

**City of Alexandria  
Standard Construction Specifications  
West End Transitway –  
Phase I Improvements**

**100% Design Submission**

**February 2025**

# **Table of Contents**

## **DIVISION 01 - GENERAL REQUIREMENTS**

000107 -	SEAL PAGE
010000 -	GENERAL REQUIREMENTS
011000 -	SUMMARY
011100 -	EXECUTION REQUIREMENTS
012200 -	UNIT PRICES
013100 -	PROJECT MANAGEMENT AND COORDINATION
013200 -	CONSTRUCTION PROGRESS DOCUMENTATION
013300 -	SUBMITTAL PROCEDURES
014000 -	QUALITY REQUIREMENTS
015000 -	TEMPORARY FACILITIES AND CONTROLS
015526 -	TRAFFIC CONTROL
015639 -	TEMPORARY TREE AND PLANT PROTECTION
017113 -	MOBILIZATION
017700 -	CLOSEOUT PROCEDURES
017839 -	PROJECT RECORD DOCUMENTS

## **DIVISION 02 - EXISTING CONDITIONS**

020113 -	MAINTENANCE OF UTILITIES
022100 -	SURVEYS
024113 -	PAVING REMOVAL
024119 -	SELECTIVE DEMOLITION
026000 -	CONTAMINATED SITE MATERIAL REMOVAL

## **DIVISION 03 - CONCRETE**

031520 -	POST-INSTALLED CONCRETE AND MASONRY ANCHORING
033000 -	CAST-IN-PLACE CONCRETE
033100 -	STRUCTURAL CONCRETE

## **DIVISION 05 - METALS**

051200 -	STRUCTURAL STEEL FRAMING
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## **DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES**

066400 -	POLYETHYLENE PLATFORM EDGE STRIPS
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## **DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

074113 -	METAL ROOF PANELS
074213 -	METAL WALL PANELS
074243 -	COMPOSITE WALL PANELS
076000 -	SHEET METAL GUTTERS AND DOWNSPOUTS
079200 -	JOINT SEALANTS

## **DIVISION 08 - OPENINGS**

084427 -	BUS RAPID TRANSIT SHELTER STRUCTURAL GLASS FAÇADE
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**DIVISION 09 - FINISHES**

099000 - PAINTING

**DIVISION 10 - SPECIALTIES**

101430 - SPECIALTY SIGNAGE  
101453 - TRAFFIC SIGNAGE  
107343 - TRANSPORTATION STOP SHELTERS

**DIVISION 12 - FURNISHINGS**

121000 - ART  
129313 - SITE BICYCLE RACKS  
129323 - TRASH AND LITTER RECEPTORS  
129343 - SITE SEATING

**DIVISION 26 - ELECTRICAL**

260500 - COMMON WORK RESULTS FOR ELECTRICAL  
260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES  
260543 - UNDERGROUND CONDUITS FOR ELECTRICAL SYSTEMS  
262713 - ELECTRICITY METERING AND PANELBOARDS  
265613 - LIGHTING POLES AND STANDARDS

**DIVISION 27 - COMMUNICATIONS**

271116 - COMMUNICATIONS CABINETS  
272100 - DATA COMMUNICATIONS NETWORK EQUIPMENT  
274216 - TRANSPORTATION INFORMATION DISPLAY SYSTEMS

**DIVISION 31 - EARTHWORK**

311000 - SITE CLEARING  
312000 - EARTH MOVING  
312333 - TRENCHING AND BACKFILLING  
315000 - SLOPE PROTECTION

**DIVISION 32 - EXTERIOR IMPROVEMENTS**

321216 - ASPHALT PAVING  
321723 - PAVEMENT MARKINGS  
321726 - TACTILE WARNING SURFACING  
328400 - PLANTING IRRIGATION  
329113 - SOIL PREPARATION  
329200 - TURF AND GRASSES  
329300 - PLANTS

**DIVISION 33 - UTILITIES**

330500 - COMMON WORK RESULTS FOR UTILITIES  
331000 - WATER UTILITIES  
333100 - SANITARY SEWERAGE PIPING  
334200 - STORMWATER CONVEYANCE  
337116 - ELECTRICAL POLES

338000 - COMMUNICATIONS UTILITIES

**DIVISION 34 - TRANSPORTATION**

344113 - TRAFFIC SIGNALS

344114 - TRANSIT SIGNAL PRIORITY (TSP) SYSTEM

SECTION 000107 - SEALS PAGE

GENERAL

DESIGN PROFESSIONALS OF RECORD

- A. Civil Engineer:
  - 1. Name: Mark Phillips, P.E.
  - 2. License No.: 0402058611
  - 3. Responsible for sections: All except as noted below.
- B. Civil Engineer:
  - 1. Name: Derik Doughty, P.E.
  - 2. License No.: 0402055074
  - 3. Responsible for sections: 334200
- C. Civil Engineer:
  - 1. Name: Bailey Lozner, P.E.
  - 2. License No.: 0402062149
  - 3. Responsible for sections: 344114
- D. Structural Engineer:
  - 1. Name: Avery Fann, P.E.
  - 2. License No.: 0402055385
  - 3. Responsible for sections: 031520, 033100, 051200

E. Architect:

1. Name: Peter Dougherty
2. License No.: 0401018690
3. Responsible for sections: 074113, 074213, 074243, 076000, 079200, 084427, 099000, 101430, 107343, 129323, 129343

F. Landscape Architect:

1. Name: Keith Aimone, PLA
2. License No.: 0406001440
3. Responsible for sections: 015639, 328400, 329113, 329200, 329300

END OF SECTION 000107

## SECTION 010000 – GENERAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. The City of Alexandria is implementing the West End Transitway to provide high-capacity transit service via high-quality stations with customer amenities. Bus service will operate along a 4.2-mile corridor running from the Van Dorn Street Metrorail Station in the south to the King Street in the north, with 19 stations at key destinations including the Mark Center Transit Center.

The first phase of the transitway is the West End Transitway – Phase 1 Improvements Project, focused on Transportation Systems Management (TSM) improvements, including new transit stations, Transit Signal Priority (TSP) technology, real-time passenger information, roadway improvements including a bus queue jump lane at North Van Dorn Street and Sanger Avenue, and pedestrian and bicycle improvements.

#### 1.2 PRECONSTRUCTION SURVEY

- A. Before any work is performed at the site by the Contractor a joint preconstruction survey will be performed. The preconstruction survey is to be provided by the Contractor. The Contractor is to provide the viewing software supporting the video images. The Contractor, COTR (Contracting Officer's Technical Representative), and Owner will review the existing conditions jointly and a video record (DVD) of this review will be made by the Contractor for record purposes. The Contractor is to retain his/her own copies of the video record. Following completion of the Work, the video record may be used to compare conditions prior to construction to those conditions following construction to ascertain that the site has been properly restored.

#### 1.3 CONSTRUCTION RECORDS AND PHOTOGRAPHS

- A. The Contractor shall keep accurate records on the construction progress (type of Work performed, extent of repairs, location, etc.) on a day-to-day basis. A qualified representative of Contractor shall enter the progress into a construction digital logbook. Entries and notations shall be made in a neat and legible manner. These logs shall be delivered to COTR upon completion of the construction.
- B. Provide pre-construction photographs prior to commencement of work on the each site, no more than two weeks prior to the commencement of construction at the specific site. Provide exposures of the area where the Work is to take place as designated by the COTR. Each photograph shall be labeled identifying the relevant features and is to indicate the date and time stamp and the direction of the view.
- C. Provide digital construction photographs during the progress of the Work. Take weekly photographs at each project location starting one (1) month after the date of the pre-construction photographs and continuing as long as the Work is in progress. Ensure each photo is annotated

in such a manner that a reviewer can clearly understand precisely where the photo was taken and what aspect or view of the Work is presented. Take photographs at each project location upon Final Acceptance and Completion of the Work.

#### 1.4 SHOP DRAWINGS AND SUBMITTALS

##### A. GENERAL

The Contractor shall furnish one (1) digital copy and descriptive literature for all manufactured or fabricated items with each submittal to the COTR for review and approval. Additional information such as special drawings, assembly, arrangement and configuration, schedules, and calculations, shall be provided when specifically required in the Technical Specifications.

The term shop drawings shall mean drawings, prints, sketches, descriptive literature, test reports, samples, calculations, schedules, material lists, material safety data sheets, and items of similar meaning. No material shall be fabricated or shipped unless the applicable drawings or submittals have been reviewed and approved by the COTR.

Contractor shall review and check drawings and submittals. Contractor shall indicate his/her review by initials and date, and shall also reference each applicable item, section, or division of the Specifications. If the drawings or submittals deviate from the Contract Drawings, Contractor shall advise COTR, in writing, of the deviation and the reasons, therefore.

In the event the Contractor obtains COTR's acceptance for the use of material or equipment other than that which is shown on the Contract Drawings or specified, Contractor shall, at his/her own expense, and using methods acceptable to COTR, make any changes to structures, facilities, and/or piping, that may be necessary to accommodate this equipment.

The shop drawings and submittals listed in these specifications are required to be prepared by the Contractor. Contractor's refusal to cooperate and provide such requirements may serve as the basis for the Owner to terminate the Contract.

##### B. WORK PLAN REQUIREMENTS

1. The Contractor shall prepare and submit to the Owner a written Draft Work Plan within ten (10) days after receipt of the Notice to Proceed.
2. The Contractor shall present the COTR, the primary schedule sequence of construction activities within ten (10) days after receipt of the Notice to Proceed.
3. The Contractor shall confirm the equipment to be used for the entire project. The Contractor shall provide noise reduction measures on all operating machinery, equipment, and systems.
4. The Contractor shall incorporate the Project Schedule and related activities, permit application review and approved traffic control plan implementation, site dewatering, flow diversion and controls, public access and use, erosion and sedimentation measures, and public notification with the Work Plan. Contractor shall also include details associated with the means and methods, as well as timing of excavations.



5. Contractor shall attend bi-weekly progress meetings.
6. Contractor shall submit a two week look ahead schedule for discussion at each bi-weekly progress meeting.
7. Contractor shall revise and submit Work Plan updates every month.

#### 1.5 PERMITS

- A. Contractor shall obtain, at his expense, all permits, approvals, and licenses required by all local, state, and federal agencies having jurisdiction. Permits issued by the City will be issued at no cost to the Contractor.

#### 1.6 CLEANING

- A. Contractor shall, at all times, keep the construction site and the surrounding area presentable to the public, clear and clean of rubbish and debris caused by or resulting from the Contractor's operations. At completion of the Work each day, Contractor shall remove all the rubbish, debris, tools, equipment, temporary Work and surplus materials, from and about the premises, and shall leave the site clean and ready for use.

On a daily basis, all waste and excess materials shall be disposed of off the project site and at no additional expense to Owner. In no case shall waste materials (any removed concrete, piping, equipment, etc.) be buried on the site. Burning is not permitted.

After completion of all Work and before final acceptance of the Work, Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, labels, stickers, etc., from the installed equipment.

#### 1.7 UTILITY SERVICE

- A. Contractor shall arrange for and pay all costs for utility services that may be required for the Work.

#### 1.8 CONTRACT DRAWINGS AND TECHNICAL SPECIFICATIONS

- A. Contractor To Check Contract Drawings, Technical Specifications, and Data:
  1. Contractor shall verify all dimensions, quantities and details shown on the Contract Drawings, Supplementary Drawings, Schedules, Technical Specifications, or other data received from the COTR, and shall notify him of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction or improper operation resulting there from nor from rectifying such conditions at his own expense. He will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the COTR, should such errors or omissions be discovered. All schedules are given for the convenience of the COTR and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size,

kind, and quality of materials and equipment included in work to be done under the Contract.

#### 1.9 TEMPORARY STRUCTURES

##### A. Responsibility for Temporary Structures

1. In accepting the Contract, the Contractor assumes full responsibility for the sufficiency and safety of all temporary structures or work and for any damage which may result from their failure or their improper construction, maintenance or operation and will indemnify and save harmless the Owner (City of Alexandria) and COTR, Owner's Consultants from all claims, suits or actions and damages or costs of every description arising by reason of failure to comply with the above provisions.

##### B. Temporary Fences

1. If, during the course of the work, it is necessary to remove or disturb any fence or part thereof, the Contractor shall, at his own expense, if approved by the COTR, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced. The COTR shall be solely responsible for the determination of the necessity for providing a temporary fence and the type of temporary fence to be used.

#### 1.10 SAFETY

##### A. Accident Prevention

1. Precautions shall be exercised at all times for the protection of persons and property. The safety provisions of applicable laws, building and construction codes shall be observed. The Contractor shall comply with the U.S. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596), and under Section 107 of the contract Work Hours and Safety Standards Act (PL-54), except where state and local safety standards exceed the federal requirements and except where state safety standards have been approved by the Secretary of Labor in accordance with provisions of the Occupational Safety and Health Act.

##### B. First Aid

1. The Contractor shall keep upon the site, at each location where work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when people are employed on the work.

#### 1.11 LINES AND GRADES

##### A. Grade

1. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Contract Drawings, or as otherwise approved by the COTR. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

2. The Contractor shall provide copies of all construction stake-out computations (cut sheets) to the COTR prior to the installation of improvements.

B. Safeguarding Marks

1. The Contractor shall safeguard all points, stakes, grade marks, monuments and benchmarks made or established on the work, bear the cost of reestablishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or to removing without authorization such established points, stakes and marks.
2. The Contractor shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the work and, if required, shall bear the cost of reestablishing them if disturbed or destroyed.

1.12 ADJACENT STRUCTURES AND LANDSCAPING

A. Responsibility

1. The Contractor shall be entirely responsible and liable for all damage or injury as a result of his operations to all adjacent public and private property, structures of any kind and appurtenances thereto met with during the progress of the work. The cost of protection, replacement in their original locations and conditions or payment of damages for injuries to such adjacent public and private property and structures affected by the work, whether or not shown on the Contract Drawings, and the removal, relocation and reconstruction of such items called for on the Contract Drawings or specified shall be included in the various Contract Items and no separate payments will be made therefore.
2. Contractor is expressly advised that the protection of buildings, structures, tunnels, tanks, pipelines, etc. and related work adjacent and in the vicinity of his operations, wherever they may be, is solely his responsibility. Conditional inspection of buildings or structures in the immediate vicinity of the project which may reasonably be expected to be affected by the Work shall be performed by and be the responsibility of the Contractor.
3. Contractor shall, before starting operations, make an examination of the interior and exterior of the adjacent structures, buildings, facilities, etc., and record by notes, measurements, photographs, etc., conditions which might be aggravated by open excavation and construction. Repairs or replacement of all conditions disturbed by the construction shall be made to the satisfaction of the Director of Transportation & Environmental Services and COTR. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be submitted to the COTR.
4. Prior to the beginning of any excavations the Contractor shall advise the COTR of all buildings or structures on which he intends to perform work or which performance of the project work will affect.

B. Protection of Trees

1. All trees and shrubs shall be adequately protected by the Contractor to the satisfaction of the COTR and the City of Alexandria Arborist. See Section 015639 Temporary Tree and Plant Protection.

C. Lawn Areas

1. Project site areas shall be left in as good condition as before the starting of the work. Where sod is removed, it shall be carefully removed, and later replaced with same or like kind.

D. Restoration of Fences

1. Any fence, or part thereof, that is damaged or removed during the course of the work shall be replaced or repaired by the Contractor and shall be left in as good a condition as before the starting of the work. The manner in which the fence is repaired or replaced, and the materials used in such work shall be subject to the approval of the COTR. The cost of all labor, materials, equipment, and work for the replacement or repair of any fence shall be deemed included in the appropriate Contract Item or items, or if no specific Item is provided therefore, as part of the overhead cost of the work and no additional payment will be made therefore. Private fences removed from within the Right-of-Way shall be replaced as described above at the Right-of-Way line.

1.13 PROTECTION OF WORK AND PUBLIC

A. Barriers and Lights

1. During the prosecution of the work, the Contractor shall put up and maintain at all times such barriers and lights as will effectually prevent accidents. The Contractor shall provide suitable barricades, lights, "danger" or "caution" signs at all places where the work causes obstructions or constitutes in any way a hazard to the public in accordance with state and local requirements.

B. Smoke Prevention

1. The Contractor shall be in strict compliance with ordinances regulating the production and emission of smoke. No open fires will be permitted.

C. Noise

1. The Contractor shall eliminate noise to as great an extent as practicable at all times. Air compressing plants shall be equipped with silencers and the exhaust of all gasoline motors or other power equipment shall be provided with mufflers. The Contractor shall strictly observe the City of Alexandria Noise Control Code, Title II, Chapter 5.
2. Except in the event of an emergency, work shall be done within the regular working hours specified in the City of Alexandria Noise Control Code, Title II, Chapter 5. If the proper and efficient prosecution of the work requires operations outside of these hours, the written permission of the Director of Transportation & Environmental Services must be obtained.

D. Access to Public Services

1. Neither the materials excavated, nor the materials or plant used in the construction of the work shall be so placed as to prevent free access to all fire hydrants, valves or manholes, or access required by emergency vehicles and/or personnel.

E. Dust Prevention

1. The Contractor shall prevent dust nuisance from his operations by keeping the construction areas sprinkled with water. Allaying dust in roadway construction areas shall be in accordance with VDOT Specification Section 511.

1.14 CLEANING

A. During Construction

1. During construction of the work, the Contractor shall, at all times, keep the site of the work and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the COTR, such material, debris, or rubbish constitutes a nuisance or is objectionable.
2. The Contractor shall remove from the site all of his surplus materials and temporary structures when no further need therefore develops.
3. The Contractor shall be responsible and liable for all spillage and incur all associated costs including, but not limited to, costs related to repair and maintenance resulting from damages thereof.

B. Final Cleaning

1. At the conclusion of the work, all erection plant, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and he shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances. The Contractor shall thoroughly clean all piping and materials installed by him prior to final inspection.

1.15 MISCELLANEOUS

A. Use of Chemicals

1. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either Environmental Protection Agency (EPA) or United States Department of Agriculture (USDA) for its intended use. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.

B. Protection Against Siltation and Bank Erosion

1. The Contractor shall arrange his operations to minimize siltation on construction sites.

2. The Contractor, at his own expense, shall remove any siltation deposits and correct any erosion problems as determined by the COTR which results from his construction operations.
3. The Contractor shall vacuum clean all new and existing storm drainage facilities and discharge points affected by construction prior to final acceptance by the Director of Transportation & Environmental Services.

C. Protection of Wetland Areas

1. The Contractor shall properly dispose of all surplus material, including soil, in accordance with Local, State and Federal regulations. Under no circumstances shall surplus material be disposed of in wetland areas as defined by the Virginia Department of Environmental Quality.

D. Existing Facilities

1. The work shall be so conducted to maintain existing facilities in operation insofar as is possible. Requirements and schedules of operations for maintaining existing facilities in service during construction shall be as described in these Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

- A. Construction Documents: Execution of the Work shall be governed by the documents listed here in order of precedence:
  1. The Contract.
  2. Technical Specifications.
  3. Contract Drawings.
  4. City of Alexandria Design and Construction Standards, latest edition.
  5. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications).
  6. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).
- B. In case of discrepancy in the figures, in the Contract Drawings or in the Specifications, the matter shall be promptly submitted to the COTR who shall promptly make a determination in writing.

3.2 HOURS OF OPERATION

- A. All work shall be carried out between the hours of 7:00 AM and 6:00 PM, Monday thru Friday, and between the hours of 9:00 AM and 6:00 PM, on Saturdays. Lane closures will take place between 9:00 AM and 3:30 PM on Time Restricted Streets, or as authorized by the City.

MEASUREMENT AND PAYMENT

- B. There will be no direct payment for work covered in this section. Payment at the Contract unit prices for the various items in the Contract will be full compensation for all work covered by this section.

END OF SECTION 010000

## SECTION 011000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Use of Premises.
  - 2. Specification Formats and Conventions.

#### 1.2 USE OF PREMISES

- A. General: The Contractor shall have full use of premises, as shown in the Contract Drawings, in conformance with the limitations stipulated by City for construction operations, including use of Project sites, during construction period. Contractor's use of premises is limited only by Owner's (City of Alexandria) right to perform work or to retain other contractors on portions of Project.
- B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project sites beyond areas in which the Work is indicated.
  - 1. Limits: Confine construction operation within the Project Limits-of-Disturbance (LOD) as noted on the Contract Drawings.
  - 2. Keep approaches to the premises clear and available to Owner (City of Alexandria), Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

#### 1.3 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections.
  - 1. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate.



Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
  - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - MEASUREMENT AND PAYMENT

- A. There will be no direct payment for work covered in this section. Payment at the Contract unit prices for the various items in the Contract will be full compensation for all work covered by this section.

END OF SECTION 011000

## SECTION 011100 - EXECUTION REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. General installation of products.
  - 4. Progress cleaning.
  - 5. Starting and adjusting.
  - 6. Protection of installed construction.
  - 7. Correction of the Work.

