power cable during installation; use cable clamps that do not have sharp edges.

c. Install water-sealed surface plate that will support pump and piping.

3.02 CONNECTIONS

A. Piping installation requirements are specified in Section 22 11 13 "Facility Water Distribution Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

1. Connect piping between well pump and water piping.

B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 26 05 19 "Low Voltage Electrical Power

Conductors and Cables."

3.03 WELL ABANDONMENT

A. Follow well-abandonment procedures of authorities having jurisdiction. Restore ground surface to finished grade.

3.04 FIELD QUALITY CONTROL

A. Test Preparation: Clean water supply wells of foreign substances. Swab casings using alkalis, if necessary, to remove foreign substances.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Plumbness and Alignment Testing: Comply with AWWA A100.

2. Furnish samples of water-bearing formation to testing laboratory and well-screen manufacturer for mechanical sieve analysis.

3. Prepare reports on static level of ground water, level of water for various pumping rates, and depth to water-bearing strata.

4. Performance Test Preparation: Start well pump and adjust controls and pressure setting. Replace damaged and malfunctioning controls and equipment.

5. Performance Testing: Conduct final pumping tests after wells have been constructed, cleaned, and tested for plumbness and alignment.

a. Arrange to conduct tests, with seven days' advance notice, after test pump and auxiliary equipment have been installed. Note water-level elevations referred to for each assigned datum in wells.

b. Provide discharge piping to conduct water to locations where disposal will not create a nuisance or endanger adjacent property. Comply with requirements of authorities having jurisdiction.

c. Provide and maintain equipment of adequate size and type for measuring flow of water, such as weir box, orifice, or water meter.

d. Measure elevation to water level in wells.

e. Perform two bailer or air-ejection tests to determine expected yield. Test at depths with sufficient quantity of water to satisfy desired yields.

f. Test Pump: Variable capacity test pump with capacity equal to maximum expected yields at pressure equal to drawdown in wells, plus losses in pump columns and discharge pipes.

g. Start and adjust test pumps and equipment to required pumping rates.

h. Record readings of water levels in wells and pumping rates at 30 minute maximum intervals throughout 24-hour minimum period.

i. Record maximum yields when drawdown is 60 inches above top of suction screens after designated times.

j. Record returning water levels in wells and plot curves of well recovery rates.

k. Remove sand, stones, and other foreign materials that may become deposited in wells after completing final tests.

E. Water supply well will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Water Analysis Testing:

1. Engage a qualified testing agency to make bacteriological, physical, and chemical analyses of water from well and report the results. Make analyses according to requirements of authorities having jurisdiction.

2. Analyze water sample from each finished well for bacteriological, physical, and chemical quality and report the results. Make analyses according to requirements of authorities having jurisdiction.

3.05 CLEANING

A. Disinfect water supply wells according to AWWA A100 and AWWA C654 before testing well pumps.

B. Follow water supply well disinfection procedures required by authorities having jurisdiction before testing well pumps.

3.06 PROTECTION

A. Water Quality Protection: Prevent well contamination, including undesirable physical and chemical characteristics.

B. Ensure that mud pit will not leak or overflow into streams or wetlands. When well is accepted, remove mud and solids in mud pit from Project site and restore site to finished grade.

C. Provide casings, seals, sterilizing agents, and other materials to eliminate contamination; shut off contaminated water.

D. Exercise care to prevent breakdown or collapse of strata overlaying that from which water is to be drawn.

E. Protect water supply wells to prevent tampering and introducing foreign matter. Retain temporary well cap until installation is complete.

END OF SECTION

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SECTION – 33 40 00

STORM DRAINAGE UTILITIES

PART 1 – GENERAL

1.01 SECTION INCLUDES:

A. This section includes the fabricating, furnishing, installing and constructing drainage structures, manufactured treatment devices, high-density polyethylene (HDPE) drainage pipe, reinforced concrete pipe (RCP), and all necessary and required ancillary items in conformance with this section and NYSDOT Standard Sheets and Specifications.

1.02 STANDARDS AND REGULATIONS

A. New York State Department Of Transportation (NYSDOT) Standard Specification:

1. Section 201 Clearing and Grubbing.
2. Section 203 Excavation and Embankment.
3. Section 206 Trench, Culvert and Structure Excavation.
4. Section 603 Culverts and Storm Drains.
5. Section 604 Drainage Structures.
6. Section 621 Cleaning Culverts, Drainage Structures and Existing Roadside Sections.
7. Section 623 Screened Gravel, Crushed Gravel, Crushed Stone, Crushed Slag.
8. Section 655 Frames, Grates and Covers.

B. New York State Department Of Transportation (NYSDOT) Standard Detail:

1. Sheets M203-5 Installation Details For Corrugated and Structural Plate Pipe And Pipe Arches.
2. Sheet 604-2 Drainage Structure Details.
3. Sheet 655-01 Rectangular Grates.
4. Sheet 655-02 Parallel Bar Frames and Grates.
5. Sheet 655-03 Cast Manhole Frames, Grates and Covers.
6. Sheet 655-04 Reticuline Grates.
7. Sheet 655-05 Cast Frames and Curb Boxes and Welded Frames.
8. Sheet 655-06 Proof Loaded Cast Steel or Iron Manhole Frames, Grates and Covers.
9. Sheet 655-07 Welded Frames and proof Loaded Cast Steel or Iron Frames and Curb Boxes.
10. Sheet 655-08 Telescoping manhole Casting and Ring.

C. American Society for Testing and Materials (ASTM)

1. ASTM F2306 Standard Specification for 12 in. to 60 in. [300 to 1500mm]

Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.

2. ASTM F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

3. ASTM F405 Standard Specification for Corrugated Polyethylene (PE) Pipe and Fittings.

4. ASTM F667 Standard Specifications for Large Diameter Corrugated Polyethylene Pipe and Fittings.

5. ASTM D3212 Standard Specifications for Joints for Drains and Sewers Plastic Pipes Using Flexible Elastomeric Seals.

6. ASTM F2510 Resilient Connectors between Reinforced Concrete Manhole Structures and Corrugated High Density Polyethylene Drainage Pipes.

7. ASTM F2487 Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene Pipelines.

8. ASTM F1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

1.03 RELATED SECTIONS

A. Division 01 Specification Sections

B. Section 32 13 13 – Concrete Paving

1.04 RESTRICTIONS AND QUALITY CONTROL

A. Provide protection during installation in accordance with Title 29 Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction (OSHA).

B. The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection by the Engineer. Such inspection may be made at the place of manufacture, or on the work site after delivery, or at both places, and the sections shall be subject to rejection at any time if material conditions fail to meet any of the specification requirements, even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the site shall be marked for identification and shall be removed from the site at once. All sections, which have been damaged beyond repair during delivery, will be rejected and, if already installed, shall be repaired to the Engineer's acceptance level, if permitted, or removed and replaced, entirely at the Contractor's expense.

C. All sections shall be inspected for general appearance, dimensions, soundness, etc. The surface shall be dense, close textured and free of blisters, cracks, roughness and exposure of reinforcement.