#### 1.2 SUBMITTALS

- A. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- C. Certified Surveys: Submit two copies signed by Virginia certified land surveyor or professional engineer.
- D. Final Property Survey: Submit one hard copy and one copy in a digital format showing the Work performed and record survey data.

#### 1.3 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in Virginia and who is experienced in providing land-surveying services of the kind indicated.

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, the contractor shall investigate and verify the existence and location of all existing underground and overhead utilities and other infrastructure and systems affecting the Work.
  - 1. Before construction, verify the location and points of connection of utility services.
  - 2. Before construction, verify the location of all trees.
  - 3. Before construction, verify location and extents of all right-of-way lines and easements.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping, and underground electrical and communications services.
  - 2. Furnish location data for work related to Project that must be performed by public and private utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Contract Drawings.

- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to COTR. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to layout the Work, verify layout information shown on Contract Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify COTR promptly.
- B. General: Engage a professional Virginia registered Surveyor to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels as needed to locate each element of Project.
  - 2. Establish dimensions within tolerances indicated. Do not scale Contract Drawings to obtain required dimensions.
  - 3. Inform installers of lines and levels to which they must comply.
  - 4. Check the location, level and plumb, of every major element as the Work progresses.
  - 5. Notify COTR when deviations from required lines and levels exceed allowable tolerances.
  - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Structure Lines and Levels: Locate and lay out control lines and levels for structures and foundations. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by COTR.

### 3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- C. Certified Survey: On completion of foundations, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.

### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels. Use proper exhaust mufflers on all construction equipment to help reduce noise to the surrounding area.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
  - 1. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg. F (27 deg. C).
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

### 3.8 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. All existing conditions must be restored to the original or better conditions to the satisfaction of the COTR. Any damage to the existing properties must be restored and paid for by Contractor.
- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

## PART 4 - MEASUREMENT AND PAYMENT

- A. There will be no direct payment for work covered in this section. Payment at the Contract unit prices for the various items in the Contract will be full compensation for all work covered by this section.

END OF SECTION 011100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for unit prices.
- B. The cost of incidental work for which there are no specific Contract Items, shall be considered as part of the general cost of doing the work and shall be included in the prices for the various Contract Items. No additional payment will be made therefore.
- C. The Contractor shall remove, demolish, and dispose of all equipment, piping, asphalt, rock and appurtenances as shown on the Contract Drawings and required to complete the work. No additional payment will be made for additional demolition or disposal work, not specifically specified on the Contract Drawings, as required to complete the work.

1.2 DEFINITIONS

- A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, applicable quality control tests, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections or plan sheets for each item of work.
- C. Cost of quality control work shall be considered as part of the general cost of doing the work and shall be included in the prices for the various Contract Items. No additional payment will be made, therefore.
- D. The City reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at the City's expense, by an independent surveyor acceptable to Contractor.
- E. The City shall have the right to increase or decrease the volume of work by 25% of the total bid price without any changes in the bid unit prices.

PART 2 - PRODUCTS (Not Used)



PART 3 - EXECUTION (Not Used)

PART 4 - MEASUREMENT AND PAYMENT

- A. There will be no direct payment for work covered in this section. Payment at the Contract unit prices for the various items in the Contract will be full compensation for all work covered by this section.

END OF SECTION 012200

## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. Coordination Drawings.
  - 2. Project meetings.
  - 3. Requests for Interpretation (RFIs).
- B. See Section 011100 Execution Requirements for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

#### 1.2 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

#### 1.3 COORDINATION

- A. Keep one copy of all construction documentation including Contract Drawings and Technical Specifications on the work site, and in good order, and make it available to the COTR.
- B. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
  - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
  - 1. Prepare similar memoranda for City and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of Contractor's Construction Schedule.
  - 2. Delivery and processing of submittals.
  - 3. Progress meetings.
  - 4. Startup and adjustment of systems.
  - 5. Project closeout activities.

#### 1.4 SUBMITTALS

- A. See Section 013300 Submittal Procedures.

#### 1.5 REQUESTS FOR INTERPRETATION (RFIs)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
  - 1. RFIs shall originate from the Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
  - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. COTR's Action: COTR will review each RFI, determine action required, and return it. Allow seven working days for COTR's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
  - 1. COTR's action may include a request for additional information, in which case COTR's time for response will start again.
  - 2. COTR's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal.
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify COTR in accordance with the Contract requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - MEASUREMENT AND PAYMENT

- A. There will be no direct payment for work covered in this section. Payment at the Contract unit prices for the various items in the Contract will be full compensation for all work covered by this section.

END OF SECTION 013100

## SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 - GENERAL (Not Used)

### PART 2 - PRODUCTS

#### 2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.
- B. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragments to demonstrate the effect of the proposed change on the overall project schedule.

### PART 3 - EXECUTION

#### 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities and an estimated two week look ahead of anticipated work. Issue schedule one week before each regularly scheduled progress meeting.
  - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  - 3. As the Work progresses, indicate Actual Completion percentage for each activity.

### PART 4 - MEASUREMENT AND PAYMENT

- A. There will be no direct payment for work covered in this section. Payment at the Contract unit prices for the various items in the Contract will be full compensation for all work covered by this section.

END OF SECTION 013200

## SECTION 013300 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. See Section 013200 Construction Progress Documentation for submitting schedules and reports, including Contractor's Construction Schedule.
- C. See Section 014000 Quality Requirements for submitting test and inspection reports and for mockup requirements.
- D. See Section 017700 Closeout Procedures for submitting warranties.
- E. See Section 017839 Project Record Documents for submitting Record Drawings, Record Specifications, and Record Product Data.

#### 1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires COTR's responsive action.
- B. Informational Submittals: Written information that does not require COTR's responsive action. Submittals may be rejected for not complying with requirements.

#### 1.3 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. COTR reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows.

1. Time for review shall commence on COTR's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  2. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. COTR will advise Contractor when a submittal being processed must be delayed for coordination.
  3. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  4. Resubmittal Review: Allow 15 days for review of each resubmittal.
- C. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Provide a space approximately 6 inches by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by COTR.
  3. Include the following information on label for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name and address of COTR.
    - d. Name and address of Contractor.
    - e. Name and address of subcontractor.
    - f. Name and address of supplier.
    - g. Name of manufacturer.
    - h. Submittal number or other unique identifier, including revision identifier.
    - i. Number and title of appropriate Specification Section.
    - j. Drawing number and detail references, as appropriate.
    - k. Location(s) where product is to be installed, as appropriate.
    - l. Other necessary identification.
- D. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.



- E. Additional Copies: Unless additional copies are required for final submittal and unless COTR observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
- F. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. COTR will return submittals, without review, received from sources other than Contractor.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
  - 1. Note date and content of previous submittal.
  - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  - 3. Resubmit submittals until they are marked "Approved".
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Use only final submittals with mark indicating "Use for Construction" taken by COTR.

## PART 2 - PRODUCTS

### 2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
  - 2. Mark each copy of each submittal to show which products and options are applicable.
  - 3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's product specifications.
    - c. Manufacturer's installation instructions.
    - d. Manufacturer's catalog cuts.

- e. Wiring diagrams showing factory-installed wiring.
  - f. Printed performance curves.
  - g. Operational range diagrams.
  - h. Compliance with specified referenced standards.
  - i. Testing by recognized testing agency.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

## 2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
- 1. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
  - 2. Test and Inspection Reports: Comply with requirements specified in Section 014000 Quality Requirements.
- B. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- D. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- E. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- F. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- G. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

## 2.3 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

### PART 3 - EXECUTION

#### 3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to COTR.
- B. Approval Stamp: Stamp each submittal with a uniform approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

#### 3.2 COTR'S ACTION

- A. General: COTR will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: COTR or designee will review each submittal, make marks to indicate corrections or modifications required, and return it.
- C. Informational Submittals: COTR will review each submittal and will not return it or will return it if it does not comply with requirements. COTR will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

PART 4 - MEASUREMENT AND PAYMENT

- A. There will be no direct payment for work covered in this section. Payment at the Contract unit prices for the various items in the Contract will be full compensation for all work covered by this section.

END OF SECTION 013300

## SECTION 014000 – QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 2. Requirements for Contractor to provide quality-assurance and -control services required by COTR or authorities having jurisdiction are not limited by provisions of this Section.
- C. See Sections for specific test and inspection requirements.

#### 1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by COTR.
- C. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- D. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- E. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- F. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

- G. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
- H. Experienced: When used with an entity, "experienced" means having successfully completed projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

### 1.3 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to COTR for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to COTR for a decision before proceeding.

### 1.4 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Reports: Prepare and submit certified written reports that include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, and telephone number of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.
  - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.

11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on re-testing and re-inspecting.

#### 1.5 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the Commonwealth of Virginia and who is experienced in providing engineering services of the kind indicated.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections.
  1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.6 QUALITY CONTROL

- A. Quality-control services to be provided by the Contractor.
  - 1. Engage a qualified testing agency to perform required quality-control services.
  - 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  - 3. Submit a certified written report, of each quality-control service.
- B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 Submittal Procedures.
- C. Re-testing/Re-inspecting: Provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with COTR and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify COTR and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  - 5. Do not release, revoke, alter, or increase the Contract Document requirements.
  - 6. Do not perform any duties of Contractor.
- E. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION



3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
- B. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

PART 4 - MEASUREMENT AND PAYMENT

- A. There will be no direct payment for work covered in this section. Payment at the Contract unit prices for the various items in the Contract will be full compensation for all work covered by this section.
- B. Measurement and Payment for work associated with Testing Services will be incidental to the respective work being performed.

END OF SECTION 014000

SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation Road and Bridge Specifications, 2020 (VDOT Specifications), Section 203 – Coarse Aggregate, Section 245 – Geosynthetics and Low Permeability Liners, Section 302 – Drainage Structures, and Section 303 – Earthwork.
- C. Virginia Erosion and Sediment Control Handbook (VESCH).
- D. Virginia Stream Restoration and Stabilization Best Management Practices Guide
- E. American Society for Testing and Materials (ASTM)
  - 1. ASTM D4884 Standard Test Method for Strength of Sewn or Bonded Seams of Geotextile

1.2 SUMMARY

- A. Section includes requirements for temporary support facilities, and security and protection facilities including erosion control measures, temporary access, and maintenance of stream flow.
- B. Erosion and Sediment Control measures:
  - 1. Inlet Protection
  - 2. Outlet Protection
  - 3. Temporary Silt Fence
  - 4. Check Dam
  - 5. Temporary Seeding
  - 6. Permanent Seeding
  - 7. Siltation Control Excavation

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated.
- B. Water and Sewer Service from Existing System: Water from Owner's existing system is not available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

#### 1.4 SUBMITTALS

- A. Action Submittal – Temporary Erosion and Sediment Control Work Plan
- B. Prepare in accordance with the latest edition of the Virginia Erosion and Sediment Control Handbook.
- C. Work Plan shall include a narrative discussing erosion and sediment measures for all phases of the work.

#### 1.5 QUALITY ASSURANCE

- A. Comply with the requirements and standards of City of Alexandria and regulatory requirements of authorities having jurisdiction whichever is more stringent.
- B. Comply with Virginia Erosion and Sediment Control Handbook (VESCH).
- C. Comply with Contract Drawings.
- D. Comply with Virginia Stream Restoration and Stabilization Best Management Practices Guide.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Maintenance of Stream Flow: Shall conform to the following.
  - 1. The diversion pump assembly, utilizing one or more pumps, shall have a capacity sufficient to convey the normal stream flow. The Contractor shall determine the required pumping capacity and select the appropriate, reliable, sufficient equipment to accomplish the diversion, including all necessary intake and discharge hoses, pipes, couplings, intake screens, filters, venturis, suction lines, and so forth. Backup pump(s) with capacity sufficient for the normal stream flow shall be on-site and readily available in case of equipment failure.
  - 2. The sandbag diversion dike assembly shall utilize the necessary sandbags, impervious sheeting, and geotextile to effectively isolate the work area.
  - 3. Temporary diversion pipes for storm drain diversions shall utilize polyethylene (PE) plastic drain tube or pipe.

4. The filter bag shall be a nonwoven bag which is sewn with a double needle matching using a high strength thread.

- a. The filter bag seams shall have an average wide width strength per ASTM D4884 as follows:

Filter Bag Style	Test Method	Test Result
A	ASTM D-4884	60 LB/IN
B	ASTM D-4884	100 LB/IN

- b. Each filter bag shall have a fill spout large enough to accommodate a 4" discharge hose and attached straps to secure the hose and prevent pumped water from escaping without being filtered.

- c. The geotextile fabric shall be nonwoven fabric with the following properties:

Properties	Test Method	Units	Nonwoven	
			A	B
Weight	ASTM D-3776	OZ/YD	8	10
Grab Tensile	ASTM D-4632	LBS.	203	250
Puncture	ASTM D-4833	LBS.	130	165
Flow Rate	ASTM D-4491	GAL/MIN/FT2	80	70
Permittivity	ASTM D-4491	SEC.-1	1.5	1.3
Mullen Burst	ASTM D-3786	LBS.IN2	400	550
UV Resistant	ASTM D-4355	%	70	70
AOS % Retained	ASTM D-4751	%	100	100

- d. In lieu of using filter bags for dewatering the work zone, the contractor has the option to utilize Portable Sediment Tanks (PSTs).

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Temporary erosion and sediment controls shall be provided in accordance with City of Alexandria Standards and the VESCH.
- B. Maintenance of Stream Flow shall be constructed in accordance with:
- The work area shall be dewatered using a pump around system as detailed on the Contract Drawings and specified herein.
  - The approved sequence of construction for the project is provided on the Erosion and Sediment Control Plans. The Contractor's project schedule, discussed elsewhere in the Contract Documents, shall address maintenance of stream flow and dewatering practices

coordinated with the work planned for each day and reflect the necessary labor and equipment allocations for daily set up, maintenance, and take-down of the practices if necessary. The Contractor shall only perform the amount of stream work that can be completed and stabilized at the end of the day. The Contractor is advised to address all permit requirements and restrictions, or any revisions thereto, when developing the project schedule.

3. Install filter bag on a flat slope so incoming water flows downhill through the filter bag without creating more erosion. Strap the neck of the filter bag tightly to the discharge hose. To increase the efficiency of filtration, place the bag on an aggregate or hay bale bed to maximize water flow through the surface area of the bag.
4. The filter bag is full when it no longer can efficiently filter sediment or pass water at a reasonable rate. Flow rates will vary depending on the size of the filter bag, the type and amount of sediment discharged into the filter bag, the type of ground, rock or other substance under the bag and the flow rates of 1500 gallons per minute. Use of excessive flow rates or overfilling filter bag with sediment will cause ruptures of the bags or failure of the hose attachment straps.
5. Dispose filter bag in accordance with all federal, state, and local requirements. If allowed, the filter bag may be cut open and the contents seeded after removing visible fabric. Filter bag is strong enough to be lifted with added straps if it must be hauled away (extra option). Off-site disposal may be facilitated by placing the filter bag in the back of a dump truck or flatbed prior to use and allowing the water to drain from the bag in place, thereby dismissing the need to lift the filter bag.

### 3.2 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
  1. Restore damaged improvements to their original condition, as acceptable to City.
- D. This work shall be incidental to construction of related works.

### 3.3 TEMPORARY EROSION AND SEDIMENT CONTROL

- A. Provide temporary erosion and sediment control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties, walkways, and storm drains in accordance with Chapter 3 of the current edition of the VESCH.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sediment controls and restore and stabilize areas disturbed during removal.

PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 303 – Earthwork, for Measurement and Payment.

END OF SECTION 015000

SECTION 015526 – TRAFFIC CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Contract Drawing and general provisions of the Contract.
- B. Manual on Uniform Traffic Control Devices, 2009 or latest edition with Revisions.
- C. Virginia Work Area Protection Manual, Standards and Guidelines, 2011 with latest Revisions.
- D. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 512 – Maintaining Traffic.

1.2 SUMMARY

- A. This Section includes requirements for maintenance of vehicular and pedestrian traffic during construction and the following items.
  - 1. Contractor shall provide all traffic control, traffic transitions and public safety measures in accordance with Virginia Work Area Protection Manual and MUTCD. Contractor will provide at no extra cost to the City any necessary safety provisions required by the City.
  - 2. Provide and maintain ingress and egress to all businesses, residences, roads, and alleys at all times.
  - 3. Contractor must maintain all streets in such a condition that vehicular and pedestrian traffic could be maintained at all times.
  - 4. Contractor must coordinate with the City to establish a temporary detour route for the pedestrian and bicyclist users during the duration of the work. Contractor must erect and maintain a barricade indicating the sidewalk is closed during the duration of the work.
  - 5. No street nor any portion of a street may be closed to traffic (either vehicular or pedestrian) without the approval of the Director of Department of Transportation & Environmental Services.
  - 6. At the time a lane of traffic is closed, Contractor shall furnish at his own expense all barricades, all lights, all flagmen and warning signs deemed necessary by the Director of Department of Transportation & Environmental Services. All of the above must conform to the Virginia Work Area Manual on Uniform Control Devices on Streets and Highways, latest edition.

7. Contractor shall furnish at his own expense all electronic arrows and electronic message signs deemed necessary by the City.
8. Contractor must provide temporary pavement marking and removal if required.
9. The Contractor shall coordinate with Alexandria Transit Company (DASH), Washington Metropolitan Area Transit Authority (WMATA) (Metrobus), Fairfax County (Connector), and any other transit services with existing bus stops along the corridor, that may be impacted by construction, in order to maintain and not interrupt service.
10. Contractor must maintain access at all times for emergency vehicles (fire, rescue and police) to get into any area under repair and to comply with any request of the chief(s) of either or both Departments (Fire and Police) that will assist them to perform their duties.
11. Contractor must furnish to the COTR the name, address and telephone number of some local person who can be contacted after hours if Contractor's services are required for lights, barricades and other services that are the responsibility of Contractor.
12. No City owned signs shall be removed or reinstalled by Contractor. If it is necessary to remove City owned signs, Contractor shall notify the COTR who will arrange for the removal and reinstalling the signs.
13. Contractor must notify the City at least forty-eight (48) hours in advance of beginning the work activities and shall advise the City as the job progresses as to changes in initial traffic requirements and shall immediately notify the City of any change not contemplated in advance or any emergency that may arise which would affect the planned traffic pattern.

### 1.3 SUBMITTALS

- A. The Contractor must submit to the City the complete Traffic Control Plan for approval. The Traffic Control Plan shall include as applicable, but not limited to, the following components:
  1. Phased operations.
  2. Lane, Sidewalk, and Trail Detours.
  3. List of Traffic control devices.
  4. Layout of control devices.
  5. Hours of operation.
  6. Duration of short-term lane closures.
  7. Duration of long-term lane closures.
  8. Duration of long-term sidewalk and trail closures.
  9. Working drawings.



10. Stockpile locations.
11. Staging Areas.
12. Parking spaces required.
13. Temporary bus stop relocations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

- A. See VDOT Specification Section 512 – Maintaining Traffic, as modified herein, for Execution requirements.
- B. Hours of Operation: The construction should take place during the normal construction hours as described in Section 010000 General Requirements. Lane closures will take place between 9:00 AM and 3:30 PM on Time Restricted Streets, or as authorized by the City.
- C. Public Awareness: No less than one week prior to the commencement of construction, night work, lane closures, or any other activity deemed disruptive by the Director of Department of Transportation & Environmental Services, the Contractor shall use Variable Message Signs notifying the public of planned construction activity. At a minimum, the message shall announce the date and time of the planned activity.

PART 4 - MEASUREMENT AND PAYMENT

- A. Traffic control will be measured and shall be paid for as a lump sum cost.
- B. This price shall include, but not be limited to, all necessary labor, materials, equipment, tools, coordination, supplies, and incidentals as may be required to maintain and protect traffic through areas of construction, maintain public and private entrances, protecting the traveling public within the limits of the project and over detours, furnishing, placing, maintaining, replacing, relocating, adjusting, aligning, and removing traffic control devices. Price shall include development of MOT plans, obtaining City permits, construction and removal of detours for vehicular and pedestrian movements, temporary asphalt, temporary pavement marking, and temporary pavement marking removal according to the VWAPM and traffic engineering guidelines and principles.