D. Imperfections may be repaired, subject to the acceptance of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final acceptance. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi (28 MPa) at the end of 7 days and 5,000 psi (34 MPa) at the end of 28 days when tested in 3-inch (76 mm) diameter by 6-inch (152 mm) long cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs.

1.05 SUBMITTALS

A. All submittals are to be in accordance with the requirements of Section 01 33 00 – Submittal Procedures.

B. Drainage Structures

1. The Contractor shall submit shop drawings for manholes, catch basins, manufactured treatment devices, frames, covers, grates, and headwalls. The shop drawings shall show dimensions, reinforcement, typical pipe openings, frame attachment details, slab details, etc.

2. The manufacturer shall certify that the design complies with NYSDOT requirements.

3. The shop drawing shall cover all structure sizes that will be used on the project.

C. Drill Sheets

1. The Contractor shall submit Drill Sheets for each drainage structure based on the approved shop drawings. The Drill Sheets shall show elevations for top of frame, top of slab, bottom of slab and all inverts. The Drill Sheets shall show structure dimensions, pipe nominal diameters and pipe wall opening sizes.

2. Pipe opening locations shall comply with NYSDOT requirements and be clearly labeled on the Drill Sheets. Pipe opening sizes shall comply with the manufacturer of the pipe-to-manhole watertight connectors.

3. The size of the drainage structure shall be sized accordingly to accommodate the proposed pipes. Drainage structures that are too small for the proposed pipes will not be approved.

D. Catalog Cuts

1. Prior to deliveries, the Contractor shall submit six (6) copies of catalog cuts, certifications and shop drawings of the following items to the Engineer for approval:

a. Drainage Pipe and Fittings

b. Crushed Stone Bedding

c. Pipe to Structure Connectors

d. Manufacturer's product data clearly marked to indicate item type and size.

e. Manufacturer's recommended installation procedure for installing pipes and manufactured treatment devices.

PART 2 – PRODUCTS

2.01 MANHOLES, CATCH BASINS, FRAMES, COVERS AND GRATES

A. NYSDOT Standard Specification Material Requirements:

1. Section 604 Drainage Structures

2. Section 655 Frames and Grates

3. Section 701-04 Concrete Repair Material
4. Section 701-05 Concrete Grouting Material
5. Section 704-02 Concrete Brick
6. Section 704-13 Precast Concrete Driveway and Sidewalk Pavers
7. Section 705-07 Premolded Resilient Joint Filler
8. Section 705-21 Mortar for Concrete Masonry
9. Section 706-02 Reinforced Concrete Pipe Classes II, III, IV, V
10. Section 706-04 Precast Concrete Drainage Units
11. Section 709-01 Bar Reinforcement, Grade 420
12. Section 709-02 Wire Fabric for Concrete Reinforcement
13. Section 709-09 Cold Drawn Wire for Concrete Reinforcement
14. Section 725-02 Steps for Manholes

B. American Society for Testing and Materials (ASTM)

1. ASTM C55, Grade S-1 Concrete Brick
2. ASTM C139 Concrete Block

C. Drainage structures shall have a 1' sump (below the lowest invert elevation).

D. All frames and covers shall accommodate HS-20 loading.

E. Bedding material shall be installed under all drainage structures and consist of a minimum of 12" of compacted crushed stone (NYSDOT No. 2). Bedding shall extend 18" horizontally beyond structure.

F. Nyloplast Drains as manufactured by ADS-Pipe or Engineer's approved equal shall be used where indicated on the plans due to site constraints and limited space. Nyloplast drains shall have a grate size as indicated on the plans.

G. Casting for Cleanouts: Catalog No. R-7506, Neenah Foundry Company, Neenah Wisconsin, or Engineer's approved equal. Lid cast with the designation "Clean Out". Diameter of frame adequate to fit over outer diameter size of sewer pipe.

2.02 DRAINAGE PIPE

A. RCP Drainage Pipe shall meet the requirements of standard NYSDOT Reinforced Concrete Pipe Class III, and meet the requirements set forth in the NYSDOT Standard Specification Section 603 and 706 for Reinforced Concrete Pipe Class III.

B. HDPE Drainage Pipe and Fittings shall be N-12 WT IB pipe as manufactured by Advanced Drainage Systems, Inc. or Engineer's approved equal and shall comply with the requirements of ASTM F 2306. Approved equals shall be selected from the NYSDOT Materials Bureau Approved List for Smooth Interior Corrugated Polyethylene Pipe (706-12).

C. Joint Performance: Pipe shall be joined with the N-12 WT IB joint meeting the requirements of ASTM F2306. Gaskets shall be oil resistant nitrile. Pipe shall be watertight according to the requirements of ASTM D3212. Nitrile gaskets shall be installed by the pipe manufacturer and covered with a removable wrap to

ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and the bell during assembly

2.03 STORM DRAIN ACCESS COVER

A. Access cover shall be installed in accordance with NYSDOT Standard Specification, Section 655 “Frames, Grates and Covers.”

2.04 SPECIAL COMPONENTS

A. Insert-a-Tee or Engineer’s approved equal shall be used for connecting roof leaders into trunk lines. Roof leader connections will not be field leak tested.

B. For HDPE pipes, an A-LOK watertight nitrile pipe-to-manhole connectors shall be used at drainage structures, or Engineer’s approved equal. Models shall be as follows:

1. Z-LOK STM Connector can be used for pipe diameters 36” or smaller

   a. In accordance with the manufacturer’s requirements, pipe entries shall be radial at round structures and within 15-degrees of perpendicular on rectangular structures.

2. A-LOK STM for pipe diameters 12” or larger.

   a. In accordance with the manufacturer’s requirements, pipe entries shall be radial at round structures and perpendicular on rectangular structures.

   b. Final custom-length section of HDPE pipes shall have factory-installed smooth wall cylinder at pipe ends for structure entry to facilitate A-LOK STM watertight connection as per the manufacturer’s requirements.

C. Z-806 6” wide trench drain system as manufactured by Zurn or Engineer’s approved equal shall be used where indicated on the plans.

PART 3 – EXECUTION

3.01 PREPARATION

A. Transmit submittals required by this section.

B. Furnish products as indicated.

C. Store products on site so that they are not damaged. Replace or repair any damaged structures to the satisfaction of the Engineer.

3.02 PIPE INSTALLATION

A. General – The drainage pipe system shall be installed in the locations indicated on the Drawings. Pipe shall be of the type and sizes specified and shall be laid accurately to line and grade. Work shall comply with NYSDOT Standard Specification Sections 603-3 and 604-3 and be in accordance with the manufacturer’s instructions.

B. Trench Excavation and Backfill – The requirements of Section 31 50 00 – Excavation Support and Protection shall apply to the work to be done hereunder.

C. Storage and Handling – Storage of drainage materials and appurtenances on the job shall be in accordance with the manufacturer’s recommendations. All drainage

materials shall be protected against impact, shock, and free fall, and only equipment of sufficient capacity and proper design shall be used in handling the pipe and appurtenances.

D. Damage – Drainage materials that are defective from any cause, including damage caused by handling, will be unacceptable for installation and replaced. Pipe and/or appurtenances that are damaged or disturbed through any cause prior to acceptance of the Work, shall be repaired, realigned, or replaced.

E. Pipe Installation – Each length of Pipe shall be laid with firm, full, and even bearing throughout its entire length, in a trench prepared and maintained in accordance with Drawings and Section 31 50 00 – Excavation Support and Protection of these Specifications. Pipe shall be laid upgrade.

F. Minimum Cover – All drainage pipes shall have a minimum cover as indicated on the Plans but in no case less than 24 inches unless encasement is provided. Consult pipe manufacturer for required temporary cover for construction loads. Concrete encasement shall be required for ground cover less than 24 inches.

G. Pipe Lengths – Only full lengths of pipe shall be used in the installation except that partial lengths of custom-manufactured pipe shall be used at the entrance to structures to obtain a proper connection to the drainage structure.

H. Pipe Entries – All drainage pipe entering structures shall be cut in the first accessible corrugation valley inside the interior face of the structure, and the cut ends of the pipe and surface of the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges, or imperfections that will impede the flow of water or affect the hydraulic characteristics of the installation.

I. Bedding and Backfill – The type of materials used as bedding and backfill and the method of placement shall conform to the requirements of Section 603 of the NYSDOT Specifications and the Contract Details.

J. Working Conditions – The installation shall be protected at all times during construction. At all times when pipe laying is not in progress, open ends of all pipes shall be closed with an ADS End Plug. If water is in the trench when work is resumed, the end plug shall not be removed until the trench has been pumped dry and all danger of water entering the pipe has been eliminated.

K. Clean Pipe Requirements – Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. Prior to the placing of a length of pipe, the end of the previously laid pipe shall be carefully and thoroughly wiped smooth and cleaned to obtain an even and close-fitting joint.

L. Tolerances – Allowable tolerances shall be one-half (1/2) inch on grade and one (1)-inch on line in any section of pipe between structures. The Engineer may request survey shots to confirm pipe line and grade. No adverse grades shall be allowed. See NYSDOT Section 603-3 for additional construction requirements and tolerances. Any line that has been rejected shall be rebuilt to the correct line and grade.

M. HDPE Pipe Joints – Pipes shall be watertight, oil resistant, and have bell/spigot joints with nitrile gaskets installed in compliance with the manufacturer's specifications.

N. Perforated HDPE pipe connections and Changes in Alignment – Pipe to pipe

connections and changes in pipe alignment shall be made only with prefabricated fittings supplied by the manufacturer of the pipe (e.g. tees, wye branches, etc.).

O. Upon completion of the installation and before final acceptance by the Engineer, the entire drainage system shall be subjected to survey of inverts in the presence of the Engineer.

3.03 LEAK TEST

A. Perform leakage tests on storm drain piping. Provide testing documentation to restrict requirements for leak proof construction and to avoid possible effluent violations due to groundwater infiltration.

B. Test sewer systems after backfilling has been completed and prior to placing any pavement.

C. Allowable Leakage: Leakage or infiltration for gravity sewer pipelines, encased or not encased, shall not exceed 200 gallons per inch diameter, per mile of sewer per day in accordance with ASTM F2487. No individual joint in any completed sewer under test shall leak an amount in excess of 1/8 gallon per hour per inch of inner diameter.

3.04 FINAL INSPECTION AND ACCEPTANCE

A. The Contractor shall clean the entire drainage system of all debris and obstructions. This shall include, but not be limited to, removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary fluid, hoses, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing storm drains or streams. All debris shall be removed from the system.

B. The work shall not be considered as complete until the Engineer has viewed the results of for line and grade survey, and the cleanliness and workmanship requirements have been met.

3.05 CLEANING CULVERTS AND CLOSED DRAINAGE SYSTEMS

A. No debris shall be flushed into existing storm drains or streams. All debris shall be removed from the system.

B. The work shall not be considered as complete until the Engineer has viewed the results of for line and grade survey, and the cleanliness and workmanship requirements have been met.

END OF SECTION

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SECTION – 34 71 17

TEMPORARY CONCRETE BARRIERS

PART 1 – GENERAL

1.01 SUMMARY

A. This Section specifies requirements for temporary concrete barriers.

B. Coordinate the Work of this Section with the requirements of "MAINTENANCE OF TRAFFIC AND WORK AREA PROTECTION" of DIVISION 1 – GENERAL PROVISIONS.

C. Materials and constructions of this Section constitute temporary facilities that are and shall remain the property of the Contractor unless otherwise shown on the Contract Drawings.

1.02 REFERENCES

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

American Society for Testing and Materials (ASTM)

ASTM A 36	Structural Steel
ASTM A 123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 307	Carbon Steel Externally Threaded Standard Fasteners
ASTM C 150	Portland Cement

1.03 SUBMITTALS

A. See Appendix "A" for submittal requirements.

PART 2 – PRODUCTS

2.01 CONSTRUCTION FEATURES AND MATERIALS

A. General

1. Provide new barriers and materials or, if acceptable to the Engineer, undamaged previously used barriers and materials in serviceable condition conforming to the requirements specified in this Section, and as shown on the Contract Drawings.

2. After delivery, a construction site inspection of the barriers and equipment will be made by the Engineer. If any barriers and equipment has been damaged or if, for any reason, the equipment does not comply with the requirements herein, the Contractor shall repair or replace the barriers and equipment at its own cost and expense, even though the barriers and equipment had been inspected for shipment. After such satisfactory replacement and/or repair and subsequent Engineer written approval, the barriers shall be installed.

B. Precast Concrete Barriers

1. Shall be manufactured with white portland cement concrete in accordance with the Contract Drawings which depict New York and New Jersey requirements. If the Contract Drawings are superseded by later New York or New Jersey Standards, then the most recent Standards shall be used, and the Contractor shall furnish Shop Drawing(s) in accordance with paragraph 1.03 B highlighting the change(s).
2. Concrete shall be proportioned to produce 3000 psi reinforced concrete.
3. Barrier sections less than 10 feet shall have one drainage pocket, and sections greater than 10 feet shall have two drainage pockets conforming to the size shown on the Contract Drawings, or styrofoam pads shall be provided to allow adequate drainage, as shown on the Contract Drawings.
4. Connectors, Anchors and Accessories:- Fabricated ASTM A 36 shapes, plates and bars welded into assemblies required, with ASTM A 307 steel bolts, and other fasteners as required. Finish each assembly and fastener with ASTM A 123 hot-dip zinc coating.

C. Barrier Reflectors

1. If specified on the Contract Drawings, barrier reflectors shall be 6" x 6", high intensity reflectorized, spaced at 20 feet on center with a minimum mounting height of 30 inches to the bottom of the reflectors. The reflector shall be white or yellow, matching the pavement edgeline, or as shown on the Contract Drawings.

D. Barrier Lights

1. If specified on the Contract Drawings barrier lights shall be steady burn Type C, spaced at 20 feet on center with a minimum mounting height of 30 inches to the bottom of the lens or as specified on the Contract Drawings. Type B flashing lights shall be placed on the approach end of barrier at 10 feet on center or as shown on the Contract Drawings.