END OF SECTION 015526

## SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

### PART 1 - GENERAL

- 1.1 All trees and shrubs shall be adequately protected by the Contractor in accordance with the City of Alexandria's Ordinances which governs the protection of trees.
- 1.2 RELATED DOCUMENTS
  - A. Contract Drawings and general provisions of the Contract.
- 1.3 SUMMARY
  - A. This Section includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.
  - B. Tree Protection work shall include, but not be limited to, the following:
    - 1. Layout, installation and maintenance of tree protection devices.
    - 2. Supersonic air tool excavation and exploration.
    - 3. Soil care activities and soil testing.
    - 4. Mulch application.
    - 5. Tree inspections.
    - 6. Pesticide, inoculant, bio-stimulant, chemical applications.
    - 7. Tree and stump removal.
  - C. Tree Removal and Trimming work shall include, but not be limited to, the following:
    - 1. Selective removal of diseased and/or unhealthy trees.
    - 2. Selective removal of healthy trees.
    - 3. Removal and/or selective removal of underbrush.
    - 4. Selective trimming of trees to remain.
- 1.4 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.
- B. Caliper (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.
- C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Contract Drawings.
- D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Contract Drawings.
- E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.
  - 1. Caliper: Diameter of the trunk at 6 inches above the soil for trees up to 6 inches in caliper and diameter at 12 inches above the soil for trees up to 12 inches in caliper.
  - 2. Diameter at Breast Height (DBH): The average trunk diameter at 4.5 feet above the ground on the uphill side of the tree, including duff layer.
  - 3. Damage, General:
    - a. Soil compaction.
    - b. Soil contamination.
    - c. Breakage and or scaring of root system, trunk, limbs, or crown.
    - d. Broken trunk or branch tissue.
    - e. Actions and/or inactions by Contractor's forces resulting in or likely to result in signs of stress including, but not limited to, defoliation, weakness, imbalance, hindered growth, chlorosis, or necrosis, as determined by the COTR.
  - 4. Damage, Limited: Damage that does not produce the results of Significant Damage, and from which the tree is expected to fully recover in one growing season, as determined by the COTR.
  - 5. Damage, Significant: Damage that might reasonably be expected to endanger the long-term health, vigor, and/or form of a tree, as determined by the COTR.
    - a. If contested, Significant Damage shall be assessed by an independent, state-qualified Arborist retained by the City. If Significant Damage is found to have occurred, the Arborist's fees will be charged against the Contractor's fees.
  - 6. Encroachment: Any activity, occurrence, or condition within a Critical Root Zone not specifically approved by the COTR.

7. Root Aeration Matting: Various triple-ply geo-composites consisting of inner permeable layer of high-density polypropylene construction attached to outer layers of non-woven permeable fabric. Typically installed in coordination with Major Fill.
8. Supersonic Air Tool (Airspeed): High speed specialized tool that loosens and removes soil by means of highly compressed air without damaging roots.
9. Supplemental Stress Reduction Measures: Including, but not limited to Cambistat Tree Growth Regulator, Soil Decompaction via Radial Mulching and/or Vertical Mulching, Compost Teas & Humates, supplemental watering, Integrated Pest Management, mulching entire root zones with 3-4 inches of composted mulch.
10. Temporary Construction Matting: Temporary protection for soil structure and roots inside Critical Root Zones from equipment and material loads.
11. Critical Root Zone (CRZ): Prescribed area surrounding individual trees or groups of trees to remain, as indicated by Tree Protection Fencing location and as directed in the field by the COTR, whether Tree Protection Fencing is installed or not.
12. Wheel Saw: 3-inch-wide mechanical trencher, Bobcat model WS24 or equal as approved by COTR.
13. Woven Silt Tube: Three-dimensional tubular sediment control and storm water runoff filtration device typically used for perimeter control of sediment and soluble pollutants, including phosphorus and petroleum hydrocarbons. Specifically designated for use within Critical Root Zones of protected trees to disallow wounding of root system.

#### 1.5 ACTION SUBMITTALS

- A. The Contractor acknowledges its responsibility to submit complete shop drawings and other required submittals. Incomplete submittals will be returned to the Contractor un-reviewed. No time extensions or cost increases will be allowed for delays caused by return of incomplete submittals.
- B. Product Data: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated.
  1. For loose material, provide approximately 1 pint in clear, sealed, heavy duty bags or clear rigid containers. Clearly label each item.
- D. Tree Pruning Schedule: Written schedule from Arborist detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
- E. Qualification Data: For Tree Service Firm and Arborist.
  1. Provide resumes from minimum two Arborists assigned to this project.

2. Provide references from minimum 10 commercial, non-governmental, or governmental projects within the Mid-Atlantic region for whom similar tree preservation programs have been successfully implemented. Include project name, size, number of trees involved, relevant photos, tree preservation budget, scope of services provided, name and contact number for project City, designer, or contractor.
- F. 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.
- G. Provide shop drawings indicating location and extent with dimensions of all Protection measures. Note the location of all of the following inside and/or within 10 feet of any Critical Root Zone:
1. Underground utilities shop drawings with dimensioned locations of transmission lines/pipes/conduits, including temporary power.
  2. Additional sediment and erosion control measures not shown on construction documents and necessary to control sediment and erosion within Critical Root Zones.
- H. Provide Maintenance and Aftercare Recommendations: From Arborist, for care and protection of trees during construction, and for Supplemental Stress Reduction Measures after completing the Work.
- 1.6 QUALITY ASSURANCE
- A. All protection measures shall be performed by, or under the direct on-site supervision of, a Certified Arborist and/or Urban Forester.
- B. Arborist Qualifications: An arborist certified by ISA or licensed in the jurisdiction where Project is located and of 5 years minimum full-time experience in the field of urban forestry and remediation of construction damage and Certification in International Society of Arboriculture (ISA).
- C. Tree Service Firm Qualifications: An experienced, specialized arboricultural firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign at least one experienced, certified Arborist to Project site at all times during execution of protection Work.
- D. Tree Pruning Standard: Comply with ANSI A300 (Part 1) - Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning).
- E. Pre-installation Conference: Conduct conference at Project site.
1. Before Work begins, meet with representatives of authorities having jurisdiction, COTR, consultants, and other concerned entities to review tree protection and trimming procedures and responsibilities.
- F. Coordination of Temporary Tree and Plant Protection: The work of the Arborist includes the following coordination items:

1. Coordinate necessary survey layout of proposed construction elements in order to provide accurate locations for tree protection devices.
2. Layout location of designated tree protection based upon proposed construction and methods of construction for that area.
3. Attend Pre-installation Conference and Preconstruction Walkthrough.
4. Notify COTR if construction adjacent to tree protection does not appear to follow specifications or conflicts with tree protection seem eminent.
5. Coordinate with COTR for access of deliveries, crews, equipment, start up, and cleanup of each item of Work.
6. Provide Record Drawings of any change to tree protection.
7. Attend progress meetings as requested.
8. Provide submittals.
9. Notify COTR of any breach or damage to tree protection.
10. Observe supersonic air tool operation and any work in or near a CRZ.

#### 1.7 FIELD CONDITIONS

- A. The following practices are prohibited within protection zones:
  1. Storage of construction materials, debris, or excavated material.
  2. Moving or 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.
- 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.

#### 1.8 PENALTIES

- A. Warnings and fees to provide replacement trees and/or forest and soil restoration will be assessed for Encroachment into areas Critical Root Zones:
  - 1. Encroachment without Damage:
    - a. First Incident: Verbal warning.
    - b. Second Offense: Written warning.
    - c. Third and succeeding incidents: \$1000.00 per incident.
  - 2. Encroachment with Damage:
    - a. Limited Damage:
      - 1) \$1000.00 per tree.
    - b. Significant Damage:
      - 1) For each tree of less than 3 inches in caliper: \$250.00 per caliper inch.
      - 2) For each tree of 3 inches and greater in caliper: \$1000.00 per caliper inch.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch (63-mm) sieve and not more than 10 percent passing a 3/4-inch (19-mm) sieve.
- B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; 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 more than 1 inch (25 mm) in diameter; and free of weeds, roots, and toxic and other non-soil materials.
  - 1. Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.
- C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.
- D. Mulch, Shredded: Shredded hardwood or ground or shredded bark, free of deleterious materials.
- E. Mulch, Chips: Hardwood chips aged a minimum of 6 months, free of leaves and deleterious materials.

F. Tree Protection Fencing:

1. Posts: Steel T- Bar, heavy duty U-bar fence post, or 2" x 4" lumber, as indicated.
2. Tree Protection Signage: Heavy-duty cardboard signs 12 inches by 18 inches attached to  $\frac{3}{4}$  inch thick exterior grade MDO plywood, or other substrate as recommended by the sign supplier. Sign shall have contrasting background with block letters, 1 inch high.
  - a. Copy: "No Entry, Tree Protection Zone, Fines Imposed" in English. Provide additional copy in Spanish, or in other language, as directed by the COTR.
    - 1) Provide alternative copy if required by jurisdiction having authority.
  - b. Attach signage to the Fencing at interval not to exceed 25 feet on center, minimum 1 sign per fence run.
  - c. Affix to posts with metal wire ties or nuts and bolts.
3. Flagging Tape: 12-inch lengths affixed to the top wire of Fabric at 4 feet on center.
  - a. 1 3/16" wide Fluorescent Lime Green and Reflective Safety striped.

PART 3 - EXECUTION

3.1 GENERAL

- A. Failure to comply with the requirements herein can result in immediate work stoppage and Penalties. All delays and costs incurred to correct non-compliant work and incurred as a result of work stoppage shall be at the Contractor's expense.
- B. No construction activity, including staging and stockpiling shall start until all the Tree Protection measures and procedures are completed, inspected, and approved by the COTR. COTR shall approve the means and methods of all work within the Critical Root Zones prior to commencement of work.

3.2 PROTECTION

- A. Do not store construction materials, debris, or excavated material inside Critical Root Zones. Do not permit vehicles or foot traffic within Critical Root Zones; prevent soil compaction and contamination over root systems.
- B. Protect tree root systems from potential and actual damage caused by runoff, sediment buildup, and erosion. Install Woven Silt Tubes. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Protect tree root systems from potential and actual damage caused by spillage of noxious materials while mixing, placing, or storing construction materials.



- D. Maintain Critical Root Zones free of weeds and trash.
- E. Maintain existing turf and/or ground cover within Critical Root Zones.
- F. Do not allow fires within Critical Root Zones.
- G. Do not allow items identified for demolition to fall into Critical Root Zones.
- H. Do not allow excavation inside the Critical Root Zones, except as specifically authorized by the COTR and by the means indicated herein, including, but not limited to, the following: silt fence, sediment erosion control, root pruning, utilities, site lighting, irrigation, drainage, etc.
- I. Work within the Critical Root Zones, when necessary and approved by the COTR, shall be performed in a manner that avoids Damage and as follows:
  - 1. Provide Temporary Construction Matting for access routes and work areas.
  - 2. Tree branches that interfere with construction may be trimmed to clear final grade by a maximum of 9 feet over sidewalks and 14 feet over pavement. Trimming of all branches and the cutting of roots shall be in accordance with accepted arboricultural practices and be performed by the Arborist.
  - 3. Do not paint tree wounds and cuts with any type of tree paint or other substances.
- J. Any issues which arise during construction that may require relocation of Fencing require prior written approval from the COTR.

### 3.3 PREPARATION

- A. Pre-construction Walkthrough
  - 1. Prior to the start of Work, meet the COTR in the field to review the location of Tree Protection Fencing and Limits of Disturbance. Any potential conflicts between construction and preservation shall be brought to the COTR's attention.
  - 2. Identify the following items' proposed locations inside and/or within 10 feet of Critical Root Zones for inspection and review:
    - a. Tree Protection Fencings.
    - b. Root-pruning.
    - c. Temporary Construction Matting.
    - d. Excavation, tunneling, drilling, access pits.
    - e. Lateral taps.
    - f. Trees to be removed.

- g. Demolition.
  - 3. Identify the following general items' locations for inspection and review:
    - a. Proposed material storage areas.
    - b. Proposed stockpiling areas.
    - c. Proposed concrete washout areas.
    - d. Direction of fall for trees to be removed.
  - 4. Identify all equipment ingress pathways, operation, and egress pathways for inspection and approval by COTR.
    - a. Equipment pathways, equipment standing/operating locations, and temporary spoils location shall avoid Critical Root Zones, except as specifically approved by COTR. Any such activity shall employ approved Temporary Construction Matting.
    - b. Additional vertical clearance required for equipment access shall be reviewed at the pre-construction walkthrough.

### 3.4 TREE PROTECTION FENCING

- A. Install Fencing as indicated on the Contract Drawings and as directed by the COTR to protect remaining trees and vegetation from construction damage.
  - 1. Maintain fences and remove when construction is complete.
  - 2. If fences should become damaged, fall down or are no longer functional, repair or replace the fence the day it is damaged. The Contractor shall assume liability for any Damages that may occur as a result of such conditions.
- B. Mulch areas inside Fencing and other areas indicated and/or directed by the COTR.
  - 1. Apply 6-inch average thickness of organic mulch. Do not place mulch within 6 inches of each tree trunk.

### 3.5 TEMPORARY CONSTRUCTION MATTING

- A. Where construction activity occurs within the Critical Root Zones, provide the following:
  - 1. Install filter fabric on undisturbed grade. Overlap 12 inches at the edges.
  - 2. Install minimum 6-inch depth of Wood Chip Mulch.
  - 3. Apply 3/4-inch exterior grade plywood only where vehicle movement and/or temporary material stockpiling is anticipated. Remove promptly.

4. Protect the trunk of the tree from mechanical damage by banding scrap lumber on to the trunk.
  - a. Do not affix by means of nails, screws, lag bolts, or any other device which penetrates and/or damages the bark.
  - b. If such banding is required to remain for a period greater than four months, check the tension of the bands and loosen them if they become tight to prevent damaging the trunk of the tree.

### 3.6 DEMOLITION

- A. Special demolition procedures inside and within 10 feet of Critical Root Zones shall be as follows:
  1. All demolition completed within the Critical Root Zones shall be completed by a method that prevents any Damage to roots, including soil compaction, located directly beneath or adjacent to the Work.
  2. Operate equipment on top of existing pavements.
  3. Do not pile or load debris adjacent to existing protected trees.
  4. After existing paved surfaces are removed, allow the COTR to inspect and investigate depth and extent of root systems below pavement. Prune surface roots as approved by the COTR.
  5. Backfill demolition areas within Tree Protection Fencing with topsoil. Tamp to fill voids. Do not compact.

### 3.7 EXCAVATION

- A. Install shoring or other protective support systems to minimize sloping or benching of excavations.
- B. Where excavation for new construction within Critical Root Zones is required and authorized by COTR, minimize damage to root systems.
  1. Excavate only by means of supersonic air tool and/or hand excavation to a minimum depth of 18 inches.
    - a. Deeper excavation may proceed mechanically, following Selective Root Removal.
  2. Selective Root Removal: Do not cut main lateral roots or taproots; cut only roots less than 1 inch diameter that interfere with Work, and as approved by COTR.
    - a. Cut roots with sharp, clean pruning instruments; do not break or chop.

3. Where utilities are required within Critical Root Zones, tunnel under or around roots by drilling, auger boring, pipe jacking; or digging by hand. Feed utility lines under existing roots from each end of trench.
4. 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, as approved by COTR.
5. 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.

C. Backfill of Excavation:

1. Use approved site topsoil for the top 18 inches.
2. If site topsoil is not available, approved offsite topsoil mix is to be used.
3. Compaction shall be minimal and not exceed 80%.

3.8 REGRADING

- A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade beyond Critical Root Zones. Maintain existing grades within Critical Root Zones.
  1. Cut tree roots less than 1 inch in diameter exposed during grade lowering. Cut roots with sharp pruning instruments; do not break or chop.
- B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single un-compacted layer and hand grade to required finished grades.
- C. Moderate Fill: Where existing grade is more than 6 inches but less than 12 inches below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:
  1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of finish grade and extend not less than 18 inches from tree trunk on all sides. For balance of Critical Root Zone, place drainage fill up to 6 inches below elevation of grade.
  2. Place filter fabric with edges overlapping 6 inches minimum.
  3. Place fill layer of topsoil to finished grade. Do not compact drainage fill or topsoil. Hand grade to required finished elevations.
- D. Major Fill: Where existing grade is more than 12 inches (300 mm) below elevation of finished grade.

### 3.9 TREE PRUNING

- A. Prune trees to remain that are affected by temporary and permanent construction, as directed by COTR.
- B. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by COTR.
- C. Pruning Standards: Prune trees according to ANSI A300 (Part 1), as follows:
  - 1. Class II: Remove dead, dying, diseased, decayed and broken branches 1 inch in diameter or larger within the crown.
  - 2. Type of Pruning: As indicated.
- D. Cut branches with sharp, clean pruning instruments; do not break or chop.

### 3.10 TREE REPAIR AND REPLACEMENT

- A. Provide COTR reports of damage and recommended remediation on a daily basis as damages occur.
- B. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to Arborist's written instructions.
- C. Remove trees indicated to remain that die or are damaged during construction operations that the COTR determines are incapable of restoring to normal growth pattern.
- D. Additional remedial maintenance activities which may be required in lieu of or in addition to other Penalties, as determined by the COTR, include, but are not limited to, the following:
  - 1. Repair: Crown pruning, root pruning, fertilization, vertical mulching, aeration, soil replacement, soil removal, watering, cabling, and bracing.
  - 2. Replacement: Remove and replace trees indicated to remain that die or are significantly damaged during construction operations that COTR determines are incapable of restoring to normal growth pattern.
    - a. Provide new trees of same size and species as those being replaced; plant and maintain as specified in Section 329300 Plants.
    - b. Provide new trees of 6-inch (150-mm) caliper size and of a species selected by COTR when damaged trees more than 6 inches (150 mm) in caliper size, measured 12 inches (300 mm) above grade, are required to be replaced. Plant and maintain new trees as specified in Section 329300 Plants.
  - 3. Vertically mulch surface soil compacted during construction to 10 feet (3 m) beyond Critical Root Zones. Incorporate granular, liquid bio-stimulant, and microbial inoculants and amendments to rebuild and restore proper balance and composition for healthy, stress resistant root systems.

- a. Means, methods, materials, testing, seasonal applications to be prescribed by the Arborist.

3.11 SITE MAINTENANCE

- A. Keep all traveled areas watered regularly or apply other approved dust control methods to prevent excessive dust accumulation on foliage of trees to be preserved. Contractor will be responsible for all costs associated with the removal of excessive dust from the foliage of trees.

3.12 DISPOSAL OF WASTE MATERIALS

- A. Burning is prohibited.
- B. Disposal: Remove excess excavated material and displaced trees from City's property and dispose of legally.

PART 4 - MEASUREMENT AND PAYMENT

- A. Components of temporary tree and plant protection will not be measured but will be paid on the individual basis, complete-in-place for each tree. The price shall include all labor, materials, equipment, tools and incidentals to maintain and protect the trees and plants.
- B. Tree and stump removal will be measured and paid for in accordance with unit price for each actual number of trees removed as shown on the Contract Drawings. The price shall include all labor, materials, equipment, tools and incidentals necessary to complete the work.

END OF SECTION 015639

## SECTION 017113 - MOBILIZATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 513 – Mobilization.
- B. See Section 012000 Unit Prices for additional measurement and payment information.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Mobilization and Demobilization.

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Refer to the requirements of VDOT Specification Section 513 – Mobilization as amended below.

### PART 4 - MEASUREMENT AND PAYMENT

- A. The bidder's total mobilization bid shall comply with the requirements of the Table below.

Contract Amount		Total Mobilization Payout Limit
More Than	To and Including	
\$0	\$200,000	10% of total contract amount
\$200,000	\$1,000,000	\$20,000 plus 7.5% (of total contract amount minus \$200,000)
\$1,000,000	More	\$80,000 plus 5% (of total contract amount minus \$1,000,000)

- B. No additional payment will be made for demobilization and remobilization because of shutdowns, suspensions of work, or other mobilization activities. When not shown as a pay item, the cost of mobilization shall be included in the price bid for other appropriate items of work. **Exceeding the Total Mobilization Payout Limit shall result in determination of non-responsiveness.**
- C. Payment for Mobilization will be made in two installments. First payment of 50 percent of lump sum will be made following mobilization and initiation of construction work. The second and final payment will be made after 20 percent of Contract work is complete.

END OF SECTION 017113



## SECTION 017700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Inspection procedures.
  - 2. Warranties.
  - 3. Final cleaning.
- B. See Section 010000 General Requirements for submitting Final Completion construction photographs and negatives.
- C. See Section 011100 Execution Requirements for submitting Final Property Survey.
- D. See Section 017839 Project Record Documents for submitting Record Drawings, Record Specifications, and Record Product Data.

#### 1.2 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
  - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - 2. Advise City of pending insurance changeover requirements.
  - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Obtain and submit releases permitting City unrestricted use of the Work and access to services and utilities.
  - 5. Prepare and submit Project Record Documents, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
  - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by City. Label with manufacturer's name and model number where applicable.

7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  8. Submit changeover information related to City's occupancy, use, operation, and maintenance.
  9. Complete final cleaning requirements, including touchup painting.
  10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, COTR will either proceed with inspection or notify Contractor of unfulfilled requirements. COTR will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by COTR, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for Final Completion.

### 1.3 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment.
  2. Submit certified copy of COTR's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by COTR. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, COTR will either proceed with inspection or notify Contractor of unfulfilled requirements. COTR will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

### 1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit digital copy of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

## 1.5 WARRANTIES

- A. Submittal Time: Submit written warranties on request of COTR for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    - a. Clean Project site in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

- d. Remove tools, construction equipment, machinery, and surplus material from Project site.
  - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - f. Remove labels that are not permanent.
  - g. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
  - h. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on City property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

#### PART 4 - MEASUREMENT AND PAYMENT

- A. There will be no direct payment for work covered in this section. Payment at the Contract unit prices for the various items in the Contract will be full compensation for all work covered by this section.