E. Chain Link Fence

1. If specified in the Contract Drawings, chain link fence shall be placed on top of the temporary concrete barrier as shown on the Contract Drawings.

F. Glare/Gawk Shield

1. Install glare / gawk shield as specified by the manufacturer or as shown on the Contract Drawings.

PART 3 – EXECUTION

3.01 PREPARATION

A. Protect the installation, maintenance, relocation and removal by providing and placing temporary traffic control devices in accordance with the requirements of the specification titled "Maintenance of Traffic and Work Area Protection" in Division 1.

3.02 INSTALLATION

A. Install barriers at locations shown on the Contract Drawings.

B. Provide styrofoam pad shimming and leveling as required to ensure smooth and

continuously aligned barriers.

C. Taper ends of barriers shall be flared away from traffic at a rate of 10 to 1 or flatter. Terminate blunt approach end with an impact attenuator as approved by the Engineer in accordance with paragraph 1.03 D or as specified on the Contract Drawings.

D. Secure barriers against lateral displacement by use of drift pins or anchor bolts drilled into roadway surface or as shown on the Contract Drawings.

E. Install reflectors and lights as specified herein, and as shown on the Contract Drawings.

3.03 MAINTENANCE

A. Maintain, clean, relocate and replace barriers, reflectors and lights as required to protect motorists, pedestrians, and workers throughout the Work of this Contract.

3.04 REMOVAL

A. Remove barriers away from Authority property, when the need has ended, when replaced by approved use of permanent construction, or when directed by the Engineer.

B. Restore damaged permanent construction, and replace construction that cannot be satisfactorily repaired, all at no cost to the Authority.

END OF SECTION

SECTION 34 71 17

TEMPORARY CONCRETE BARRIERS

APPENDIX "A"

3.05 SUBMITTALS

A. Submit the following for approval by the Engineer in accordance with the requirements of Section 01 33 00 – Submittal Procedures:

1. Certification from the concrete barrier supplier stating that the concrete barrier(s) meet the requirements of the Contract Drawings.

2. Shop Drawings detailing departures from the Standard Drawings included in the Contract Documents.

3. Proposed equipment Catalog Cuts and procedures to be used for installing, maintaining, relocating and removing the barrier(s).

4. Proposed end treatment details and Catalog Cuts including but not limited to impact attenuator type.

END OF APPENDIX A

END OF SECTION

SECTION – 34 71 18

RECTANGULAR RAPID FLASHING BEACON (RRFB) ASSEMBLY

PART 1 – GENERAL

1.01 DESCRIPTION

A. This work shall consist of furnishing and installing a Rectangular Rapid Flashing Beacon (RRFB) assembly in accordance with the contract documents or as directed by the Engineer. All materials and labor required to provide a complete functioning system are to be included.

1.02 GENERAL REQUIREMENTS

A. RRFB unit shall consist of two rapidly flashed, rectangular-shaped yellow indications with an LED-array-based light source. It shall be designed, located, and operated in accordance with the detailed requirements of the contract and as specified below.

B. Each RRFB shall conform to all provisions of the MUTCD.

C. Each RRFB shall be a complete assembly consisting of supporting structure (pole, breakaway transformer base, sign, cabinet, and solar panel supports), indications, signage, cabinet, solar panel, and electrical components (wiring, solid-state circuit boards, etc.).

D. Each RRFB shall be supplied with all required hardware to install assembly.

E. Each RRFB shall be ADA compliant.

F. Each RRFB shall be rated for 90 mph wind conditions.

G. All components shall be designed to operate under ambient temperature conditions from -30 to 165 °F.

1.03 FUNCTIONAL REQUIREMENTS

A. The RRFB shall be normally dark, shall initiate operation only upon pedestrian actuation, and shall cease operation after a predetermined period of operation. The predetermined period of operation shall be based on the procedures provided in Section 4E.06 of the current MUTCD for the timing of pedestrian clearance times for pedestrian signals.

B. When actuated, all RRFB units associated with a given crosswalk shall simultaneously commence operation of their rapid-flashing indications within 120 milliseconds. All RRFB units associated with a given crosswalk shall simultaneously cease operation of their rapid-flashing indications within 120 milliseconds.

C. During activation, a small light, directed at and visible to pedestrians in the crosswalk, shall be installed integral to the RRFB to give confirmation that the RRFB is in operation. The pedestrian indication shall flash concurrently with one of the vehicle indications to give confirmation that the RRFB is in operation.

D. Upon actuation, the two or four yellow indications in each RRFB unit shall flash in a sequence of 75 cycles per minute. The left and right RRFB indications shall operate using the following sequence during each 800-millisecond cycle:

1. The RRFB indication on the left-hand side shall be illuminated for approximately 50 milliseconds.
2. Both RRFB indications shall be dark for approximately 50 milliseconds.
3. The RRFB indication on the right-hand side shall be illuminated for approximately 50 milliseconds.
4. Both RRFB indications shall be dark for approximately 50 milliseconds.
5. The RRFB indication on the left-hand side shall be illuminated for approximately 50 milliseconds.
6. Both RRFB indications shall be dark for approximately 50 milliseconds.
7. The RRFB indication on the right-hand side shall be illuminated for approximately 50 milliseconds.
8. Both RRFB indications shall be dark for approximately 50 milliseconds.
9. Both RRFB indications shall be illuminated for approximately 50 milliseconds.
10. Both RRFB indications shall be dark for approximately 50 milliseconds.
11. Both RRFB indications shall be illuminated for approximately 50 milliseconds.
12. Both RRFB indications shall be dark for approximately 250 milliseconds.

E. The flash rate of each individual RRFB indication, as applied over the full flashing sequence, shall not be between 5 and 30 flashes per second to avoid frequencies that might cause seizures in anyone viewing the activated RRFB.

F. The light intensity of the yellow indications during daytime conditions shall meet the minimum specifications for Class 1 yellow peak luminous intensity in the current Society of Automotive Engineers (SAE) Standard J595 (Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles).

G. To minimize excessive glare, an automatic signal dimming device shall be used to reduce the brilliance of the RRFB indications during nighttime conditions.

PART 2 – MATERIALS

2.01 MATERIALS

A. All provisions of §709-01, §715, §723, §724 and §730 shall apply except as detailed below:

2.02 INDICATORS

A. Each RRFB facing shall consist of two rectangular-shaped yellow indications each with an LED-array-based light source. The size of each RRFB indication shall be at least 5 inches wide by at least 2 inches high and shall be aligned horizontally, with the longer dimension horizontal and with a minimum space between the two indications of at least 7 inches, measured from the nearest edge of one indication to the nearest edge of the other indication.

B. The outside edges of the RRFB indications, including any housings, shall not project beyond the outside edges of the signage of the RRFB.

C. Indicators shall be mounted in a housing constructed of durable, corrosion resistant, powder-coated aluminum with stainless steel fasteners.

D. Mounting hardware shall be stainless steel.

E. The indicator housing shall be located between and immediately adjacent to the bottom of the crossing warning sign and the top of the supplemental downward diagonal arrow plaque (or, in the case of a supplemental advance sign, the AHEAD or distance plaque).

F. All RRFB light bars shall be field adjustable to maximize the field of view on each vehicle approach.

G. Shall be rated for a minimum 15-year life span.

2.03 RADIO NETWORK CONTROLLER AND CABINET

A. The local equipment controlling the components of the beacon assembly shall be housed in a lockable, weatherproof, vandal and tamper resistant NEMA 3R rated aluminum enclosure, intended for outdoor use, primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, hose directed water, and damage from ice formation.

B. The cabinet shall be mounted on the pole and a work pad shall be provided, in accordance with signal system details. Cabinet shall not intrude into sidewalk or obstruct the pedestrian push button.

C. The cabinet shall be mounted on the side of the pole away from approaching traffic at a height between 3.5 – 4.5 feet from the bottom of the cabinet to the ground. In unpaved areas a concrete work pad shall be installed in front of the cabinet door not to exceed 5 feet by 5 feet by 4 inches deep and shall abut the pole foundation.

D. The cabinet shall be of sufficient size to house all required equipment.

E. Cabinet locking mechanisms shall meet NYSDOT standards currently used by the regional traffic signal groups. All keys to installed locking mechanisms shall be supplied to the Engineer upon acceptance of the work. The cabinet shall be secured with a Corbin lock and keyed as directed by the Regional Traffic Engineer for securing the cabinet door.

F. The controller shall be replaceable independently of other components.

2.04 CONTROLS

A. Controls shall include integrated constant current LED drivers with a minimum of two output channels for driving one or two assemblies.

B. Controls shall be completely programmable:

1. To run for a user specified time period when activated via switch, button contact closure, or when triggered from an external sensor such as a wireless transmitter, radar detector, presence detector, or wireless walk through bollard with a compatible sensor output. 2.3.3 Controls shall be capable of being programmed for alternate flash rates and patterns with a minimum resolution of 0.25s per trigger action.

C. Controls shall seamlessly integrate with the wireless transceiver to form a network of connected devices.

D. Controls shall allow adjustable and programmable light intensity levels for the beacons. Intensity level programming shall allow for manual and automatic modes. Manual mode shall allow the light intensity to be configured for a constant output on every available intensity level. Automatic mode shall allow for automatic intensity adjustment based upon assembly's ambient light conditions. Assemblies shall have a minimum of two brightness intensities available, exclusive of any unlit condition.

E. Controls shall include data-logging capabilities with selectable interval from one minute to one day with at least a 60-day logging period.

F. Controls shall include an RS232 serial interface and ethernet interface for local programming. Controls mays include USB cable interfaces for supplemental data connections.

G. Controls shall be locally programmable using software for Microsoft Windows 2007 or later or web based program.

H. The controller software shall allow programmable operation of the Assembly. Direct control of functions such as lighting controls shall be possible.

2.05 TRANSCEIVER

A. Shall provide wireless communication between the assemblies to integrate the pushbutton activation of indications.

B. Shall seamlessly integrate with the controller to ensure sequential activation of other radio-equipped devices in the system.

C. Shall synchronize the system components to activate the indications within 120 ms of one another and remain synchronized throughout the duration of the flash (timeout) cycle.

D. Shall include network-wide modification of sign controller settings and output durations using programmability from any networked transceiver without the use of additional equipment or software.

E. Shall be capable of operating as a parent (gateway) or child (node or repeater).

F. Shall be capable of providing site-survey data for verification of signal strength between network devices.

G. Shall operate on the license-free ISM band.

H. Radio control shall operate on an FCC approved 900 MHz frequency, hopping spread spectrum network with a normal operating range of ~1000 feet.

I. Shall operate from 3.3 to 15 VDC input.

J. Shall comply with 47 CFR Part 15.

K. Shall be replaceable independently of other components.

L. The product must be FCC certified to comply with all 47 CFR Part 15 Subpart B Emission requirements.

2.06 EMERGENCY SHUTOFF

A. One toggle-type power switch, for either the AC or solar power source, shall be provided for emergency shutoff at the local cabinet on the pole.

2.07 POWER SUPPLY

A. The power supply shall be either solar or 120 VAC and meet all applicable codes.

B. With the exception of conduits run for service entrance cables as detailed in NFPA 70: National Electric Code, the assembly shall contain no externally mounted wiring or wiring conduits.

C. Autonomy with a fully charged battery shall be at least 30 days of continuous operation without charging at an ambient temperature of 70 °F with at least ten actuations per hour.

2.08 BATTERY

A. Shall have a nominal output voltage of 12 VDC and a capacity of 48 Ah at a C100 discharge rate.

B. Shall be sealed and spill proof.

C. Shall have terminals that accept screws or bolts for secure wiring connections.

D. Shall be replaceable independently of other components.

E. Shall be fused for short circuit protection.

2.09 SOLAR POWER

A. One solar array with a bracket for mounting to the top of the pole.

B. Flexible, liquid tight conduit shall be used from the solar panel to the weather head/pole cap or as instructed by the solar panel manufacturer's instructions.

C. The solar panel shall be affixed to an aluminum plate and bracket, adjustable at an angle of 45 – 60 degrees to facilitate adjustment for maximum solar collection and optimal battery strength.

D. The solar panel assembly (panel, plate and bracket) shall be secured to a pole cap mount, capable of 360-degree rotation, to facilitate adjustment for maximum solar collection and optimal battery strength.

E. The solar panel shall be capable of withstanding operating temperatures of -30 to 165 °F.

F. If an Accessible Pedestrian Signal (APS) system is called for in the contract documents, all provisions for the continuous operation of the APS will be accounted for in the solar power system.

G. Solar Charge Controller:

1. Shall automatically provide Low Voltage Disconnect (LVD) to protect diminished power batteries.

2. Shall automatically provide Load-Reconnection once battery levels have been restored to an acceptable power level.

3. Shall protect against and automatically recover from short circuits, overloads, reverse polarities, high temperatures, lightning and transient surges, and voltage spikes.

4. Shall be independently replaceable of other control panel components.

2.10 ELECTRICAL POWER

A. The AC input terminals shall be equipped with a 210 J (joule) capacity power line surge suppressor. The suppressor shall have noise blanking capability.

B. Where required by the contract documents, or as required by the utility company, a meter shall be included.

C. All electrical components and wiring shall be approved to CSA or UL standards as applicable.

D. AC Power shall have electrical service disconnect.

2.11 POLE SHAFT

A. Shall be a standard 4.5-inch OD galvanized steel pole as per §724 with 4 bolt base plate with a 12.75-inch bolt circle.

B. Shall meet MUTCD height requirements.

2.12 POLE PEDESTAL BASE

A. Shall conform to §723-15 and mount on a concrete foundation attached by four anchor 'J' bolts that are to be imbedded in a concrete foundation.