END OF SECTION 017700

## SECTION 017839 - PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Product Data.
  - 2. Record Drawings

#### 1.2 SUBMITTALS

- A. Record Product Data: Submit one copy of each Product Data submittal.
- B. Record Drawings: Submit one copy of As-Built drawings.

### PART 2 - PRODUCTS

#### 2.1 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders and Record Drawings where applicable.

#### 2.2 RECORD DRAWINGS

- A. Record Drawings shall indicate any part of the project that was not built in accordance with the contract documents.

#### 2.3 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

### PART 3 - EXECUTION

#### 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for COTR's reference during normal working hours.

### PART 4 - MEASUREMENT AND PAYMENT

- A. There will be no direct payment for work covered in this section. Payment at the Contract unit prices for the various items in the Contract will be full compensation for all work covered by this section. All documentation shall be completed before final project acceptance.

END OF SECTION 017839

## SECTION 020113 - MAINTENANCE OF UTILITIES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Protecting, supporting, removing supports, and maintaining utilities within, adjacent to, or affected by the Work under this Contract. Utilities shown on the Contract Drawings or encountered in the Work shall be maintained and protected in their locations unless otherwise provided for. Except as modified herein, by other specification sections and on the Contract Drawings, Work shall be in accordance with the Industry Standards.

#### 1.2 SUBMITTALS

- A. Submit in accordance with Section 013300 Submittal Procedures.
- B. Submit Working Drawings.
  - 1. Working drawings shall include schedules, the actual location of existing and rearranged utility services, interferences which these facilities present to the new Work, details of the proposed temporary support systems for those facilities designated on the Contract Drawings, or where required to be supported, and method of procedure.
  - 2. Submit all working drawings through the COTR for utilities owners to review and approve.
  - 3. No Work shall be started until the COTR and the utility owners have given their written approvals.
  - 4. The methods of temporary support of various facilities, if indicated, are suggestions only and the requirements of the utility owner shall apply.
- C. Submit copies of all notices to utilities, to the COTR.

#### 1.3 JOB-SITE CONDITIONS

- A. Within the limits of and adjacent to the Project, there are known to exist public and private utilities in the form of sanitary sewers, storm sewers, aerial power lines, aerial and underground cable television facilities, aerial and underground communications lines, aerial telephone lines, aerial and underground traffic signal lines, street lighting systems, gas mains, water mains, and fire hydrants. The Contract Drawings indicate the known existing utilities in their approximate locations and the rearrangement of these utilities. The Contractor is, however, cautioned that these locations are approximate; there is no guarantee that all existing utility facilities within the limits of the Project have been shown on the Contract Drawings. It shall be the Contractor's responsibility to coordinate with the utility owners to determine the actual location of their existing and proposed facilities. The location of utility facilities as indicated does not relieve the

Contractor of his obligation of coordinating all Work affecting the facilities with the utility owners involved.

- B. The Contractor shall alert all utility owners by notifying Virginia 811 (VA811) by calling 811 or 1-800-552-7001 at least 48 hours but no more than 10 working days in advance of work before performing excavation of any segment of the construction site. Contractor shall cooperate with the owners in protecting their facilities or property during construction operations. Each utility owner will mark the facility locations in accordance with Virginia Law to ensure the safety of the facilities.
- C. The Contractor shall immediately notify the affected utility owner and the COTR of damage to any utility facility. Repairs shall be made by the utility owner at the Contractor's expense for damage caused by the Contractor's operations.
- D. Existing manhole frame and covers, valves and valve boxes, junction boxes, curb cocks, and water meter boxes and other utility appurtenances shall be adjusted where necessary in accordance with Contract Drawings.
- E. Work shall not be started until the COTR and the utilities owner have given their approval in writing.

#### 1.4 REARRANGEMENT OF UTILITY FACILITIES BY OTHERS

- A. Rearrangement of existing communications lines, gas mains, electrical, and water pipes will be performed by their owners in close coordination with the Work specified in this Contract. For rearrangement of facilities by owners that will be performed in conjunction with Work included in this Project, the Contractor shall give the owners as much advance written notice, as possible, of the Work schedule. In no event shall written notice to the utility owners be less than 14 days prior to the Contractor's scheduled commencement of the Work. However, it is not guaranteed that rearrangements will be started or completed at the end of the minimum notice period.
- B. Where the above utilities or their appurtenances interface with permanent construction, the Work involved in permanently relocating or otherwise altering such utilities and their appurtenances will be done by the utility owners except where specified otherwise. If the Contractor wishes to have any utilities temporarily or permanently relocated for his own convenience, he shall make the necessary arrangements with the utility owners and reimburse them at his own expense for the cost of the Work. The Contractor shall not move any utility structures without written consent of the utility owner, and upon completion of the Work, the utility shall be as safe and permanent as before starting any Work.
- C. The Contractor shall permit the utility owners and personnel engaged by them access to the site of the Work at all times, in order to relocate or inspect their facilities, and the Contractor shall cooperate with them in performing this Work.

#### 1.5 CONTINUITY OF SERVICE

- A. The Contractor shall be responsible for the continuity of service and shall maintain, in safe and satisfactory operating condition, all overhead, surface, or subsurface utilities affected by his operations. The provision of this Article shall be construed to apply equally to and refer to facilities owned by the City, public utilities, or private owners.



- B. The Contractor may be required to install temporary utilities to maintain continuity of service and to satisfy the requirements of construction scheduling and to complete the Project. The Contractor shall prepare working drawings for temporary facilities and submit drawings for approval in accordance with Section 013300 Submittal Procedures. Temporary utilities shall have the same functional capacity as the existing utilities to be maintained. Installation of temporary utilities shall be in accordance with the requirements of the applicable Specifications sections.

## PART 2 - PRODUCTS

- 2.1 MATERIALS: Unless otherwise specified, materials shall conform to the requirements of the respective Sections of the Specifications for each system to which materials pertain.

## PART 3 - EXECUTION

### 3.1 EXISTING SUBSURFACE STRUCTURES AND FACILITIES

- A. Determine positions of existing subsurface structures before the Work in the vicinity of those structures begins. Work shall be performed without damage to existing subsurface structures and facilities indicated to remain or to be abandoned and remain in service until rearrangement has been completed.

### 3.2 SANITARY AND STORM SEWERS

- A. Service for active sewers, building connections, and laterals shall be maintained in an operating condition and in a closed system at all times. Take adequate precautions and safety measures to avoid flooding during storms and to avert dangers from sudden increase in flows for any reason that might clog, damage, or interfere with normal operations. Discharge of storm water sediment and construction generated sediment into the sanitary sewer systems and flow of wastewater contaminants across surfaces of streets, property, into open excavations, or other natural or man-made systems shall not be permitted.
- B. Existing sanitary service lines shall be connected to new and relocated sanitary sewers where and when required. Wye or tee fittings of the sizes required at each location shall be used. Provide additional lengths of service line pipe to make connections. It shall be the Contractors responsibility to determine the location of all encountered service lines. The Work shall be performed as prescribed by the City.
- C. Replace or repair Contractor's damaged active sewer building connection, or lateral not requiring replacement, as required by the City with no additional compensation.
- D. Provide temporary sanitary and storm drainage sewer facilities and supports necessitated by the construction where required. Design temporary sanitary and storm drainage sewer facilities and supports, and construct in accordance with working drawings approved by the COTR. Working drawings shall conform to the requirements of Section 013300 Submittal Procedures. Furnish, install, maintain and ultimately remove the temporary sanitary and storm drainage sewer

facilities. Furnish and install new sanitary and storm sewer facilities at the proper line and grade as indicated or required.

### 3.3 WATER MAINS

- A. The Contractor shall be responsible for maintaining in service the continuity of all the existing water mains and for the temporary support and protection of these facilities during his operations unless otherwise indicated.
- B. Details for supporting water mains during construction must be approved in writing by American Water before excavation.
- C. Except as otherwise indicated, American Water shall perform Work in connection with the relocation, removal, and replacement and construction of new permanent and temporary water mains as indicated.
- D. The Contractor shall perform Work in connection with the relocation, removal, and replacement and construction of new permanent and temporary hydrants and service connections as indicated. The Contractor's work shall conform to ANSI/AWWA C600 and the latest American Water standards and specifications.
- E. Operation of water valves and fire hydrants on functional lines shall be solely by American Water. Notify American Water 14 days before valves and hydrants will be required to be operated.

### 3.4 ELECTRICAL DISTRIBUTION AND SERVICES

- A. The Contractor shall be responsible for maintaining the continuity of the existing facilities and for the temporary support and protection of Dominion Energy Virginia and City facilities during his operations.
- B. Except as otherwise indicated, Dominion Energy Virginia will perform all Work in connection with the relocation, removal, replacement, and construction of its permanent and temporary electric facilities, and BRT station and traffic signal service connections. Where electric lines are to be abandoned or taken out of service, Dominion Energy Virginia will disconnect the lines, and services therefrom, and remove cables prior to any Work by the Contractor.

### 3.5 GAS MAINS AND SERVICES

- A. The Contractor shall be responsible for supporting and maintaining the continuity of the existing facilities and for the temporary support and protection of Washington Gas facilities during his operations.
- B. Except as otherwise indicated, Washington Gas will perform all Work in connection with the relocation, removal, replacement, and construction of permanent and temporary gas mains and service connections. Washington Gas will disconnect gas mains to be taken out of service or abandoned, the mains and services therefrom and cap the mains to remain, prior to any removal Work by the Contractor. Washington Gas will supervise removal of temporary supports from its facilities and placing of backfill around and over its facilities.

### 3.6 COMMUNICATION FACILITIES AND SERVICES

- A. The Contractor shall be responsible for maintaining the continuity of the existing facilities and for the temporary support and protection of the communications utility facilities during his operations including but not limited to Comcast, Verizon, City of Alexandria fiber, and others as directed by the City.
- B. Except as otherwise indicated, the franchise communications utility will perform all Work in connection with the relocation, removal, replacement, and construction of permanent and temporary communication facilities and building service connections. The franchise communications utility will disconnect communication lines to be abandoned or taken out of service, the lines, and services therefrom, and remove cables prior to any Work by the Contractor.
- C. The Contractor shall perform Work in connection with the relocation, removal, replacement, and construction of permanent and temporary City of Alexandria communications as indicated on the Contract Drawings.

### 3.7 STREETLIGHTS

- A. The Contractor shall be responsible for maintaining the continuity of the existing facilities and for the temporary support and protection of Dominion Energy Virginia and City facilities during his operations.
- B. Except as otherwise indicated, Dominion Energy Virginia will perform all Work in connection with the relocation, removal, replacement, and construction of its permanent and temporary streetlights. Where streetlights are to be abandoned or taken out of service, Dominion Energy Virginia will disconnect the lines, and services therefrom, and remove cables prior to any Work by the Contractor.

### PART 4 - MEASUREMENT AND PAYMENT

- A. The Work of this Section will not be measured for payment. The Work of this Section will be incidental to the work being performed.

END OF SECTION 020113

SECTION 022100 – SURVEYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 517 – Contractor Construction Surveying.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Construction Surveying

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to the requirements of VDOT Specification 517 – Contractor Construction Surveying.

PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification of VDOT Specification 517 – Contractor Construction Surveying, for measurement and payment.

END OF SECTION 022100

## SECTION 024113 – PAVING REMOVAL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 508 – Demolition of Pavement and Obscuring Roadway, Section 510 – Relocating or Modifying Existing Miscellaneous Items, and Section 515 – Planing or Milling Pavement.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Removal of existing pavement which includes:
    - a. Remove Existing Sidewalk.
    - b. Remove Existing Curb and Gutter
    - c. Remove Existing Curb.
    - d. Remove Existing Coping Curb.
    - e. Remove Existing Asphalt Pavement.
    - f. Remove Existing Concrete Pavement.
    - g. Remove Existing Concrete Entrance & Apron.
- B. Related Requirements:
  - 1. Section 020113 Maintenance of Utilities for protection of existing utilities encountered above- and below-grade of site improvements not part of pavement removal.
  - 2. Section 311000 Site Clearing for site clearing and removal of above- and below-grade site improvements not part of pavement removal.

#### 1.3 DEFINITIONS

- A. Remove: Demolish and detach items from existing construction and dispose of off-site.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to the City that may be uncovered during demolition remain the property of the City.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to the City.

1.5 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

1.6 CLOSEOUT SUBMITTALS

- A. Inventory: If applicable, submit a list of items that have been salvaged as per Closeout procedure.

1.7 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of City.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

1.8 FIELD CONDITIONS

- A. Hazardous Materials: **It is not expected that hazardous materials will be encountered in the Work.**
  - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the City.
- B. On-site storage or sale of removed items or materials is not permitted.

1.9 COORDINATION

- A. Coordinate demolition schedule with Section 015526 Traffic Control.

PART 2 - PRODUCTS

2.1 SOIL MATERIAL

- A. Satisfactory Soils: Comply with requirements in Section 312000 Earth Moving.

PART 3 - EXECUTION

3.1 GENERAL

- A. The extent of the demolition is shown on the Contract Drawings. Removal of existing sidewalk shall consist of removal of brick or concrete sidewalk, and if present, concrete base beneath the brick sidewalk.
- B. Site Access and Temporary Controls: Conduct demolition activities and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from the City and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways and/or traffic control if required by authorities having jurisdiction.
  - 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

### 3.2 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction provided by the City. The City 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.

### 3.3 PREPARATION

- A. Existing Utilities: Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

### 3.4 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain entrances and exits from existing buildings.
- B. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
  - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by the City and authorities having jurisdiction.
  - 2. Provide temporary services during interruptions to existing utilities, as acceptable to the City and authorities having jurisdiction.
- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated.
  - 1. Protect adjacent buildings and facilities from damage due to demolition activities.

2. Protect existing site improvements, appurtenances, and landscaping to remain.
  3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain as indicated on the Contract Drawings prior to demolition activities.
  4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  5. Provide protection to ensure safe passage of people around demolition area and to and from occupied portions of adjacent buildings and structures.
  6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to demolition operations.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

### 3.5 SAW CUTTING

- A. Saw cutting shall be performed so that pavement designated to remain shall not be damaged. Saw cutting shall extend to the full depth of pavement. Cut lines shall be vertical.
- B. All Saw cutting and demolition shall include water for dust suppression. Inlets shall be protected, and slurry shall not enter the storm inlet. Waste materials must be collected using dry techniques (Shovel, Broom, etc.) and not washed down the inlets.

### 3.6 DUST AND NOISE CONTROL

- A. Take all measures necessary to minimize the amount of dust and noise resulting from demolition activity. Refer to VDOT Specification Section 511.

### 3.7 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Below-Grade Areas: Completely fill below-grade areas and voids resulting from pavement demolition operations with satisfactory soil materials according to backfill requirements in Section 312000 Earth Moving.
- C. 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.

### 3.8 REPAIRS

- A. Promptly repair damage to adjacent facilities caused by demolition operations in accordance with VDOT pavement open cuts Land Use Permit for Northern Virginia (LUP-OC NOVA).



3.9 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction.
  - 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.
  - 3. Do not burn demolished materials.

3.10 CLEANING

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

PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 508 – Demolition of Pavement and Obscuring Roadway, Section 510 – Relocating or Modifying Existing Miscellaneous Items, and Section 515 – Planing or Milling Pavement, for measurement and payment.
  - 1. The Specifications shall be amended to include the following:
    - a. Removal of concrete sidewalks and pedestrian ramps
    - b. Removal of combination curb and gutter, curb, and coping curb
    - c. Removal of concrete entrance and aprons
- B. Payment shall include full compensation for all labor, materials, equipment, and incidentals necessary for sawcut, breaking, removal, and disposal of removal items.
  - 1. Removal of Concrete Sidewalk and Pedestrian Ramps shall be measured and paid for at contract unit price per square yard.
  - 2. Removal of Combination Curb and Gutter, Curb, and Coping Curb shall be measured and paid for at contract unit price per linear foot, measured along the face of curb.
  - 3. Removal of concrete entrances and aprons shall be measured and paid for at contract unit price per square yard and includes full depth removal.
  - 4. Sawcut is considered incidental to the cost of removal and will not be measured for payment.

END OF SECTION 024113

## SECTION 024119 - SELECTIVE DEMOLITION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 508 – Demolition of Pavement and Obscuring Roadway, and Section 510 – Relocating or Modifying Existing Miscellaneous Items.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Abandoning in-place or removal of below-grade construction.
  - 2. Demolition and removal of selected portions of structure.
  - 3. Demolition and removal of selected site elements.
  - 4. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
  - 1. Section 020113 Maintenance of Utilities for protection of existing utilities encountered above- and below-grade of site improvements not part of selective demolition.
  - 2. Section 311000 Site Clearing for site clearing and removal of above- and below-grade improvements not part of selective demolition.

#### 1.3 DEFINITIONS

- A. Remove: Demolish items as necessary and detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to the City ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

#### 1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to City that may be uncovered during demolition remain the property of the City.
  - 1. Carefully salvage in a manner to prevent damage and promptly return to the City.

#### 1.5 PREINSTALLATION MEETINGS

- A. Pre-demolition Conference: Conduct conference at Project site
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review structural load limitations of existing structure.
  - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review and finalize protection requirements.
  - 5. Review procedures for noise control and dust control, and erosion and sediment control.
  - 6. Review procedures for protection of adjacent buildings and vegetation.
  - 7. Review items to be salvaged and returned to the City.
  - 8. Review traffic controls.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection for dust control and for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
  - 2. Temporary interruption of utility services. Indicate how long utility services will be interrupted.

3. Coordination for shutoff, capping, and continuation of utility services.

- C. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Submit before Work begins.
- D. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

#### 1.8 FIELD CONDITIONS

- A. Notify the City of discrepancies between existing conditions and Contract Drawings before proceeding with selective demolition.
- B. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify City.
- C. Storage or sale of removed items or materials on-site is not permitted.
- D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.
- E. Signs: Salvage educational and regulatory signs, including posts, frames and hardware. Store signs at Contractor's facility as approved by the City or as directed. Concrete footings shall not be salvaged. Provide an inventory of signs salvaged with photos. Photos must be taken prior to removal.

#### 1.9 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

#### 1.10 COORDINATION

- A. Coordinate demolition schedule with Section 015526 Traffic Control.

- B. Arrange demolition schedule so as not to interfere with the City's on-site operations or operations of adjacent occupied buildings, roadways, and sidewalk.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing authorities notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by the City. The City does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Perform an engineering survey of condition of building, bridges, culvert, and roadway to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during demolition operations.
- D. Verify that hazardous materials have been remediated before proceeding with demolition operations.
- E. Inventory and record the condition of items to be removed and salvaged.

### 3.2 PREPARATION

- A. Salvaged Items: Comply with the following:
  - 1. Clean salvaged items of dirt and demolition debris.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until delivery to City.
  - 4. Transport items to storage area designated by City.
  - 5. Protect items from damage during transport and storage.

### 3.3 PROTECTION

- A. Existing Facilities: Maintain sidewalks, roadway throughways, and entrances and exits.
- B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of demolition.
- C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations as stated in Section 020113.
  - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by the City and authorities having jurisdiction.
  - 2. Provide temporary services during interruptions to existing utilities, as acceptable to the City and authorities having jurisdiction.
  - 3. Provide at least 48 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated.
  - 1. Protect adjacent buildings and facilities from damage due to demolition activities.
  - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
  - 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
  - 4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 5. Provide protection to ensure safe passage of people around demolition area and to and from occupied portions of adjacent buildings and structures.
  - 6. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings, public walkways, and public Right of Way.
- E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

### 3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish indicated site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
  2. Maintain fire watch during and for at least 4 hours after flame-cutting operations.
  3. Maintain adequate ventilation when using cutting torches.
  4. Locate demolition equipment and remove debris and materials so as not to impose excessive loads on adjacent structures, slopes, supporting walls, or facilities.
  5. Begin demolition only after Temporary Protection and dust control plan and control measures have been established and accepted by the City.
  6. When removing or relocating lighting structures, ensure electrical service is disconnected prior to demolition. Demolition shall include foundations.
- B. Site Access and Temporary Controls: Conduct demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from the City and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
  2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- C. Explosives: Use of explosives is not permitted.
- 3.5 DEMOLITION BY MECHANICAL MEANS
- A. Contractor must be responsible for all Means and Methods.
- B. Below-Grade Construction: Demolish foundations and other below-grade construction that are within footprint of new construction and extending 5 feet outside footprint indicated for new construction. Abandon below-grade construction outside this area.
1. Remove below-grade construction, including foundations and footings, completely to at least 12 inches below bottom of foundations and/or footings.
- 3.6 SAW CUTTING
- A. All Saw cutting and demolition shall include water for dust suppression. Inlets shall be protected, and slurry shall not enter the storm inlet. Waste materials must be collected using dry techniques (Shovel, Broom, etc.) and not washed down the inlets.
- 3.7 DUST AND NOISE CONTROL

- A. Take all measures necessary to minimize the amount of dust and noise resulting from demolition activity. Refer to VDOT Specification Section 511 – Allaying Dust and Section 010000 – General Requirements.

### 3.8 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.

### 3.9 REPAIRS

- A. Promptly repair damage to adjacent buildings, structures, and infrastructure caused by the Contractor. Costs for damages to adjacent buildings, structures, infrastructure, and other items not part of the contract documents, shall be at the Contractor's sole expense.

### 3.10 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
  - 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. Do not burn demolished materials.

### 3.11 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before building demolition operations began.
  - 1. Clean roadways of debris caused by debris transport.



PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 508 – Demolition of Pavement and Obscuring Roadway, and Section 510 – Relocating or Modifying Existing Miscellaneous Items, for Measurement and Payment.

END OF SECTION 024119

SECTION 026000 – CONTAMINATED SITE MATERIAL REMOVAL

Reserved for future use, as applicable.

SECTION 031520 – POST-INSTALLED CONCRETE AND MASONRY ANCHORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. American Concrete Institute (ACI)
  - 1. 318 Building Code Requirements for Structural Concrete
  - 2. 355.2 Standard for Evaluating the Performance of Post-Installed Mechanical Anchors in Concrete
- C. ASTM International
  - 1. A36 Carbon Structural Steel
  - 2. A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - 3. A193 Alloy-Steel and Stainless Steel Bolting for High-Temperature or High Pressure Service and Other Special Applications
  - 4. A307 Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength
  - 5. A510 General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel and Alloy Steel
  - 6. A615 Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
  - 7. A706 Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
  - 8. B633 Electrodeposited Coatings of Zinc on Iron and Steel
  - 9. B695 Coatings of Zinc Mechanically Deposited on Iron and Steel
  - 10. C881 Epoxy-Resin-Base Bonding Systems for Concrete
  - 11. F1554 Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
- D. Federal Specifications (FS): A-A-1923A, Shield Expansion (Lag, Machine and Externally Threaded Wedge
- E. International Code Council - Evaluation Service (ICC-ES)

1. AC01 Acceptance Criteria for Expansion Anchors in Masonry Elements
2. AC58 Acceptance Criteria for Adhesive Anchors in Masonry Elements
3. AC70 Acceptance Criteria for Fasteners Power-Driven into Concrete, Steel, and Masonry Elements
4. AC106 Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements
5. AC193 Acceptance Criteria for Mechanical Anchors in Concrete Elements
6. AC308 Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

F. Underwriters' Laboratories, Inc (UL)

G. Factory Mutual Global (FMG)

## 1.2 SUMMARY

- A. Requirements pertaining to post-installed anchors for materials and equipment. This Section pertains to all other Sections of these Specifications that require post-installed anchors, unless specified otherwise.

## 1.3 SUBMITTALS

- A. Product Data: Submit data for proprietary materials, manufacturer's specifications (including finishes and/or materials), and installation procedures.
- B. Test Reports: ICC-ES listings and performance data that includes recommended loading for each application.

## 1.4 QUALITY ASSURANCE

- A. Post-Installed anchors and related materials shall be listed by one or more of the following agencies, as applicable:
1. ICC-ES
  2. UL
  3. FMG
- B. Materials and workmanship shall comply with the applicable requirements of the codes and standards listed in Article 1.5 of this Section.

## 1.5 SUBSTITUTIONS

- A. Only manufacturers with an ICC-ES listing will be considered for substitution requests.

1. Contractor shall submit for COTR review, calculations that are prepared and sealed by a registered Professional Engineer licensed in the Commonwealth of Virginia demonstrating that the substituted product is capable of achieving the pertinent equivalent performance values of the specified product using the appropriate design procedure and/or standard(s) as required by ACI 318 Building Code.
2. The calculations shall specify the diameter and embedment depth of the substituted product. Any increase in material costs for such submittal shall be the responsibility of the Contractor.

## PART 2 - PRODUCTS

### 2.1 ADHESIVE ANCHORS

- A. An adhesive anchor shall consist of an insert and an adhesive formula. Inserts shall meet the requirements of ASTM A307, A36, A193 Grade B7, or F1554 for threaded rods or ASTM A615 or A706 for rebar. For exterior exposure the threaded insert shall be stainless steel or zinc coated carbon steel. The zinc coating shall be either hot dipped in accordance with ASTM A153 Class C or D; mechanically deposited in accordance with ASTM B695, Class 65, Type I; or demonstrated through tests to be equivalent to the coatings previously described. The adhesive formula shall be one of the following:
  1. Concrete Anchoring Adhesives: Anchors used to transmit load between structural elements and/or from life safety-related attachments shall be designed in accordance with ACI 318 Appendix D as amended by the specific design provisions of ICC-ES AC308. Adhesives shall be a cartridge type, two-component, high solids epoxy based system dispensed and mixed through a static mixing nozzle supplied by the manufacturer. The adhesive shall meet the minimum requirements of ASTM C881 Type I and IV, Grade 3, Class C. Acceptable installation and performance temperature ranges shall be verified with manufacturer's literature prior to installation.
    - a. Epoxy adhesives shall have an evaluation report issued by ICC-ES and have been tested and qualified for use in cracked and uncracked concrete in accordance with ICC-ES AC308 for all mandatory tests and including the following:
      - 1) Seismic tension and shear in cracked concrete
      - 2) Static and cyclic cracks
      - 3) Horizontal and overhead installations
      - 4) Long term creep at elevated temperatures
      - 5) Damp holes
      - 6) Freeze-thaw conditions

- 7) Critical and minimum edge distance and spacing
  - 8) Unless otherwise noted, cracked concrete epoxy adhesives shall be:
    - a) “SET-XP” (ICC-ES ESR-2508) by Simpson Strong-Tie.
    - b) Accepted equivalent, see Article 1.8 of this Section.
2. Masonry Anchoring Adhesives: Adhesive shall be a cartridge type, two-component system dispensed and mixed through a static mixing nozzle supplied by the manufacturer. The adhesive shall meet the minimum physical requirements of ASTM C881 Type I and IV, Grade 3, Class A, B and C. Acceptable installation and performance temperature ranges shall be verified with manufacturer’s literature prior to installation.
- a. Acrylic adhesives shall have an evaluation report issued by ICC-ES and have been tested in accordance with ICC-ES AC58 for all mandatory tests and including the following:
    - 1) Seismic tension and shear
    - 2) Long term creep at elevated temperatures
    - 3) Static loading at elevated temperatures
    - 4) Damp and water-filled holes
    - 5) Freeze-thaw conditions
    - 6) Critical and minimum edge distance and spacing
  - b. Unless otherwise noted, masonry anchoring adhesives shall be:
    - 1) “Acrylic-Tie Adhesive” (AT) (ICC-ES ER-5791) by Simpson Strong-Tie
    - 2) “SET Epoxy-Tie High-Strength Adhesive” (SET) (ICC-ES ESR-1772) by Simpson Strong-Tie.
    - 3) Accepted equivalent, see Article 1.8 of this Section.

**B. LIMITATIONS:**

1. Installation Temperature: When the base material temperature drops below 40-degrees F (5-degrees C), only Acrylic or Encapsulated Adhesives shall be used for adhesive installations. See manufacturer’s instructions for additional minimum temperature requirements.
2. Hollow Substrates: The adhesive manufacturer’s screen tubes shall be used for adhesive installations into hollow substrate material. Encapsulated Adhesives shall not be used in hollow substrate applications.

3. Moisture: Encapsulated Adhesives shall not be used when moisture is present in or around hole.
  4. Oversized Holes: Refer to manufacturer's information if drilled hole size is larger than what is recommended.
  5. Core-drilled holes: Refer to manufacturer's information if holes are drilled with a core-drill bit.
- C. ANCHOR SIZES: The anchor size (nominal diameter and embedment depth) shall be as indicated on the Contract Drawings. If not indicated on the Contract Drawings, sizes shall be provided as required to maintain not less than the appropriate Code safety factors over manufacturer's performance load tables. If the actual concrete compressive strength is not known, the compressive strength shall be determined through testing.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Installation of anchors shall be in strict accordance with the manufacturer's written instructions. Where manufacturer recommends use of special tools for installation of anchors, such tools shall be used, unless otherwise permitted specifically by the COTR.
- B. Where holes are drilled in concrete or masonry, holes shall be accurately and squarely drilled, and the holes shall be cleaned in accordance with the manufacturer's recommendations.

#### 3.2 FIELD QUALITY CONTROL

- A. Special Inspection, periodic or continuous, of post-installed anchors shall be provided as required by ICC-ES evaluation reports and/or as specified by the COTR. This service shall be performed by personnel independent of the Manufacturer or Contractor so as to prevent a conflict of interest.
- B. The City may require pullout or shear tests, in addition to Special Inspection, to determine the adequacy of anchors. A field testing program shall be established by the independent test laboratory and/or City and performed in accordance with appropriate ASTM test standards. Field tests shall be non-destructive whenever possible.

### PART 4 - MEASUREMENT AND PAYMENT

- A. The Work of this Section will not be measured for payment. The Work of this Section will be paid for as a part of the Contract unit price per items being anchored.

END OF SECTION 031520

## SECTION 033000 – CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 207 – Select Material, Section 208 – Subbase and Aggregate Base Material, Section 212 – Joint Materials, Section 217 – Hydraulic Cement Concrete, Section 223 – Steel Reinforcement, Section 316 – Hydraulic Cement Concrete Pavement, Section 404 – Hydraulic Cement Concrete Operations, Section 406 – Reinforcing Steel, Section 502 – Incidental Concrete Items, Section 504 – Sidewalks, Steps, and Handrails, Section 506 – Retaining Walls, Section 510 – Relocating or Modifying Existing Miscellaneous Items, and Section 700 – General.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).
- D. Virginia Department of Transportation Structure and Bridge Division – Instruction and Informational Memorandum on Corrosion Resistant Reinforcing Steels (CRR) – IIM-S&B-81.8, and Supplemental Section 406 – Reinforcing Steel or latest technical guidance.
- E. City of Alexandria Design and Construction Standards, latest edition.
- F. City of Alexandria, Department of Transportation & Environmental Services, Standard Details for Construction, 2022 (City Standards Details).

#### 1.2 REFERENCES

- A. AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing.
- B. Concrete Reinforcing Steel Institute (CRSI) design guide(s) for concrete structures.
- C. National Ready Mixed Concrete Association (NRMCA), research & engineering documentation and certifications.
- D. Portland Cement Association (PCA), Design and Control of Concrete Mixtures, current edition.

#### 1.3 SUMMARY

- A. This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Standard and Radial Combination Concrete Curb and Gutter, CSCG-1



2. Standard and Radial Concrete Coping Curb, CSCG-1
3. Standard and Modified Hydraulic Cement Concrete Sidewalk
4. Hydraulic Cement Concrete for Station Platform
5. Detectable Warning Surface, CG-12
6. Retaining Wall, RW-2 and RW-3
7. Concrete Footings for Handrails, Guardrails and Wooden Barriers
8. Continuous Reinforced Hydraulic Cement Concrete Pavement 10" (Bus Pad)
9. Median Strip, MS-1A and MS-2
10. Concrete Median Barrier
11. Concrete Sanitary Sewer and Storm Structures (Manholes and Pipes) – Repairs Only
12. Light Pole and Traffic Signal Foundations
13. Traffic Signal Cabinet Foundations
14. Junction Box and Handholes Collars
15. Manholes or Vault Concrete Collars

B. Related Requirements:

1. Section 312000 Earth Moving for execution of excavation, backfill procedures, and compaction standards for structural stability.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: At the request of the City, conduct conference at the Project site or an alternative location with prior approval of the City. Digitally hosted preinstallation conferences are acceptable with approval.

1. Review methods and procedures related to concrete maintenance including, but not limited to the following:
  - a. Verify concrete-maintenance specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
  - b. Materials, material application, sequencing, tolerances, and required clearances.
  - c. Quality-control program.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, chemical composition, physical properties, test data, mixing, preparation, and application instructions.
2. Any existing/proposed manhole covers located within an accessible route shall be stable, firm, and slip resistant. Manhole covers located within the detectable warning surface of curb ramps shall contain an ADA compliant detectable warning surface.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For concrete-maintenance specialist and manufacturers.
- B. Material Certificates: For each type of cement aggregate supplied for mixing or adding to products at Project site.
- C. Product Test Reports: For each product indicated as is necessary to confirm and ensure compliance.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  1. A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
  2. The manufacturer shall be in accordance with handling, blending and mixing operations in accordance with Sections 207 and 208 of the VDOT Road and Bridge Specifications. The manufacturer is responsible for having a Certified Central Mix Aggregate Technician (as outlined in Section 308.05(a) of VDOT Road and Bridge Specifications) and documenting results and maintaining quality control.
  3. The City may conduct random requests for copies of reports and documentation from the manufacturer for City projects.
  4. The manufacturer shall conform to the quality standards of AASHTO Materials Reference Laboratory (AMRL) and the Cement and Concrete Reference Laboratories (CCRL).
- B. BACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- C. Testing and Inspecting: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.
- B. Store cementitious materials off the ground, under cover, and in a dry location.

- C. Store aggregates covered and in a dry location; maintain grading and other required characteristics and prevent contamination.

#### 1.9 FIELD CONDITIONS

- A. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.
  - 1. Use only Class A epoxies when substrate temperatures are below or are expected to go below 40 deg F within eight hours.
  - 2. Use only Class A or B epoxies when substrate temperatures are below or are expected to go below 60 deg F within eight hours.
  - 3. Use only Class C epoxies when substrate temperatures are above and are expected to stay above 60 deg F for eight hours.
- B. Cold-Weather Requirements for Cementitious Materials: Comply with the following procedures:
  - 1. When air temperature is below 40 deg F, heat patching-material ingredients and existing concrete to produce temperatures between 40 and 90 deg F.
  - 2. When mean daily air temperature is between 25 and 40 deg F, cover completed Work with weather-resistant insulating blankets for 48 hours after repair or provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after repair.
  - 3. When mean daily air temperature is below 25 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after repair.
- C. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 deg F and above.
- D. Environmental Limitations for High-Molecular-Weight Methacrylate Sealers: Do not apply when concrete surface temperature is below 55 deg F or above 75 deg F. Apply only to substrates that have been dry for at least 72 hours.
- E. Working drawings and specifications for concrete structures shall provide such detail as required for the successful prosecution of the work and which are not standard drawings provided by the Virginia Department of Transportation or City Standards. Drawings and specifications shall include at minimum; reinforcement details and calculation, bracing, falsework, masonry, layout diagrams, and other details needed for construction.

#### PART 2 - PRODUCTS

2.1 GENERAL

A. The following must conform to City Standards:

1. Standard and Radial Combination Concrete Curb and Gutter, CSCG-1
2. Standard and Radial Concrete Coping Curb, CSCG-1
3. Residential Driveway Entrance, CSER-1
4. Storm Sewer
5. Sanitary Sewer

B. The following must conform to VDOT Standards:

1. ADA Accessible Curb Ramp
2. Detectable Warning Surface, CG-12
3. Standard and Modified Hydraulic Cement Concrete Sidewalk
4. Hydraulic Cement Concrete Station Platform
5. Concrete Median Barrier
6. Continuous Reinforced Hydraulic Cement Concrete Pavement 10" (Bus Pad)
7. Entrance Gutter
8. Concrete Retaining Wall, RW-2 and RW-3
9. Light Pole and Traffic Signal Foundations
10. Traffic Signal Cabinet Foundations
11. Junction Box and Handholes Collars
12. Manholes or Vault Concrete Collars
13. Median Strip, MS-1A and MS-2

2.2 MANUFACTURES

- A. Source Limitations: For repair products, obtain each color, grade, finish, type, and variety of product from single source and from single manufacturer with resources to provide products of consistent quality in appearance and physical properties.

2.3 STEEL REINFORCEMENT

- A. Use materials as specified in VDOT Specifications Section 223 – Steel Reinforcement.

1. Reinforcing Steel, Grade 60.

## 2.4 CONCRETE MATERIALS

- A. Use materials as specified in VDOT Specifications Section 217 – Hydraulic Cement Concrete.

## 2.5 RELATED MATERIALS

- A. Use materials as specified in VDOT Specifications Section 212 – Joint Materials.

## 2.6 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Proportion normal-weight concrete mixture in compliance with requirements of VDOT Specifications Section 217.07 – Proportioning Concrete Mixtures.
  1. Class A3 Minimum 28-day Compressive Strength: 3000 psi.

## 2.7 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to requirements of VDOT Specifications Section 406 – Reinforcing Steel.

## 2.8 CONCRETE MIXING

- A. Concrete mixing must comply with requirements of VDOT Specifications Section 217.09 – Mixing. Furnish batch ticket information.

# PART 3 - EXECUTION

## 3.1 GENERAL

- A. Concrete Operations Comply with applicable requirements of City Standards and VDOT Standards. Where City Standards do not provide detail or directive, VDOT Standards and VDOT Specification Section 502 – Incidental Concrete Items must apply.

## 3.2 FORMWORK

- A. Comply with requirements of VDOT Specifications Section 502.03 – Procedures.

## 3.3 STEEL REINFORCEMENT

- A. Comply with requirements of VDOT Specifications Section 406 – Reinforcing Steel.

## 3.4 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Comply with requirements of VDOT Specifications Section 404 – Hydraulic Cement Concrete Operations.

### 3.5 FINISHING FORMED SURFACES

- A. Comply with requirements of VDOT Specifications Section 404.07 – Finishing Concrete Surfaces.
  - 1. Class 1, Ordinary Surface Finish: All surfaces except wearing surface of the pavement slab.
  - 2. Class 7, Sidewalk Finish: Wearing Surface of the pavement slab.
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.6 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with requirements of VDOT Specifications Section 404.03 – Procedures.

### 3.7 CONCRETE SURFACE REPAIRS

- A. Defective Concrete includes color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
- B. The Contractor must note all instances of defective concrete within the project limits. Repair and patch defective areas when approved by COTR.
- C. Remove and replace concrete that cannot be repaired and patched to COTR 's approval.
- D. Repair defects on surfaces exposed to view by blending cement so that, when dry, patching mortar matches surrounding color.

### 3.8 HYDRAULIC CEMENT CONCRETE FOR STATION PLATFORMS

- A. Concrete station platform slabs shall be constructed as a monolithic pour that includes the adjacent 9" curb & gutter. No differential settlement is allowed to take place between the curb and platform slab.

### 3.9 CONCRETE RETAINING WALLS

- A. Concrete Retaining Walls must be constructed according to the latest version of Virginia Department of Transportation Road and Bridge Specification.
- B. Class A3 Concrete must be substituted for Class C1 Concrete.
- C. Provision of the Concrete Retaining Wall shall include weep holes spaced and size appropriately for the application.

3.10 CONCRETE FOUNDATIONS FOR TRAFFIC LIGHTS AND STREET LIGHT POLES

- A. Concrete foundations for Traffic Signals and Street Light Poles shall be as described in the latest version of Virginia Department of Transportation Road and Bridge Specification Section 700 – General.

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Contractor must engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
  - 1. Tests shall include at a minimum – on site concrete air content and slump testing. Compression test will include 7-day and 28-day results, unless instructed otherwise by the City.
- B. Testing agency must immediately report to the City, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
- C. Testing agency must report results of tests and inspections, in writing, to City, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
- D. Individuals that are field testing shall have certifications from WACEL and/or ACI for the test being performed. Testing within labs shall meet AASHTO T280 and meet VDOT's Materials Division Quality Assurance Program. All testing shall be overseen and approved by a Commonwealth of Virginia Professional Engineer.
- E. The Contractor shall prohibit wet or uncured concrete from entry into surface waters. The Contractor shall not dispose of excess or waste concrete in surface waters and prevent wash water from discharging into surface waters. The Contractor shall employ measures to prevent spills of fuels or lubricants into surface waters. All pollution prevention measures and practices proposed by the Contractor shall be identified in the Contractor's Pollution Prevention Plan as required by the Specifications or other Contract documents.

PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 316 – Hydraulic Cement Concrete Pavement, for measurement and payment of the following items, including VDOT Standard and non-standard items:
  - 1. Continuous Reinforced Hydraulic Cement Concrete Pavement 10" (Bus Pad)

- B. See VDOT Specification Section 502 – Incidental Concrete Items, for measurement and payment of the following items, including VDOT Standard and non-standard items:
  - 1. Standard and Radial Concrete Coping Curb
  - 2. Standard and Radial Concrete Curb and Gutter
  - 3. Median Strip, MS-1A and MS-2, including gutter pan
  - 4. Entrance Gutter
- C. See VDOT Specification Section 504 – Sidewalks, Steps, and Handrails, for measurement and payment of the following items, including VDOT Standard and non-standard items:
  - 1. Hydraulic Cement Concrete Sidewalk
  - 2. CG-12 Detectable Warning Surface
- D. See VDOT Specification Section 506 – Retaining Walls, for measurement and payment of the following items, including VDOT Standard and non-standard items:
  - 1. Retaining Walls RW-2 and RW-3
- E. See VDOT Specification Section 510 – Relocating or Modifying Existing Miscellaneous Items, for measurement and payment of the following items, including VDOT Standard and non-standard items:
  - 1. Reset, adjust, or modify Junction box
  - 2. Reset, adjust, or modify handhole
  - 3. Reset, adjust, or modify manhole
  - 4. Reset, adjust, or modify vault
- F. See VDOT Specification Section 700 – General, for measurement and payment of the following items, including VDOT Standards and non-standard items:
  - 1. Concrete Foundations for traffic signal poles and light poles (PF-8)
  - 2. Concrete Foundations for traffic signal poles (CF-1)
  - 3. Concrete Foundations for signs (STP-1)
  - 4. Electrical Service Work Pads
- G. Hydraulic Concrete Cement Station Platforms shall be measured and paid for at the contract unit price per cubic yard. Payment shall include full compensation for all labor, materials, equipment, testing and incidentals necessary for forming and installing all items, including grading, compaction of subgrade, reinforcing steel, dowels, forming, compacting, finishing, spraying with approved curing compound, providing and placing required joints and joint



material, protection from inclement weather and any other material, labor or equipment needed to conform with the Contract Documents.

- H. Concrete Repairs shall be measured and paid for at the contract unit price per cubic yard installed to the satisfaction of the COTR. Payment shall include full compensation for all labor, materials, equipment, testing and incidentals necessary for forming and installing all items, including saw cut and 12 inches of excavation or fill to finished subgrade; preparations, removal and disposal of unsuitable material; forming, pouring, finishing, spraying with approved curing compound and protection from inclement weather; provision of weep holes when applicable; placing and compacting bedding material as specified by the Contract Drawings and protection of the subgrade from inclement weather; and providing and placing required expansion joint material; backfilling, top soiling, seeding and fertilizing within 1 foot on all sides.

END OF SECTION 033000

## SECTION 033100 – STRUCTURAL CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Specification Section 217 – Hydraulic Cement Concrete, Section 223 – Steel Reinforcement, Section 403 – Bearing Piles, Section 404 – Hydraulic Cement Concrete Operations, and Section 406 – Reinforcing Steel.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).
- D. Virginia Department of Transportation Structure and Bridge Division – Instruction and Informational Memorandum on Corrosion Resistant Reinforcing Steels (CRR) – IIM-S&B-81.8, and Supplemental Section 406 – Reinforcing Steel or latest technical guidance.
- E. City of Alexandria Design and Construction Standards, latest edition.
- F. City of Alexandria, Department of Transportation & Environmental Services, Standard Details for Construction, 2022 (City Standards Details).

#### 1.2 REFERENCES

- A. AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing.
- B. Concrete Reinforcing Steel Institute (CRSI) design guide(s) for concrete structures.
- C. National Ready Mixed Concrete Association (NRMCA), research & engineering documentation and certifications.
- D. Portland Cement Association (PCA), Design and Control of Concrete Mixtures, current edition.

#### 1.3 SUMMARY

- A. This Section specifies cast-in-place structural concrete piles, including formwork, reinforcement, concrete materials, mixture design, and placement procedures, and when required, load-testing piles of the type and dimension specified on the contract drawings, for the following work:
  - 1. Shelter drilled shaft foundations.
- B. Related Requirements:

1. Section 033000 Cast-In-Place Concrete for concrete materials, reinforcement, mixture design, and placement.

#### 1.4 PREINSTALLATION MEETING

- A. Preinstallation Conference: At the request of the City, conduct conference at the Project site or an alternative location with prior approval of the City.
  1. Review methods and procedures related to structural concrete including, but not limited to the following:
    - a. Verify concrete specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
    - b. Mixture design, materials, material application, sequencing, tolerances, and required clearances.
    - c. Quality-control program.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  1. Include construction details, material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For concrete specialist and manufacturers.
- B. Material Certificates: For each type of cement aggregate supplied for mixing or adding to products at Project site.
  1. For drilled shaft foundations.
  2. For all reinforcing steel.
- C. Product Test Reports: For each product indicated as is necessary to confirm and ensure compliance.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  1. A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
  2. The manufacturer shall be in accordance with handling, blending and mixing operations in accordance with Sections 207 and 208 of the VDOT Road and Bridge Specifications. The manufacturer is responsible for having a Certified Central Mix Aggregate Technician

(as outlined in Section 308.05(a) of VDOT Road and Bridge Specifications) and documenting results and maintaining quality control.

3. The City may conduct random requests for copies of reports and documentation from the manufacturer for City projects.
  - B. BACI Publications: Comply with ACI 301 Specification for Structural Concrete, unless modified by requirements in the Contract Documents.
  - C. Testing and Inspecting: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. The Contractor shall comply with VDOT Road and Bridge Specifications for delivery, storage, and handling of all materials.
- 1.9 FIELD CONDITIONS
- A. The Contractor shall comply with VDOT Specification 403 – Bearing Piles for field conditions limitations.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. The following shall conform to VDOT Road and Bridge Specifications:
  1. Shelter Drilled Shaft Foundations.

### 2.2 MANUFACTURERS

- A. Source Limitations: Obtain each grade, finish, type, and variety of product from single source and from single manufacturer with resources to provide products of consistent quality in physical properties.

### 2.3 STEEL REINFORCEMENT

- A. Use materials as specified in VDOT Specifications Section 223 – Steel Reinforcement and Section 403 – Bearing Piles.

### 2.4 CONCRETE MATERIALS

- A. Use materials as specified in VDOT Specification Section 217 – Hydraulic Cement Concrete.

### 2.5 STEEL SHELLS

- A. Use materials as specified in VDOT Specification Section 403 – Bearing Piles.

### 2.6 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Proportion normal-weight concrete mixture in compliance with requirements of VDOT Specifications Section 217.07 – Proportioning Concrete Mixtures.
  - 1. Class A4 Minimum 28-day Compressive Strength: 4,000 psi.

## 2.7 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to requirements of VDOT Specifications Section 406 – Reinforcing Steel.

## 2.8 CONCRETE MIXING

- A. Concrete mixing must comply with requirements of VDOT Specifications Section 217.09 – Mixing. Furnish batch ticket information.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Comply with requirements of VDOT Specification Sections 403- Bearing Piles, Section 404 – Hydraulic Cement Concrete Operations, and Section 406 – Reinforcing Steel, for all formwork, steel reinforcement, concrete protecting and curing, repairs, testing and inspection associated with the construction of drilled shafts.

## PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 403 – Bearing Piles and Section 404 – Hydraulic Cement Concrete Operations, for Measurement and Payment.

END OF SECTION 033100

## SECTION 051200 – STRUCTURAL STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Structural steel.

B. Related Requirements:

1. Section 036200 – “Non-Shrink Grouting” for shrinkage-resistant cementitious grout.
2. **Section 051213 – "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.**
3. Section 055000 – "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other steel items not defined as structural steel.
4. Section 099600 – "High-Performance Coatings" for coating requirements.

#### 1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.
- B. Demand-Critical Welds: Those welds in primary members and connections, the failure of which would result in significant degradation of the strength and stiffness of the seismic-load-resisting system. Except as specifically noted on Drawings or approved in writing by the Engineer, the following welds shall be considered Demand-Critical Welds:
1. Complete-joint-penetration groove welds of beam flanges to columns.
  2. Welds indicated as "demand critical" or "seismic critical" on Drawings.

#### 1.3 REFERENCE STANDARDS

A. American Institute of Steel Construction (AISC)

1. 303-16 – Code of Standard Practice for Steel Buildings and Bridges
2. 341-16 – Seismic Provisions for Structural Steel Buildings
3. 360-16 – Specification for Structural Steel Buildings

B. American Society for Testing and Materials (ASTM)

1. A36 – Standard Specification for Carbon Structural Steel Plates, Channels, and Angles.

2. A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  3. A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
  4. A123 – Standard Specification for Zinc Coatings on Iron and Steel Products
  5. A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  6. A216 – Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
  7. A449 – Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
  8. A500 – Standard Specification for Carbon Structural Steel Tubes
  9. A563 – Standard Specification for Carbon and Alloy Steel Nuts
  10. A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
  11. A668 – Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
  12. A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
  13. A992 – Standard Specification for Structural Steel Shapes
  14. A1085 – Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS)
  15. C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
  16. F436 – Standard Specification for Hardened Steel Washers
  17. F959 – Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
  18. F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
  19. F3125 – Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength
- C. American Welding Society (AWS)
1. D1.1 – Structural Welding Code – Steel

2. D1.8 – Structural Welding Code – Seismic Supplement

D. International Accreditation Service, Inc. (IAS)

1. AC 172 – Accreditation Criteria for Fabricator Inspection Programs for Structural Steel

E. Research Council on Structural Connections (RCSC)

1. Specification for Structural Joints Using High-Strength Bolts – 2020 Edition

F. Society for Protective Coatings (SSPC)

1. QP 3 – Standard Procedure for Evaluating Qualifications of Shop Painting Applicators

2. SP 16 – Surface Preparation Specification, Brush-off Blast Cleaning Non-Ferrous Metals

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
2. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

B. Preinstallation Meetings

1. Retain "Preinstallation Conference" Paragraph below if Work of this Section is extensive or complex enough to justify a conference.
  - a. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: Submit certification that manufactured products meet or exceed specified requirements.

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Direct-tension indicators.
4. Tension-control, high-strength, bolt-nut-washer assemblies.
5. Anchor rods.
6. Threaded rods.



7. Forged-steel hardware.
  8. Shop primer.
  9. Galvanized-steel primer.
  10. Etching cleaner.
  11. Galvanized repair paint.
- B. Shop and Erection Drawings: Shop and erection drawings for structural steel fabrications shall be submitted for review prior to fabrication.
1. Include complete fabrication and erection plans and procedures giving full information on aspects of the erection which will effect alignment, plumb and dimensional accuracy of the structure.
  2. Include drawings for any required temporary supports and design calculations for stress checks of structural steel framing where erection procedures impart loads differing in magnitude and/or orientation from those induced under final erected condition.
  3. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  4. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
  6. Identify members not to be shop primed.
  7. Contractor shall survey, review, and confirm as-built conditions prior to developing shop drawings. Field modifications to suit as-built conditions shall be at the Contractor's expense.
  8. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1 for each welded joint whether prequalified or qualified by testing, including the following:
    - a. Power source (constant current or constant voltage).
    - b. Electrode manufacturer and trade name, for demand-critical welds.
    - c. WPS for demand-critical welds shall conform to the additional requirements of AWS D1.8.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For installer, fabricator, shop-painting applicators, and professional engineer.
- B. Welders' Certificates: Documentation certifying each welder employed on the Project meets the requirements of Article 1.07.C.4
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill Test Reports: For structural-steel materials, including chemical and physical properties.
- E. Survey of existing conditions.

#### 1.7 QUALITY ASSURANCE

- A. Comply with applicable provisions of AISC 303.
- B. Survey anchor bolts for location and elevation prior to casting concrete.
- C. Steel Team Qualifications
  - 1. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172).
  - 2. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
  - 3. Shop-Painting Applicators: Qualified in accordance with AISC's Sophisticated Paint Endorsement P1, P2, or P3 or to SSPC-QP 3.
  - 4. Welder Qualifications: Welders shall be qualified in accordance with AWS D1.1 for each process, position, and joint configuration.
    - a. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

#### 1.8 DESIGN CRITERIA

- A. Comply with applicable provisions of the following specifications and documents:
  - 1. ANSI/AISC 303-16.
  - 2. ANSI/AISC 341-16.
  - 3. ANSI/AISC 360-16.
  - 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts," 2014.

B. Connection Design Information:

1. Option 1: Design of connections has been completed for those connections fully detailed on the Drawings.
2. Option 3B: Design of connections and final configuration of member reinforcement at connections not fully detailed on the Drawings shall be performed in accordance with ANSI/AISC 303 by the fabricator's qualified professional engineer registered in the Commonwealth of Virginia.
  - a. Use Load and Resistance Factor Design; data are given at factored-load level.
  - b. Moment Connections: Type FR, fully restrained.
  - c. Construction: Combined system of Ordinary Cantilevered Column System (OCCS) and Ordinary Moment Frame (OMF).

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
- B. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- C. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

1.10 PRODUCTS

A. STRUCTURAL-STEEL MATERIALS

1. W-Shapes: ASTM A992.
2. Channels, Angles: ASTM A36, Grade 36.
3. Plate and Bar: ASTM A572, Grade 50.
4. Steel Pipe: ASTM A53, Type E or Type S, Grade B.

5. Steel Castings: ASTM A216, Grade WCB, with supplementary requirement S11.
6. Steel Forgings: ASTM A668.
7. Welding Electrodes: Comply with AWS requirements.

**B. BOLTS AND CONNECTORS**

1. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.
  - a. Finish: Hot-dip or mechanically deposited zinc coating.
  - b. Direct-Tension Indicators: ASTM F959, Type 325-1, compressible-washer type with mechanically deposited zinc coating or mechanically deposited zinc coating, baked epoxy-coated finish.

**C. RODS**

1. Headed Anchor Rods: ASTM F1554, Grade 105, straight.
  - a. Nuts: ASTM A563 heavy-hex carbon steel.
  - b. Plate Washers: ASTM A36 carbon steel.
  - c. Washers: ASTM F436, Type 1, hardened carbon steel.
  - d. Finish: Hot-dip zinc coating, ASTM A153, Class C.
2. Threaded Rods: ASTM A449.
  - a. Nuts: ASTM A63 heavy-hex carbon steel.
  - b. Washers: ASTM F436, Type 1, hardened or ASTM A36 carbon steel.
  - c. Finish: Hot-dip zinc coating, ASTM A153, Class C.

**D. PRIMER**

1. Steel Primer:
  - a. Comply with Section 09 90 00 "Painting and Coating."
2. Galvanized-Steel Primer: MPI#134.
  - a. Etching Cleaner: MPI#25, for galvanized steel.
  - b. Galvanizing Repair Paint: ASTM A780.

**E. SHRINKAGE-RESISTANT GROUT**

1. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

## PART 2 - FABRICATION

- 2.1 Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AIS 303 and to ANSI/AISC 360.
  - A. Camber structural-steel members where indicated.
  - B. Fabricate beams with rolling camber up.
  - C. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
  - D. Mark and match-mark materials for field assembly.
  - E. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- 2.2 Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - A. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- 2.3 Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- 2.4 Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- 2.5 Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.
- 2.6 Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
  - A. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - B. Weld threaded nuts to framing and other specialty items indicated to receive other work.
- 2.7 SHOP CONNECTIONS
  - A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
  - B. Joint Type: Snug tightened, Pretensioned, or Slip critical, as indicated in Contract Drawings or approved Delegated Connection Design Submittal.
  - C. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

## 2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123.
- B. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
  1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

## 2.9 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
  1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  2. Surfaces to be field welded.
  3. Surfaces of high-strength bolted, slip-critical connections.
  4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  5. Galvanized surfaces, unless indicated to be painted.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
  1. SSPC-SP 3.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  1. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

## 2.10 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Bolted Connections: Inspect and test shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1 and the following inspection procedures, at testing agency's option:
  - a. Liquid Penetrant Inspection: ASTM E165/E165M.
  - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
  - c. Ultrasonic Inspection: ASTM E164.
  - d. Radiographic Inspection: ASTM E94/E94M.
  - e. Prepare test and inspection reports.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

#### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  1. Set plates for structural members on wedges, shims, or setting nuts as required.

2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  3. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
  2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- 3.4 FIELD CONNECTIONS
- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
- B. Joint Type: Snug tightened, Pretensioned, or Slip critical, as indicated in Contract Drawings or approved Delegated Connection Design Submittal.
- C. Weld Connections: Comply with AWS D1.1 and AWS D1.8 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
  3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.
- 3.5 REPAIR
- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780.



B. Touchup Painting:

1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
2. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
3. Cleaning and touchup painting are specified in Section 09 96 00 – “High-Performance Coatings.”
4. Touchup Priming: Cleaning and touchup priming are specified in Section 09 96 00 – “High-Performance Coatings.”

3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector or special inspection agency to perform field inspections and tests. Inspection services shall conform to the Statement of Special Inspections noted in the structural drawings.

1. Contractor must correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.
2. Additional testing performed to determine compliance of corrected Work with specified requirements shall be at Contractor's expense.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
  - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
  - b. Liquid Penetrant Inspection: ASTM E165.
  - c. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
  - d. Ultrasonic Inspection: ASTM E164.
  - e. Radiographic Inspection: ASTM E94.

PART 4 - MEASUREMENT AND PAYMENT

- A. Structural steel framing for the Bus Rapid Transit Shelters shall be included in the contract lump sum price for each location specified below. Payment shall include full compensation for all labor, equipment, material, tools, and incidentals necessary to construct Bus Rapid Transit Shelters as specified in the Contract Drawings and Contract Documents.
- B. The following Bus Rapid Transit Shelter locations shall be specified as a contract lump sum price for each location:
  - 1. North Beauregard Street at King Street – Northbound
  - 2. North Beauregard Street at King Street – Southbound
  - 3. North Beauregard Street at West Braddock Road – Northbound
  - 4. North Beauregard Street at West Braddock Road – Southbound
  - 5. North Beauregard Street at Fillmore Avenue – Northbound
  - 6. North Beauregard Street at Fillmore Avenue – Southbound
  - 7. North Beauregard Street at Rayburn Avenue – Northbound
  - 8. North Beauregard Street at Rayburn Avenue – Southbound
  - 9. Sanger Avenue at North Beauregard Street – Eastbound
  - 10. Sanger Avenue at North Beauregard Street – Westbound
  - 11. North Van Dorn Street at Sanger Avenue – Northbound
  - 12. North Van Dorn Street at Taney Avenue – Southbound
  - 13. North Van Dorn Street at Holmes Run Parkway – Northbound
  - 14. North Van Dorn Street at Holmes Run Parkway – Southbound
  - 15. South Van Dorn Street at Stevenson Avenue – Northbound
  - 16. South Van Dorn Street at Stevenson Avenue – Southbound
  - 17. South Van Dorn Street at South Pickett Street – Northbound
  - 18. South Van Dorn Street at South Pickett Street – Southbound

END OF SECTION 051200

## SECTION 066400 – POLYETHYLENE PLATFORM EDGE STRIPS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.

#### 1.2 SUMMARY

- A. Section includes polyethylene platform edge strips (rub rail).

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples:
  - 1. Polyethylene platform edge strips: 8-inch lengths
  - 2. Fasteners: Each fastener type.

#### 1.4 QUALITY ASSURANCE

- A. Testing Agency: Acceptable to the COTR.

### PART 2 - PRODUCTS

#### 2.1 POLYETHYLENE PLATFORM EDGE STRIPS

- A. Edge Strip Size and Configuration.
  - 1. Shapes, profiles, lengths, locations and mounting heights shall be coordinated to comply with bus operation requirements.
    - a. Nominal Thickness: 3 ¼ inches
    - b. Vertical Height: 7 inches
    - c. Horizontal Strip Length: 10' minimum
  - 2. Recessed counter-sunk mounting holes 2-inches from each end, and maximum 1'-4" on center, for fastening to the concrete platform face.

3. Bearing Capacity: Platform edge strip to be capable of supporting the bearing weight of a person seated in a wheelchair, approximately 800 lbs. over a 38-inch by 48-inch area, plus accepted factors of safety for structural bearing surfaces, while boarding and alighting a transit bus.
  4. Public transit quality and suited to withstand local weather conditions including road surface treatments applied during inclement weather.
- B. Edge Strip Material: Ultra-High Molecular Weight Polyethylene (UHMWP)
1. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
    - a. Flammability, ASTM E162:
      - 1) Flame Spread: Radiant Panel Index Is = 35 maximum
    - b. Smoke Generation, ASTM E662:
      - 1) Flaming Mode: Specific Optical Density = 12 maximum
      - 2) Flaming Mode: Maximum Specific Optical Density Dm = 430 maximum
      - 3) Non-flaming Mode: Specific Optical Density Ds = 8 maximum
      - 4) Non-flaming Mode: Maximum Specific Optical Density Dm = 246 maximum
    - c. Smoke Toxicity, ASTM E800:
      - 1) Carbon Monoxide (CO): Maximum 123 ppm, flaming mode
      - 2) Hydrogen Fluoride (HF): Maximum 1.5 ppm, flaming mode
      - 3) Hydrogen Chloride (HCl): Maximum 1.2 ppm, flaming mode
      - 4) Hydrogen Cyanide (HCN): Maximum 2 ppm, flaming mode
      - 5) Nitrogen Oxide (NOx): Maximum 53 ppm, flaming mode
      - 6) Sulfur Oxide (SO2): Maximum 1 ppm, flaming mode
      - 7) Carbon Dioxide (CO2): Maximum 10,000 ppm, flaming mode
  2. Coefficient of thermal expansion, degrees Fahrenheit, tested in accordance with ASTM D696 (astm.org), not to exceed:
    - a. 0-deg to 75-deg:  $1.1 \times 10^{-4}$  inches per inch
    - b. 75-deg to 120-deg:  $1.87 \times 10^{-4}$  inches per inch

3. Straightness tolerance, on platform edge side of the edge strip: 1/8-inch in a 120-inch section.
4. Variation in width of strip: Not more than 1/16-inch in any length section.
5. Surface finish: Top (bearing) surface to be scarified in crosshatch pattern to create a non-slip surface.
6. Color: High visibility yellow or as approved by COTR.