B. Shall meet or exceed AASHTO break-away requirements for traffic signal supports.

2.13 PEDESTRIAN PUSH BUTTONS

A. A piezo pushbutton shall be ADA compliant, and shall operate as normally open (n/o) circuit.

2.14 STATIC SIGNS

A. All signs shall conform to the MUTCD and the NYS Supplement to the MUTCD.

B. All sign panels and plaques shall conform to the requirements of §645-2.02 of the NYS Standard Specifications.

C. Sign sheeting shall conform to the requirements in §645-2.02.

D. All sign assemblies shall use anti-vandal fasteners and tools to mount components to sign and sign to fixture.

E. Crossing sign assemblies shall consist of one of the following with the appropriate plaque: Pedestrian Crossing (W11-2), a School Crossing (S1-1), or a Trail Crossing (W11-15).

F. R10-25 shall be furnished, at least a size of 9 by 12 inches, to be mounted adjacent to and above each pedestrian pushbutton.

PART 3 – CONSTRUCTION DETAILS

3.01 CONSTRUCTION DETAILS

A. All provisions of §645 and §680 shall apply except for all electrical wiring and as modified below.

B. Electrical and communication wires shall be run in separate conduits.

C. Prior to any fabrication or installation of any of the components of the Flashing Beacon Assembly, the Contractor shall submit detailed specifications, parts lists, manufacturer's cut sheets, instruction sheets, and wiring diagrams to the Engineer for approval at least 14 calendar days before installation.

D. The Contractor shall install and position the beacon assembly in such a manner as to optimize visibility for roadway traffic, and optimize incident light for the solar assembly, using the manufacturer's recommendations and instructions for installation.

E. If the Engineer determines that the unit is not functioning properly, the Contractor shall secure the services of the manufacturer's representative for installation and testing.

F. Where new work is to meet existing infrastructure, the Contractor's methods shall provide for neat lines, to achieve a satisfactory installation.

PART 4 – METHOD OF MEASUREMENT

4.01 METHOD OF MEASUREMENT

A. This work will be measured as the number of RRFB assemblies furnished and installed in accordance with the Contract Documents, or as directed by the Engineer.

PART 5 – BASIS OF PAYMENT

5.01 BASIS OF PAYMENT

A. The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work, including the signs shown in the associated details.

B. Note:

X= 2 = two forward beacons,

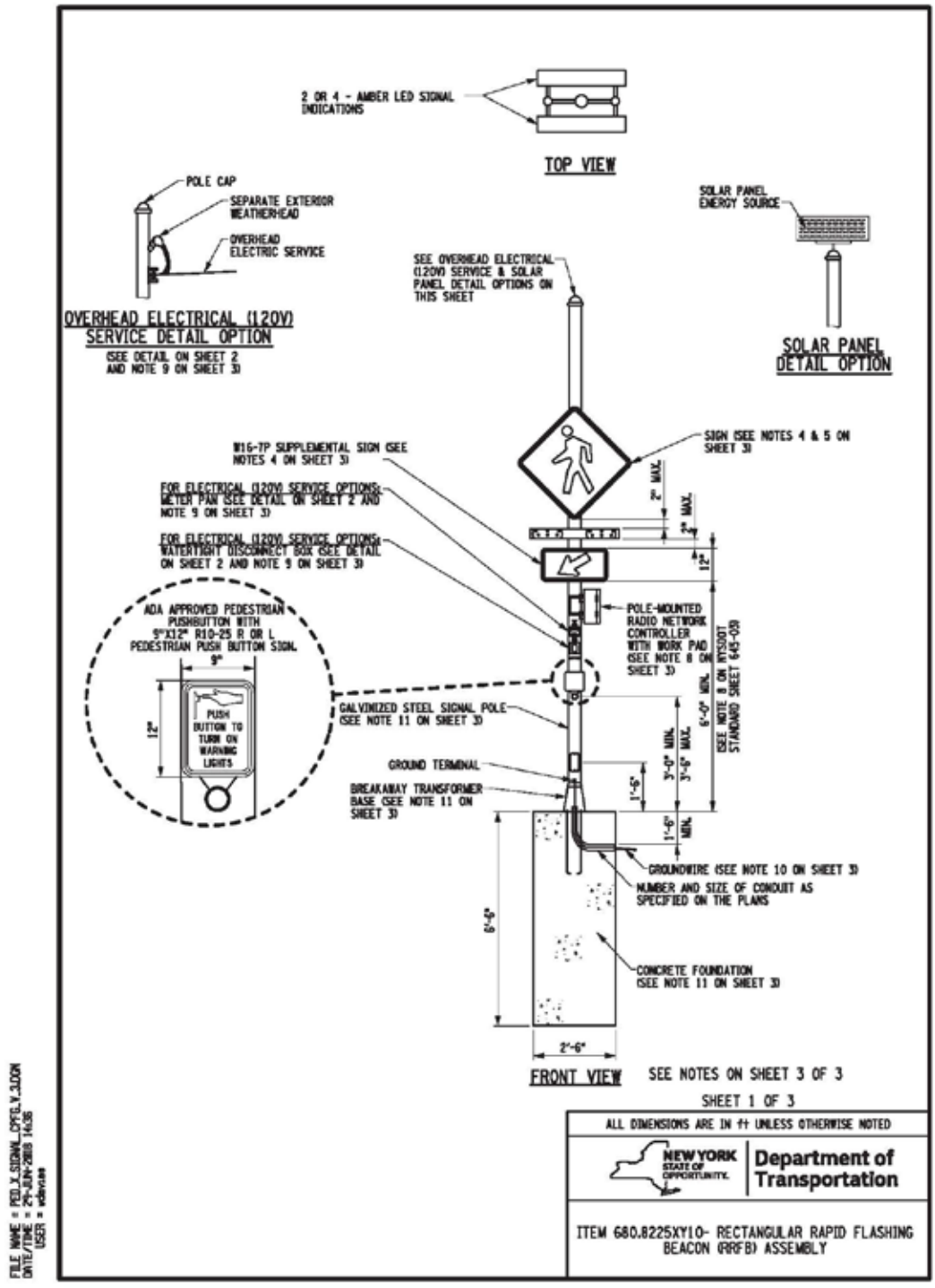
4 = four beacons, two forward facing beacons, and two rearward facing beacons;