C. Fasteners:

1. Bolts: Stainless Steel Type 316; minimum 3/8-inch in lengths required
2. Lock Washers: Stainless Steel Type 316; sized to match bolt and anchors
3. Fender Washers: Stainless Steel Type 316; sized to match bolt and anchors
4. Drop-In Anchors: Stainless Steel Type 316; minimum 3/8-inch in lengths required

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products may be incorporated into the Work include, but are not limited to the following:
1. Polymer Industries Polyslick Bus Curb, or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify conditions prior to installation.
- B. Clean platform curb mounting surface of substances including oil, grease, dirt, and dust.
- C. Lay out strips before installing. Locate strip joint so that trimmed strips at ends are not less than 10 feet in length.
- D. Provide scarf joints where two strips meet. Apply adhesive at scarf joints per manufacturer's instructions. Locate strip scarf joints in direction of bus travel.

3.2 INSTALLATION

- A. Install fasteners according to manufacturer's specifications and instructions for edge strip installation.
- B. Edge strip installed tolerance, top (bearing) surface: No greater than 1/8-inch difference in height at juncture of concrete platform and edge strip.

- C. Coordinate anchor locations with concrete rebar.

#### PART 4 - MEASUREMENT AND PAYMENT

- A. Payment shall include full compensation for all labor, materials, equipment, tools and incidentals necessary for installing all items to the satisfaction of the COTR.
  - 1. Polyethylene platform edge strips shall be measured and paid for at the contract unit price per linear foot installed.

END OF SECTION 066400

## SECTION 074113 – METAL ROOF PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.

#### 1.2 SUMMARY

- A. Section includes:

1. Structural standing seam metal roof panels.
2. Accessories, including concealed anchor clips, fasteners, perimeter flashing, trim, and penetration treatments.
3. Roof Underlayer.
4. Roof Sheathing.

- B. Related Sections

1. Section 074213 Metal Walls Panels
2. Section 074243 Composite Walls Panels
3. Section 076000 Sheet Metal Gutters and Downspouts
4. Section 084427 Bus Rapid Transit Shelter Structural Glass Façade

#### 1.3 REFERENCES

- A. ASTM International

1. ASTM A240; Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A653; Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM A666; Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
4. ASTM B85; Standard Specification for Aluminum Alloy Die Castings.
5. ASTM B117; Standard Practice for Operating Salt Spray (Fog) Apparatus.

6. ASTM B209; Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  7. ASTM B221; Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  8. ASTM E1592; Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
  9. ASTM E1646; Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
  10. ASTM E1680; Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems.
  11. ASTM E2140-01(2009); Standard Test Method for Water Penetration of Metal Panel Roof Systems by Static Water Pressure Head
- B. Southern Building Code Conference International (SBCCI)
1. SBCCI Standard 12-99; Standard for Determining the Wind Resistance from Windborne Debris.
- C. Underwriters Laboratories (UL)
1. UL 580; Tests for Uplift Resistance of Roof Assemblies.
- D. Factory Mutual Research Corporation (FM)
1. FM 4471; Approval Standard for Class 1 Panel Roofs.
- 1.4 SUBMITTALS
- A. Product Data: Submit manufacturer current technical literature for each type of product.
- B. Shop Drawings – Submit detailed drawings showing:
1. Profile.
  2. Gauge of panel.
  3. Location, layout, and dimensions of panels.
  4. Location and type of fasteners.
  5. Shape and method of attachment of all trim.
  6. Locations and type of sealants.
  7. Installation sequence.



8. Other details as may be required for a weathertight installation.
  - C. Samples: Provide nominal 3 x 5 inch of each color indicated.
  - D. Quality Assurance Submittals
  - E. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with requirements.
  9. Manufacturer Erection Instructions: Provide manufacturer's written installation instructions including proper material storage, material handling, installation sequence, panel location(s), and attachment methods, details and required trim and accessories.
  - F. Closeout Submittals
    1. Maintenance data.
    2. Manufacturer's Warranty: Executed copy of manufacturer's standard warranty.
- 1.5 ADMINISTRATIVE REQUIREMENTS
- A. Pre-installation meeting: Conduct a pre-installation meeting at the job site attended by Owner, Architect, Manufacturer's Technical Representative, Panel Installer, and Contractors of related trades. Coordinate structural support requirements in relation to roof panel system, installation of any separate air/water barriers, treatment of fenestration, and other requirements specific to the project.
- 1.6 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Manufacturer shall have a minimum of ten (10) years experience in the production of metal roof panels. Manufacturer shall demonstrate past experience with examples of projects of similar type and exposure.
  - B. Installer Qualifications: Installer shall be authorized by the manufacturer regarding proper installation of the specified product and have a minimum of five (5) years experience with projects of similar size and scope.
  - C. Metal roof panel attachment shall meet the requirements of Factory Mutual 4471 – Class 1 Rating.
- 1.7 DELIVERY, STORAGE AND HANDLING
- A. Deliver panel materials and components in manufacturer's original, unopened, undamaged packaging with identification labels intact.
  - B. Store roof panel materials on dry, level, firm, and clean surface. Elevate one end of bundle to allow moisture run-off, cover and ventilate to allow air to circulate and moisture to escape.
- 1.8 WARRANTY

- A. Material Warranty: Standard form in which manufacturer agrees to repair or replace items that fail in materials or workmanship within specified warranty period. The items covered by the warranty include structural performance and material integrity.
  - 1. Warranty Period: Two (2) years from date of Substantial Completion.
- B. Finish Warranty: Standard form in which manufacturer agrees to repair or replace metal panels that evidence deterioration of fluoropolymer finish, including flaking or peeling from approved primed metal substrate, chalk in excess of 8 when tested in accordance with ASTM D4214, Method A, and /or color fading in excess of 5 ΔE Hunter units on panels when tested in accordance with ASTM D2244.
  - 1. Warranty Period: Twenty (20) years from date of Substantial Completion, or 20 years and 3 months from the date of shipment from manufacturer's plant, whichever occurs first.
- C. Installers "Weather-tight" Warranty: The Manufacturer Certified Installer shall provide a "leak-free" roofing warranty in which the installer agrees to repair leaks discovered in the roofing system under the terms outlined by the roofing manufacturer within the specified warranty period.
  - 1. Warranty Period: Two (2) years from date Substantial Completion.
- D. Weather-tight Warranty: Provide manufacturer's limited weathertightness warranty in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Twenty (20) years from date Substantial Completion, or 20 years and 3 months from the date of shipment from manufacturer's plant, whichever occurs first.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. Basis of Design: Morin-SymmeTry Roof Series (Structural Standing Seam Metal Roof Panels) from Kingspan Group Company; or comparable product.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance:
  - 1. Roof assembly shall be tested for structural performance under uniform static air pressure differences in accordance with ASTM E1592.
    - a. Uniform Pressure: as indicated on drawings; acting inward or outward.

2. Snow Loads: as indicated on Contract Drawings
3. Deflection: Panel shall be limited to L/180.
- B. Metal roof panels shall be capable of withstanding a 250-pound concentrated load applied to a 4 square inch area in the middle of the panel. No noticeable buckling or permanent distortion of the panel shall occur.
- C. Water Penetration under Static Pressure: Provide metal roof panel systems designed to resist penetration of water under static pressure. Testing shall be based on ASTM E1646. Roof panels when tested shall have no water leakage at 40.0 pounds per square foot.
- D. Air Infiltration: Provide metal roof panel assemblies designed to resist air infiltration. Testing shall be done based on ASTM E1680. Roof panels when tested shall have a maximum air infiltration leakage of 0.006 cfm per square feet of fixed roof area at a minimum static air-pressure differential of 40-foot pounds per square foot.
- E. Wind Uplift Resistance:
  1. Roof assembly shall comply with UL 580 for wind uplift resistance; class UL 90
  2. Energy Performance:
  3. Energy Star Qualified: Metal panels shall meet the requirements of Energy Star Roofing Products for low slope.
  4. Solar Reflectance Index: Panels shall have a solar reflectance Index of not less than 78 for low-sloped roofs.
- F. Fire Performance: Roof assembly to meet requirements of ASTM E108, Class A.

## 2.3 ROOF PANEL MATERIALS

- A. Aluminum:
  1. Coil stock meeting ASTM B209; 3003-H14 as required for forming operations.
  2. Gauge: 0.050 inch.
  3. Panel Width: 16 inches
  4. Profile: SymmeTry Roof Series
  5. Seam Height: 1 ½ inches
  6. Texture: Smooth

## 2.4 ACCESSORIES

- A. Roof panel accessories: Provide accessories as required for a complete installation. Accessories shall be as indicated on approved shop drawings and per manufacturer's approved standard details.

1. Fasteners: Fasteners as recommended by manufacturer.
2. Concealed Anchor Clips: Floating anchor clip, two piece, or single halter style clip.
3. Closure Strips: Provide closed cell closure strips, minimum 1 inch thick matching metal roof panel profile.

B. Flashing and Trim:

1. Fabricate flashing and trim from same material as roof panels unless otherwise noted. Finish to match metal roof panels.
2. Locations include, but are not limited to the following: Drips, eave and rake edges, roof penetrations, hips, and valleys.

C. Panel Sealant:

1. Joint Sealant: ASTM C920 as recommended in writing by metal roof panel manufacturer.
2. Butyl Tape: Per panel manufacturer's recommendations for panel to panel and panel to trim seal.
3. Butyl Sealants: Non-skinning type per panels manufacturer's recommendations.

2.5 UNDERLAYMENT MATERIALS

A. Self-Adhering Sheet Membrane Roof Underlayment: Base of Design Grace Ice and Water Shield HT by GCP Applied Technologies, Inc with the following characteristics:

1. Material: Cold applied, self-adhering membrane composed of an innovative and proprietary rubberized asphalt adhesive and interwound with a disposable release sheet. An embossed, slip resistant surface is provided on the high-performance film with UV barrier properties.
2. Membrane Thickness: 40 mils (1.02 mm) per ASTM D3767 Method A.
3. Membrane Tensile Strength: MD 33 lbf/in, CD 31 lbf/inch per ASTM D412 Die C Modified.
4. Membrane Elongation: 250% per ASTM D412 Die C Modified.
5. Low Temperature Flexibility: Unaffected at -20 degrees F (-29 degrees C) per ASTM D1970.
6. Adhesion to Plywood: 5.0 lb/in. width (876 N/m) per ASTM D903.
7. Maximum Permeance: 0.05 perms (2.9 ng/sgms Pa) per ASTM E96.
8. Maximum Material Weight Installed: 0.22 pounds/sqft (1.1 kg/sqm) per ASTM D461.
9. Service Temperature: 260 degrees F (115.6 degrees C) per ASTM D1204

10. Compatibility: Suitable for use under all types of sloped roofing with the exception high altitude climates where zinc, copper or Cor-Ten roof coverings are used.
11. Adhesive: Rubberized asphalt adhesive containing post-consumer recycled content, contains no calcium carbonate, sand or fly ash.
12. Exposure: Can be left exposed for a maximum of 120 days from date of installation per ASTM G90 – EMMAqua test.
13. Primer: Water-based Perm-A-Barrier WB Primer by GCP Applied Technologies, Inc.
14. Code and Standards Compliance:
  - a. ASTM D1970.
  - b. ICC-ES ESR-3121, per AC 48 Acceptance Criteria for Roof Underlayments used in Severe Climate Areas.
  - c. Underwriters Laboratories Inc. R13399 – Class A fire classification under fiber-glass shingles and Class C under organic felt shingles (per ASTM E108/UL 790).
  - d. Underwriters Laboratories Inc. Classified Sheathing Material Fire Resistance Classification with Roof Designs: P225, P227, P230, P237, P259, P508, P510, P512, P514, P701, P711, P717, P722, P723, P732, P734, P736, P742, P803, P814, P818, P824
  - e. CCMC Approval No. 13671-L GCP Applied Technologies Inc.
15. Slip Sheet: Manufacturer’s recommended slip sheet, of type required for application.

## 2.6 ROOF SHEATHING

- A. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Huber Engineered Woods LLC; AdvanTech Sheathing or a comparable product.
  2. Span Rating and Performance Category: Not less than ½ Performance Category
  3. Edge Profile: Square edge
  4. Provide fastening guide on top panel surface with pre-spaced fastening symbols for 16-inches (406 mm) and 24-inches (610 mm) on center spacings.

## 2.7 FABRICATION

- A. Metal roof panels shall be formed to lap with edges of adjacent panels which are then mechanically attached to roof deck using fasteners and concealed anchor clips. Anchor clips are then machine seamed into standing seam.
- B. Fabricate metal roof panels with joints between panels designed to form weathertight seals.

- C. Flashing and Trim Accessories: Fabricate trim accessories to comply with recommendations outlined in SMACNA's "Architectural Sheet Metal Manual".

## 2.8 FINISHES

### A. Aluminum:

#### 1. Finish and Color:

##### a. Color:

- 1) Exposed Surface: Zinc Gray.
- 2) Concealed Surface: Manufacturer's standard primer

##### b. Finish System:

- 1) 2.4 mil. Fluoropolymer (PVDF) Three Coat system: 0.8 mil primer with 0.8 mil Kynar 500 (70%) SOLID color coat and 0.8 mil clear coat.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Provide field measurements to manufacturer as required to achieve proper fit of the metal roof panels to building envelope. Measurements shall be provided in a timely manner so that there is no impact to construction or manufacturing schedule.
- B. Supporting Steel: All structural supports required for installation of panels shall be by others. Support members shall be installed within the following tolerances:
  - 1. Plus or minus ¼ inch in 20 feet in any direction along plane of framing.
  - 2. Plus or minus ½ inch from framing plane over entire roof.

- C. Examine individual panels upon removing from the bundle; notify manufacturer of panel defects. Do not install defective panels.

### 3.2 PANEL INSTALLATION

- A. Apply sealant to joints per manufacturer's recommendations and approved shop drawings.
- B. Coordinate roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

- C. Install roofing underlayment on sloped surfaces at locations indicated on the Drawings, but not less than at hips, ridges, eaves, valleys, sidewalls and chimneys, and surfaces over interior space within 36 inches (914 mm) from the inside face of the exterior wall. Strictly comply with manufacturer's installation instructions including but not limited to the following:
1. Schedule installation such that underlayment is covered by roofing within the published exposure limit of the underlayment.
  2. Do not install underlayment on wet or frozen substrates.
  3. Install when surface temperature of substrate is a minimum of 40 degrees F (5 degrees C) and rising.
  4. Remove dust, dirt, loose materials and protrusions from deck surface.
  5. Install membrane on clean, dry, continuous structural deck. Fill voids and damaged or unsupported areas prior to installation.
  6. Prime concrete and masonry surfaces using specified primer at a rate of 500-600 square feet per gallon (12-15 sqm/L). Priming is not required for other suitable clean and dry surfaces.
  7. Install membrane such that all laps shed water. Work from the low point to the high point of the roof at all times. Apply the membrane in valleys before the membrane is applied to the eaves. Following placement along the eaves, continue application of the membrane up the roof. Membrane may be installed either vertically or horizontally after the first horizontal course.
  8. Side laps minimum 3-1/2 inches (89 mm) and end laps minimum 6 inches (152 mm) following lap lines marked on underlayment.
  9. Patch penetrations and damage using manufacturer's recommended methods.
- D. Install Metal Roof Panels level and true-to-line to dimensions and layout indicated on approved shop drawings.
- E. Install Metal Roof Panels in one piece lengths from ridge to eave unless otherwise indicated on approved shop drawings.
- F. Attach panels to framing using recommended clips, screws, fasteners and sealants as indicated on approved shop drawings.
- G. Installation shall be in accordance with manufacturer's installation guidelines and recommendations. Roof panels shall be installed weathertight, without distortion, buckles or waves.
- H. Seaming of panels shall be done using an electric powered seaming machine as recommended by manufacturer.
- I. Provide weatherproof fittings for pipe and conduit penetrating roof.

- J. Curb units shall be under/over type as recommended by roof panel manufacturer.
- K. Cutting and fitting of panels shall be neat, square and true. Torch cutting is prohibited.
- L. Dissimilar materials: where the metal panel system comes into contact with dissimilar materials, treat contact areas as recommended by roof panel manufacturer.

### 3.3 FLASHING AND TRIM INSTALLATION

- A. Place trim and trim fasteners only as indicated per details on the approved shop drawings.
- B. Apply sealant at trim, per manufacturer's details and approved shop drawings, for weathertight installation.

### 3.4 CLEANING AND PROTECTION

- A. Remove protective film immediately after installation.
- B. Touch-up, repair or replace metal panels and trim that have been damaged.
- C. After metal roof panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

## PART 4 - MEASUREMENT AND PAYMENT

- A. No separate measurement or payment will be made for items in Section 074113 Metal Roof Panels. Payment for all work shall be considered incidental to the Contract lump sum price for each Bus Rapid Transit Shelter Structural Glass Façade, as specified in Section 084427.

END OF SECTION 074113



## SECTION 074213 – METAL WALL PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.

#### 1.2 SUMMARY

- A. Section Includes:

1. Field assembled metal wall panel concealed fastener exterior profile for structural column cladding.
2. Uninsulated single-skin concealed fastener metal wall panel system.
3. Concealed fastener, track mounted rain screen modular wall panel system.
4. Concealed fastener, continuous engagement rain screen modular wall panel system.

- B. Related Section:

1. Section 074113 Metal Roof Panels
2. Section 074243 Composite Walls Panels
3. Section 084427 Bus Rapid Transit Shelter Structural Glass Façade

#### 1.3 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA):

1. AAMA 501.1 - Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
2. AAMA 508 - Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems.
3. AAMA 620 - Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum Substrates.
4. AAMA 621 - Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.
5. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM International (ASTM):

1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 755/A 755M - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM B 209 - Specification for Aluminum and Aluminum Alloy Sheet and Plate.
4. ASTM B 221 - Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
5. ASTM C 754 - Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products.
6. ASTM C 920 - Specification for Elastomeric Joint Sealants.
7. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
8. ASTM D 3359 - Standard Test Methods for Measuring Adhesion by Tape Tests.

9. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
10. ASTM E 112 - Standard Test Method for Determining Average Grain Size.
11. ASTM E 283 - Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
12. ASTM E 329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
13. ASTM E331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

C. American Iron and Steel Institute (AISI):

1. Specification for the Design of Cold-Formed Steel Structural Members.

D. American Institute of Steel Construction (AISC):

1. Code of Standard Practice.

E. American Society of Civil Engineers (ASCE):

1. ASCE-7, Minimum Design Loads for Buildings and Other Structures.

F. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA):

1. Architectural Sheet Metal Manual.

#### 1.4 SUBMITTALS

- A. Submit product data, test reports, and certifications in accordance with quality assurance and performance requirements specified herein.

- B. LEED Submittals: Credit MR 4.1/MR4.2, Manufacturer's Product Data indicating the following:
1. Percentages by weight of post-consumer and pre-consumer recycled content.
  2. Indicate total weight of products provided.
  3. Include statement indicating costs for each product having recycled content.
- C. Submit panel shop drawings consisting of design and erection drawings, finish specifications, and other data necessary to clearly describe the design, materials, sizes, layouts, construction details, and erection. Submit small-scale layouts of panels and large-scale details of edge conditions, joints, fastener and sealant placement, flashings, penetrations, and special details. Distinction must be made between factory and field assembled work.
- D. Submit structural design calculations, in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members, for the metal wall panel system.
1. A professional engineer registered in the state where the project is located shall certify the calculations.
- E. Material Samples:
1. Panels: One of each type, full panel width by 12 inches (305 mm) long.
  2. Fasteners: Two of each type with statement of intended use.
  3. Closures: One of each type metal closure and foam closure as required.
  4. Sealants: One sample of each type with statement of intended use.
  5. Clips: Two of each type.
- F. Selection Samples for Color: For each finish product specified, furnish two color chip samples selected from the manufacturer's full range of available colors and patterns.
- G. Verification Samples for Color: For each finish product specified, two samples, minimum size 6 square inches (150 mm), representing actual product, color, and patterns.

- H. Qualification Information: For Installer firm, proof of installer's manufacturer trained field supervisor.
- I. Warranty: Submit proposed warranty meeting requirements of this Section.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: The manufacturer shall have had a minimum of ten years experience in the successful completion of projects employing similar materials, applications, and performance requirements.
- B. Manufacturer shall provide a list of five similar completed projects with addresses of the project location, architect, and owner.
- C. Installer Qualifications: The wall systems contractor shall have had a minimum of ten years experience in the successful completion of projects employing similar materials, applications, and performance requirements.
  - 1. The wall systems contractor shall provide a list of five similar completed projects with addresses of the project location, architect, and owner.
- D. Buy American Act Certification: Submit documentation certifying that products comply with provisions of the Buy American Act 41 U.S.C 10a - 10d.
- E. Calculations supporting structural performance of the wall panels shall be prepared by a professional structural engineer.
- F. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - 1. Finish areas designated by Architect.
  - 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
  - 3. Refinish mock-up area as required to produce acceptable work.
- G. Pre-installation Conference: Conduct conference at Project site in compliance with Division 01 requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be unloaded and stored per the manufacturer's instructions to prevent damage due to handling and weather.