Y= 1 = AC powered (overhead supply),

2 = AC powered (underground supply),

3 = Solar powered

END OF SECTION


2 OR 4 - AMBER LED SIGNAL INDICATIONS
TOP VIEW
POLE CAP
SEPARATE EXTERIOR WEATHERHEAD
OVERHEAD ELECTRIC SERVICE
OVERHEAD ELECTRICAL (120V) SERVICE DETAIL OPTION
(SEE DETAIL ON SHEET 2 AND NOTE 9 ON SHEET 3)
SOLAR PANEL ENERGY SOURCE
SOLAR PANEL DETAIL OPTION
SEE OVERHEAD ELECTRICAL (120V) SERVICE & SOLAR PANEL DETAIL OPTIONS ON THIS SHEET
SIGN (SEE NOTES 4 & 5 ON SHEET 3)
W16-7P SUPPLEMENTAL SIGN (SEE NOTES 4 ON SHEET 3)
FOR ELECTRICAL (120V) SERVICE OPTIONS: METER PAN (SEE DETAIL ON SHEET 2 AND NOTE 9 ON SHEET 3)
FOR ELECTRICAL (120V) SERVICE OPTIONS: WATERTIGHT DISCONNECT BOX (SEE DETAIL ON SHEET 2 AND NOTE 9 ON SHEET 3)
ADA APPROVED PEDESTRIAN PUSHBUTTON WITH 9"X12" R10-25 R OR L PEDESTRIAN PUSH BUTTON SIGN.
PUSH BUTTON TO TURN ON WARNING LIGHTS
POLE-MOUNTED RADIO NETWORK CONTROLLER WITH WORK PAD (SEE NOTE 8 ON SHEET 3)
GALVINIZED STEEL SIGNAL POLE (SEE NOTE 11 ON SHEET 3)
GROUND TERMINAL
BREAKAWAY TRANSFORMER BASE (SEE NOTE 11 ON SHEET 3)
GROUNDWIRE (SEE NOTE 10 ON SHEET 3)
NUMBER AND SIZE OF CONDUIT AS SPECIFIED ON THE PLANS
CONCRETE FOUNDATION (SEE NOTE 11 ON SHEET 3)
FRONT VIEW
SEE NOTES ON SHEET 3 OF 3
SHEET 1 OF 3
ALL DIMENSIONS ARE IN ft UNLESS OTHERWISE NOTED
NEW YORK STATE OF OPPORTUNITY. Department of Transportation
ITEM 680.8225XY10- RECTANGULAR RAPID FLASHING BEACON (RRFB) ASSEMBLY
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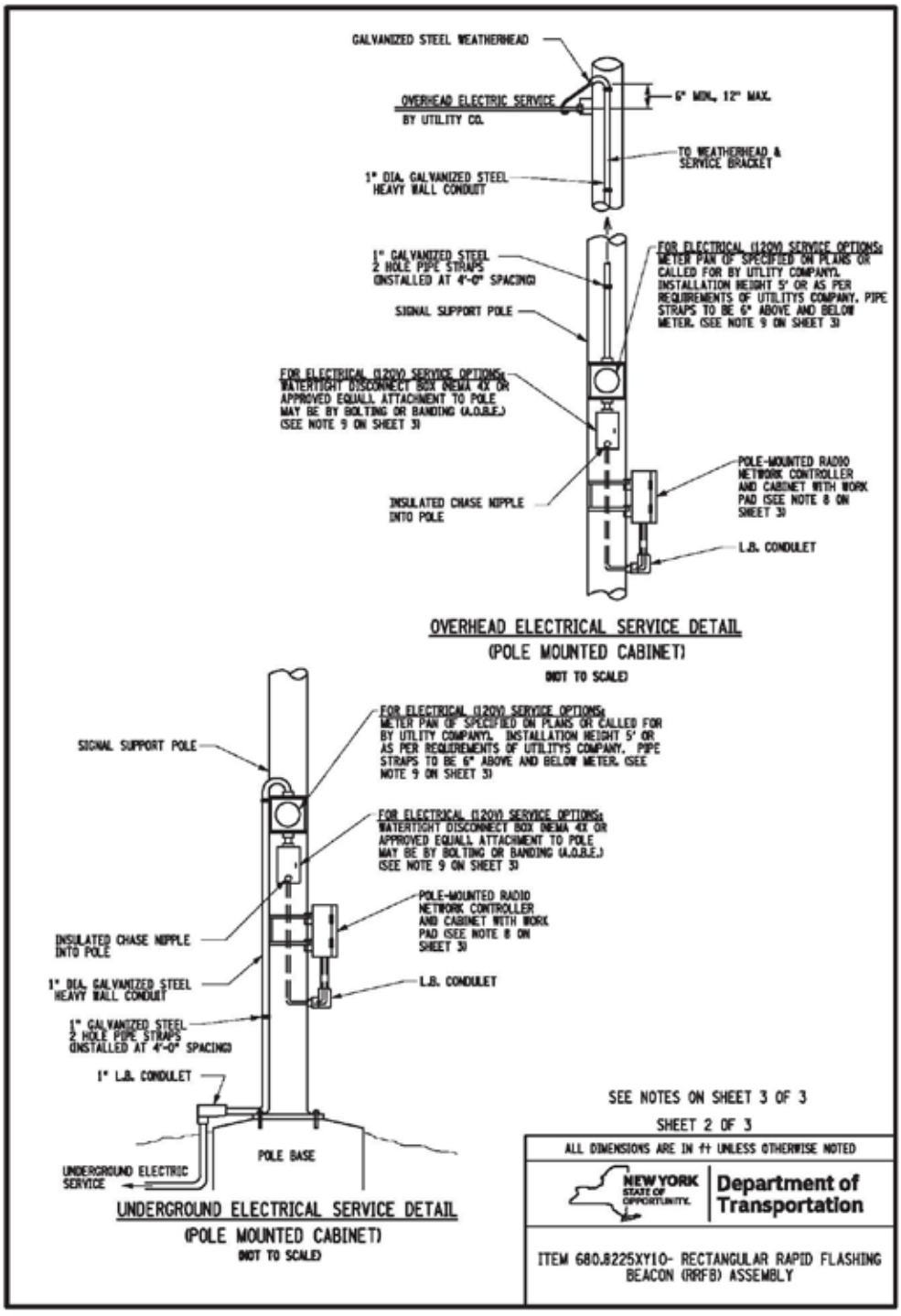
GALVANIZED STEEL WEATHERHEAD
OVERHEAD ELECTRIC SERVICE BY UTILITY CO.
6" MIN., 12" MAX.
TO WEATHERHEAD & SERVICE BRACKET
1" DIA. GALVANIZED STEEL HEAVY WALL CONDUIT
1" GALVANIZED STEEL 2 HOLE PIPE STRAPS (INSTALLED AT 4'-0" SPACING)
SIGNAL SUPPORT POLE
FOR ELECTRICAL (120V) SERVICE OPTIONS: METER PAN (IF SPECIFIED ON PLANS OR CALLED FOR BY UTILITY COMPANY). INSTALLATION HEIGHT 5' OR AS PER REQUIREMENTS OF UTILITYS COMPANY. PIPE STRAPS TO BE 6" ABOVE AND BELOW METER. (SEE NOTE 9 ON SHEET 3)
FOR ELECTRICAL (120V) SERVICE OPTIONS: WATERTIGHT DISCONNECT BOX (NEMA 4X OR APPROVED EQUAL). ATTACHMENT TO POLE MAY BE BY BOLTING OR BANDING (A.O.B.E.) (SEE NOTE 9 ON SHEET 3)
POLE-MOUNTED RADIO NETWORK CONTROLLER AND CABINET WITH WORK PAD (SEE NOTE 8 ON SHEET 3)
INSULATED CHASE NIPPLE INTO POLE
L.B. CONDULET
OVERHEAD ELECTRICAL SERVICE DETAIL
(POLE MOUNTED CABINET)
(NOT TO SCALE)
SIGNAL SUPPORT POLE
FOR ELECTRICAL (120V) SERVICE OPTIONS: METER PAN (IF SPECIFIED ON PLANS OR CALLED FOR BY UTILITY COMPANY). INSTALLATION HEIGHT 5' OR AS PER REQUIREMENTS OF UTILITYS COMPANY. PIPE STRAPS TO BE 6" ABOVE AND BELOW METER. (SEE NOTE 9 ON SHEET 3)
FOR ELECTRICAL (120V) SERVICE OPTIONS: WATERTIGHT DISCONNECT BOX (NEMA 4X OR APPROVED EQUAL). ATTACHMENT TO POLE MAY BE BY BOLTING OR BANDING (A.O.B.E.) (SEE NOTE 9 ON SHEET 3)
POLE-MOUNTED RADIO NETWORK CONTROLLER AND CABINET WITH WORK PAD (SEE NOTE 8 ON SHEET 3)
INSULATED CHASE NIPPLE INTO POLE
L.B. CONDULET
1" DIA. GALVANIZED STEEL HEAVY WALL CONDUIT
1" GALVANIZED STEEL 2 HOLE PIPE STRAPS (INSTALLED AT 4'-0" SPACING)
1" L.B. CONDULET
POLE BASE
UNDERGROUND ELECTRIC SERVICE
UNDERGROUND ELECTRICAL SERVICE DETAIL
(POLE MOUNTED CABINET)
(NOT TO SCALE)
SEE NOTES ON SHEET 3 OF 3
SHEET 2 OF 3
ALL DIMENSIONS ARE IN ft UNLESS OTHERWISE NOTED
NEW YORK STATE OF OPPORTUNITY.
Department of Transportation
ITEM 680.8225XY10- RECTANGULAR RAPID FLASHING BEACON (RRFB) ASSEMBLY
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NOTES:

1. NOTIFY DIG SAFELY - NEW YORK AT (800) 962-7962 PRIOR TO ANY EXCAVATION.
2. WIDTH OF SOLAR PANEL AND LED SIGNAL INDICATION ASSEMBLY SHALL NOT EXCEED THE WIDTH OF SIGN PANEL.
3. WHEN MULTIPLE UNITS ARE USED AT A LOCATION CONTRACTOR SHALL USE DIFFERENT RADIO FREQUENCIES TO AVOID COMMUNICATION ISSUES.
4. SEE CONTRACT DOCUMENTS FOR THE TYPE(S) AND LOCATION(S) OF PROPOSED RRFB ASSEMBLIES . IN THE ITEM NUMBER:

   X INDICATES IF IT IS A FORWARD FACING ASSEMBLY ONLY OR FORWARD AND REARWARD FACING (BACK-TO-BACK) ASSEMBLY WHERE:

   X=2 A FORWARD FACING ASSEMBLY CONSISTING OF 2 AMBER LED BEACON INDICATIONS WITH 1-W11-2 OR S1-1 OR W11-15 CROSSING SIGN AND 1-W16-7P SUPPLEMENTAL SIGN.

   X=4 FOR A FORWARD AND REARWARD FACING (BACK-TO-BACK) ASSEMBLY CONSISTING OF 4 AMBER LED BEACON SIGNAL INDICATIONS (TWO FORWARD FACING AND TWO REARWARD FACING) WITH 2-W11-2 OR S1-1 OR W11-15 CROSSING SIGNS AND 2-W16-7P SUPPLEMENTAL SIGNS (ONE SET OF EACH FACING FORWARD AND REARWARD).

   Y IS METHOD OF PROVIDING ELECTRICAL SERVICE WHERE:

   Y=1 FOR OVERHEAD ELECTRICAL SERVICE

   Y=2 FOR UNDERGROUND ELECTRICAL SERVICE.

   Y=3 FOR SOLAR POWER

   SEE DETAILS ON SHEET FOR ADDITIONAL REQUIREMENTS.
5. CROSSING SIGNS AND SUPPLEMENTAL PLAQUES SHALL UTILIZE FLUORESCENT YELLOW-GREEN TYPE IX SHEETING. SIGN AND PLAQUE SIZES SHALL CONFORM TO HE MUTCD. ALL SIGNS AND PLAQUES SHALL CONFORM TO THE MATERIAL REQUIREMENTS IN SECTION 645 OF THE STANDARD SPECIFICATIONS.
6. WHEN USED IN PAIRS/SET (SUCH AS ON BOTH TERMINUS POINT OF A CROSSWALK) ACTIVATION OF ONE SHALL ACTIVATE THE OTHER(S) IN THE SET/SYSTEM.
7. POLE PENETRATING MOUNTING DEVICES (RELATING TO LIGHTS, SIGNS, CABINETS, CONDUITS, CLAMPS, BUTTONS, ETC.) SHALL NOT SIGNIFICANTLY DEGRADE THE INTEGRITY OF THE SIGNAL POLE.
8. THE POLE-MOUNTED RADIO NETWORK CONTROLLER CABINET SHALL NOT INTRUDE INTO THE SIDEWALK AREA OR OBSTRUCT THE PEDESTRIAN PUSHBUTTON. THE CABINET SHALL BE MOUNTED ON THE SIDE OF THE POLE AWAY FROM APPROACHING TRAFFIC AT A HEIGHT BETWEEN 3.5-4.5 FROM THE BOTTOM OF THE CABINET TO THE FINISHED GROUND SURFACE. IN UNPAVED AREAS A CONCRETE WORK PAD SHALL BE CONSTRUCTED IN FRONT OF THE CABINET DOOR (ADBE) NOT TO EXCEED 5'X5'X4" DEEP AND SHALL ABUT AND BE FLUSH WITH THE POLE FOUNDATION. THE CABINET SHALL BE OF SUFFICIENT SIZE TO HOUSE ALL REQUIRED EQUIPMENT.
9. ELECTRICAL SERVICE MAY ALSO BE PROVIDED UNDERGROUND AND ENTER THROUGH THE BASE AS SPECIFIED ON THE PLANS. WHERE ELECTRICAL SERVICE IS PROVIDED OVERHEAD, THE POLE HEIGHT SHALL BE AS NECESSARY TO ACHIEVE MINIMUM SERVICE CABLE CLEARANCES AND/OR AVOID CONFLICTS. SEE DETAILS ON SHEET 1 & 2 FOR ADDITIONAL REQUIRMENTS.
10. SEE NOTES 3.6 & 3.7 ON STANDARD SHEET 680-04 FOR ADDITIONAL GROUNDING REQUIREMENTS.
11. THIS ASSEMBLY SHALL INCLUDE A GALVANIZED STEEL POLE WITH AN APPROVED BREAKAWAY TRANSFORMER BASE AND CONCRETE FOUNDATION MEETING ALL THE MATERIAL REQUIREMENTS OF STANDARD SPECIFICATION SECTION 680-2 AND BE SUITABLE TO HANDLE THE STATIC & DYNAMIC LOADING OF THE ASSEMBLY AS PER MANUFACTURER REQUIREMENTS. FOR FOUNDATION REINFORCEMENT, SEE STANDARD SHEET FOR TRAFFIC SIGNAL POLE FOUNDATIONS, CODE J-2.

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DATE/TIME = 29-JUN-2018 14:07
USER = wdevoss

SHEET 3 OF 3

ALL DIMENSIONS ARE IN ft UNLESS OTHERWISE NOTED

NEW YORK STATE OF OPPORTUNITY. Department of Transportation

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