1.7 PROJECT CONDITIONS

- A. Field Measurements: It is the panel installers responsibility to verify locations of structural members, adjoining construction and wall openings dimensions by field measurement before panel fabrication and indicate measurements on final shop drawings.
- B. Coordinate with constructions schedule to ensure panel assemblies fit properly and do not delay construction progress.
  - 1. Established dimensions: where field measurements cannot be made without delaying construction progress, guarantee dimensions and proceed with fabrication of wall panel assemblies corresponding to the established dimensions.

1.8 WARRANTY

- A. Material Warranty: The manufacturer shall warrant that the materials and accessories furnished in accordance with these specifications shall remain free from defects in material and factory workmanship for a period of two years from date of shipment.
- B. Paint Finish Warranty: The manufacturer shall warrant against fading, chalking, peeling, cracking, checking, chipping, or erosion to base metal of the exterior panel finish, in accordance with the paint supplier's standards.
  - 1. Warranty Period: 20 years.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: CENTRIA, or comparable product.

2.2 CONCEALED FASTENER METAL WALL PANELS

A. System Description:

1. Metal Wall Panels and Metal Liner Panel Wall System: Single-skin concealed fastener metal wall panels applied as the exterior cladding over wall framing with board insulation and metal liner panels. Metal wall panel installation specified in this Section includes secondary metal subgirt framing for panel attachment and an interior sealed-joint metal liner panel that provides air and water vapor control.
    - a. Water-resistive barrier is specified in other specification section.
  2. Metal Wall Panels over Multi-Component Framed Wall System: Single-skin concealed fastener metal wall panels applied as exterior rainscreen cladding. Wall framing indicated with exterior sheathing specified in other specification section. Applied membrane that provides air, moisture, and water vapor control in other specification section. Insulation within the framing specified in other specification section. Metal wall panel installation specified in this Section includes secondary metal subgirt framing and mounting clips for panel attachment.
    - a. Air, moisture, and water vapor control membrane is specified in other specification section.
  3. Metal Wall Panels over Outside-Insulated Framed Wall System: Single-skin concealed fastener metal wall panels applied as exterior rainscreen cladding. Wall framing specified in other specification section. Exterior sheathing specified in other specification section. Applied membrane that provides air, moisture, and water vapor control specified in other specification section. Insulation within the framing and applied outboard of the sheathing specified in other specification section. Metal wall panel installation specified in this Section includes secondary metal subgirt framing and mounting clips for panel attachment.
  4. Metal Wall Panels over Uninsulated Framed Screen Wall System: Single-skin concealed fastener vertical metal wall panels applied as exterior barrier cladding over wall framing specified in other specification section. Water-resistive barrier specified in other specification section. Metal wall panel installation specified in this Section includes secondary metal subgirt framing and mounting clips for panel attachment.
- B. Metal Wall Panels, General: Factory-formed, concealed fastener panels with interconnecting side joints, fastened to supports with concealed fasteners, with factory-applied sealant in side laps when required to meet performance requirements.
- C. System Performance Requirements: Provide metal wall panel assemblies meeting performance requirements as determined by application of specified tests by a qualified testing agency on manufacturer's standard assemblies.

1. Air Infiltration: Maximum 0.06 cfm/sq. ft. (0.3 L/s per sq. m) per ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa), using minimum 10-by-10 foot (3050-by-3050 mm) test panel that includes side joints.
  2. Water Penetration, Static Pressure: No uncontrolled water penetration per ASTM E 331 at a minimum static differential pressure of 6.24 lbf/sq. ft. (299 Pa), using minimum 10-by-10 foot (3050-by-3050 mm) test panel that includes side joints.
  3. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, per ASTM E 72:
    - a. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
    - b. Limits of Deflection: Metal wall panel assembly shall withstand scheduled wind pressure with the following allowable deflection:
      - 1) Maximum allowable deflection limited to L/180 deflection of panel perimeter normal to plane of wall with no evidence of failure.
    - c. Secondary Metal Framing: Design secondary metal framing for metal wall panel assembly according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
  4. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction.
- D. Metallic-Coated Steel Face Sheet: Coil-coated, ASTM A 755/A 755M.
- E. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Class Z275), structural steel quality.
1. Aluminum-zinc alloy-coated Steel Sheet: ASTM A 792/A 792 M, Class AZ50 Grade 50 (Class AZM150, Grade 275), structural steel quality.
  2. Face Sheet: Minimum 0.024 inch/24 gage (0.60 mm) nominal uncoated thickness.
  3. Face Sheet: Minimum 0.030 inch/22 gage (0.76 mm) nominal uncoated thickness.
  4. Face Sheet: Minimum 0.036 inch/20 gage (0.91 mm) nominal uncoated thickness.
  5. Face Sheet: Minimum 0.047 inch/18 gage (1.19 mm) nominal uncoated thickness.
  6. Surface: Smooth.
  7. Surface: Non-Directional Embossed.



- F. Aluminum Face Sheet: Smooth surface coil-coated, ASTM B 209, 3003-H14 or 5052-H32 alloy.
1. Face Sheet: 0.032 inch (0.8 mm) nominal thickness.
  2. Face Sheet: 0.040 inch (1.0 mm) nominal thickness.
  3. Face Sheet: 0.050 inch (1.27 mm) nominal thickness.
  4. Surface: Smooth.
  5. Surface: Non-Directional Embossed.
  6. Aluminum Products Recycled Content: Average of postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
- G. Stainless-Steel Face Sheet: ASTM A 666, architectural grade alloy type as indicated.
1. Face Sheet: 0.024 inch/24 gage (0.60 mm) nominal thickness.
  2. Face Sheet: 0.030 inch/22 gage (0.76 mm), nominal thickness.
  3. Face Sheet: 0.036 inch/20 gage (0.91 mm), nominal thickness.
  4. Alloy: Type 304, bright, non-directional polish, No. 2B.
  5. Alloy: Type 316, bright, non-directional polish, No. 2B.
- H. Reveal-joint profile with raised flat pan MWP#\_\_\_:
1. Basis of Design Product: CENTRIA, CS-200.
  2. Panel Coverage: 12 inches (305 mm).
  3. Panel Height: 0.875 inch (22 mm).
- I. Reveal-joint profile with raised flat pan and concealed extended fastener leg MWP#\_\_\_:
1. Basis of Design Product: CENTRIA, CS-200E.
  2. Panel Coverage: 12 inches (305 mm).
  3. Panel Height: 0.875 inch (22 mm).

- J. Double-reveal profile with raised flat pan and rib MWP#\_\_\_:
1. Basis of Design Product: CENTRIA, CS-210.
  2. Panel Coverage: 12 inches (305 mm).
  3. Panel Height: 0.875 inch (22 mm).
- K. Double-reveal profile with raised flat pan and rib, with concealed extended fastener leg MWP#\_\_\_:
1. Basis of Design Product: CENTRIA, CS-210E.
  2. Panel Coverage: 12 inches (305 mm).
  3. Panel Height: 0.875 inch (22 mm).
- L. Three-rib Profile MWP#\_\_\_:
1. Basis of Design Product: CENTRIA, CS-260.
  2. Panel Coverage: 12 inches (305 mm).
  3. Panel Height: 0.875 inch (22 mm).
- M. Three-rib profile with concealed extended fastener leg MWP#\_\_\_:
1. Basis of Design Product: CENTRIA, CS-260E.
  2. Panel Coverage: 12 inches (305 mm).
  3. Panel Height: 0.875 inch (22 mm).
- N. Double-reveal profile with raised flat pan and rib MWP#\_\_\_:
1. Basis of Design Product: CENTRIA, CS-610.
  2. Panel Coverage: 16 inches (406 mm).
  3. Panel Height: 0.875 inch (22 mm).

- O. Double-reveal profile with raised flat pan and rib, with concealed extended fastener leg MWP#\_\_\_:
1. Basis of Design Product: CENTRIA, CS-610E.
  2. Panel Coverage: 16 inches (406 mm).
  3. Panel Height: 0.875 inch (22 mm).
- P. Double-reveal profile with evenly spaced raised flat pan between reveals MWP#\_\_\_:
1. Basis of Design Product: CENTRIA, CS-620.
  2. Panel Coverage: 16 inches (406 mm).
  3. Panel Height: 0.875 inch (22 mm).
- Q. Double-reveal profile with evenly spaced raised flat pan between reveals and concealed extended fastener leg MWP#\_\_\_:
1. Basis of Design Product: CENTRIA, CS-620E.
  2. Panel Coverage: 16 inches (406 mm).
  3. Panel Height: 0.875 inch (22 mm).
- R. Four-rib profile with recessed flat pan between ribs MWP#\_\_\_”
1. Basis of Design Product: CENTRIA, CS-660.
  2. Panel Coverage: 16 inches (406 mm).
  3. Panel Height: 0.875 inch (22 mm).
- S. Four-rib profile with recessed flat pan between ribs and concealed extended fastener leg MWP#\_\_\_:
1. Basis of Design Product: CENTRIA, CS-660E.
  2. Panel Coverage: 16 inches (406 mm).
  3. Panel Height: 0.875 inch (22 mm).
- T. Exposed Coil-Coated Finish System:

1. Fluoropolymer Two-Coat System: 0.2-mil primer with 0.8-mil 70 percent PVDF fluoropolymer color coat.
  - a. AAMA 620.
  - b. AAMA 621.
  - c. Basis of Design: CENTRIA Fluorofinish.
2. Fluoropolymer Two-Coat System: 0.8 mil primer with 0.8 mil 70 percent PVDF fluoropolymer color coat.
  - a. AAMA 620.
  - b. AAMA 621.
  - c. Basis of Design: CENTRIA Duraguard.
3. Fluoropolymer Three-Coat System: 0.8 mil primer with 0.8 mil 70 percent PVDF fluoropolymer color coat, and a 0.8 mil 70 percent PVDF fluoropolymer clear coat.
  - a. AAMA 620.
  - b. AAMA 621.
  - c. Basis of Design: CENTRIA Duraguard Plus.
4. Fluoropolymer Two-Coat Mica System: 0.25-mil primer with 0.8-mil 70 percent PVDF fluoropolymer color coat providing a pearlescent appearance.
  - a. AAMA 620.
  - b. AAMA 621.
  - c. Basis of Design: CENTRIA Sundance Mica.
5. Fluoropolymer Three-Coat Metallic System: 0.2 mil primer with 0.8-mil 70 percent PVDF fluoropolymer color coat containing metal flakes, and a 0.5-mil 70 percent PVDF fluoropolymer clear coat.
  - a. AAMA 620.
  - b. AAMA 621.
  - c. Basis of Design: CENTRIA Sundance AM.
6. Fluoropolymer Two-Coat Corrosion and Abrasion Resistant System: 3.0 mil primer with 0.8 mil 70 percent PVDF fluoropolymer color coat.
  - a. Interior Finish: 3.0 mil primer and wash coat topcoat.
  - b. Interior Finish: 3.0 mil primer and polyester topcoat.

- c. Interior Finish: 3.0 mil primer and urethane topcoat.
  - d. Basis of Design: CENTRIA Versacor Ultra PF.
- 7. Urethane Two-Coat Corrosion and Abrasion Resistant System: 3.0 mil primer with 1.5 mil urethane color coat.
  - a. Interior Finish: 3.0 mil primer and wash coat topcoat.
  - b. Interior Finish: 3.0 mil primer and polyester topcoat.
  - c. Interior Finish: 3.0 mil primer and urethane topcoat.
  - d. Basis of Design: CENTRIA Versacor Ultra TF.
- 8. Urethane Two-Coat Plus Corrosion and Abrasion Resistant System: 3.0 mil primer with 3.0 mil urethane color coat.
  - a. Interior Finish: 3.0 mil primer and wash coat topcoat.
  - b. Interior Finish: 3.0 mil primer and polyester topcoat.
  - c. Interior Finish: 3.0 mil primer and urethane topcoat.
  - d. Basis of Design: CENTRIA Versacor Ultra HF.
- 9. Fluoropolymer Three Coat System: 0.2 mil primer with a 0.5 mil polyester base coat and a 0.8 mil nominal PVDF fluoropolymer topcoat providing an iridescent finish.
  - a. Basis of Design: CENTRIA KolorShift.

U. Color:

- 1. Exterior Surface: As indicated.
- 2. Exterior Surface: As selected by Architect from manufacturer's standard colors.
- 3. Exterior Surface: Match Architect's custom color.
- 4. Interior Surface: Manufacturer's standard primer color.
- 5. Interior Surface: As indicated.
- 6. Interior Surface: As selected by Architect from manufacturer's standard colors.
- 7. Interior Surface: Match Architect's custom color.

2.3 LINEAR PANELS

- A. Metal Liner Panels, General: Factory-formed panels with interconnecting side joints, fastened to supports with fasteners.

1. Material: Aluminum-zinc alloy-coated Steel Sheet.
  2. Face Sheet: Minimum 0.024 inch/24 gage (0.60 mm) nominal uncoated thickness.
  3. Face Sheet: Minimum 0.030 inch/22 gage (0.76 mm) nominal uncoated thickness.
  4. Face Sheet: Minimum 0.036 inch/20 gage (0.91 mm) nominal uncoated thickness.
  5. Face Sheet: Minimum 0.047 inch/18 gage (1.19 mm) nominal uncoated thickness.
  6. Panel Sheet: Solid.
  7. Panel Sheet: Perforated, with 10 percent free area.
  8. Surface: Smooth.
  9. Surface: Non-Directional Embossed.
- B. Metal liner panel MLP#\_\_\_:
1. Basis of Design Product: CENTRIA, L2.
  2. Panel Coverage: 24 inches (610 mm).
  3. Panel Height: 1-3/8 inches (35 mm).
  4. Stiffening Beads: Two.
- C. Metal liner panel MLP#\_\_\_:
1. Basis of Design Product: CENTRIA, L2-2.
  2. Panel Coverage: 24 inches (610 mm).
  3. Panel Height: 2 inches (50 mm).
  4. Stiffening Beads: Two.
- D. Metal liner panel MLP#\_\_\_:
1. Basis of Design Product: CENTRIA, L2-3.
  2. Panel Coverage: 24 inches (610 mm).
  3. Panel Height: 3 inches (76 mm).
  4. Stiffening Beads: Two.
- E. Exposed Coil-Coated Finish System:
1. Fluoropolymer Two-Coat System: 0.2-mil primer with 0.8-mil 70 percent PVDF fluoropolymer color coat, AAMA 621.

- a. Basis of Design: CENTRIA Fluorofinish.
2. Fluoropolymer Two-Coat System: 0.8 mil primer with 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621.
  - a. Basis of Design: CENTRIA Duraguard.
3. Fluoropolymer Three-Coat System: 0.8 mil primer with 0.8 mil 70 percent PVDF fluoropolymer color coat, and a 0.8 mil 70 percent PVDF fluoropolymer clear coat, AAMA 621.
  - a. Basis of Design: CENTRIA Duraguard Plus.
4. Fluoropolymer Two-Coat Mica System: 0.25-mil primer with 0.8-mil 70 percent PVDF fluoropolymer color coat providing a pearlescent appearance, AAMA 621.
  - a. Basis of Design: CENTRIA Sundance Mica.
5. Fluoropolymer Three-Coat Metallic System: 0.2 mil primer with 0.8-mil 70 percent PVDF fluoropolymer color coat containing metal flakes, and a 0.5-mil 70 percent PVDF fluoropolymer clear coat, AAMA 621.
  - a. Basis of Design: CENTRIA Sundance AM.
6. Fluoropolymer Two-Coat Corrosion and Abrasion Resistant System: 3.0 mil epoxy-modified primer with 0.8 mil 70 percent PVDF fluoropolymer color coat.
  - a. Basis of Design: CENTRIA Versacor Ultra PF.
  - b. Interior Exposed Finish: 3.0 mil primer and wash coat topcoat.
  - c. Interior Exposed Finish: 3.0 mil primer and polyester topcoat.
  - d. Interior Exposed Finish: 3.0 mil primer and urethane topcoat.
7. Urethane Two-Coat Corrosion and Abrasion Resistant System: 3.0 mil primer with 1.5 mil urethane color coat.
  - a. Basis of Design: CENTRIA Versacor Ultra TF.
  - b. Interior Exposed Finish: 3.0 mil primer and wash coat topcoat.
  - c. Interior Exposed Finish: 3.0 mil primer and polyester topcoat.
  - d. Interior Exposed Finish: 3.0 mil primer and urethane topcoat.
8. Urethane Two-Coat Plus Corrosion and Abrasion Resistant System: 3.0 mil primer with 3.0 mil urethane color coat.
  - a. Basis of Design: CENTRIA Versacor Ultra HF.
  - b. Interior Exposed Finish: 3.0 mil primer and wash coat topcoat.

- c. Interior Exposed Finish: 3.0 mil primer and polyester topcoat.
  - d. Interior Exposed Finish: 3.0 mil primer and urethane topcoat.
- 9. Fluoropolymer Three Coat System: 0.2 mil primer with a 0.5 mil polyester base coat and a 0.8 mil nominal PVDF fluoropolymer topcoat providing an iridescent finish.
  - a. Basis of Design: CENTRIA KolorShift.
- F. Color:
  - 1. Interior Exposed Surface: As indicated.
  - 2. Interior Exposed Surface: As selected by Architect from manufacturer's standard colors.
  - 3. Interior Exposed Surface: Match Architect's custom color.
  - 4. Concealed Surface: Manufacturer's standard primer color.

#### 2.4 METAL WALL ACCESSORIES

- A. Metal Wall Panel Backup System: Refer to related specification section for requirements.
- B. Metal Wall Panel Accessories, General: Provide complete metal wall panel assembly incorporating trim, copings, fasciae, parapet caps, soffits, sills, inside and outside corners, and miscellaneous flashings. Provide manufacturer's factory-formed clips, shims, flashings, gaskets, lap tapes, closure strips, and caps for a complete installation. Fabricate and install accessories in accordance with SMACNA Manual.
- C. Extruded Trim: Manufacturer's complementary aluminum extrusions for head, jamb, sill, base, flush, reveal, inside and outside corner, endwall, and expansion joint details. Finish to match metal wall panels.
  - 1. Basis of Design: CENTRIA, Microline Extrusions.
- D. Mitered Corners: Structurally bonded horizontal interior and exterior trimless corners matching metal wall panel material, profile, and factory-applied finish, fabricated and finished by metal wall panel manufacturer.
  - 1. Welded, riveted, fastened, or field- fabricated corners do not meet the requirements of this specification.
  - 2. Basis of Design: CENTRIA, MicroSeam Corners.
- E. Formed Flashing and Trim: Match material, thickness, and color of metal wall panel face sheets.
- F. Sealants: Type recommended by metal wall panel manufacturer for application, meeting requirements of Joint Sealants section.
- G. Flashing Tape: 4 inches (102 mm) wide self-adhering butyl flashing tape.



- H. Fasteners, General: Self-tapping screws, bolts, nuts, and other acceptable fasteners recommended by panel manufacturer. Where exposed fasteners cannot be avoided for miscellaneous applications, supply corrosion-resistant fasteners with heads matching color of metal wall panels by means factory-applied coating.
- I. Concealed Clips: Galvanized steel, 0.051 inch/16 gauge (1.3 mm) thick, designed to allow unimpeded thermal movement of panel and configured to hold panel minimum 1/2 inch (13 mm) from substrate.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine wall panel substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal wall panels.
- B. Wall Substrate: Confirm that wall substrate is within tolerances acceptable to metal wall panel system manufacturer.
  - 1. Maximum substrate and framing deviations from flat plane acceptable:
    - a. 1/4 inch in 20 feet (6 mm in 6 m) vertically or horizontally.
    - b. 1/2 inch (13 mm) across building elevation.
    - c. 1/8 inch in 5 feet (3 mm in 1.5 m).
- C. Framing: Inspect framing that will support metal wall panels to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal wall panels.
- D. Air/Moisture Barriers: Confirm that work has been completed, inspected, and tested as required.
- E. Openings: Verify that window, door, louver and other penetrations match layout on shop drawings.
- F. Correct out-of-tolerance work and other deficient conditions prior to proceeding with metal wall panel system installation.

#### 3.2 METAL WALL PANEL INSTALLATION

- A. General: Install modular metal panel system in accordance with approved shop drawings and manufacturer's recommendations.
- B. Installation: Attach panels to metal sub-framing using recommended clips, screws, fasteners, sealants, and adhesives indicated on approved shop drawings.
  - 1. Horizontal Joinery: Working from base of installation to top, connect upper panel to lower panel at joinery.

2. Vertical Joinery: Provide reveal between vertical ends of panels as shown on shop drawings.
  3. Galvanic Action: Where elements of modular metal wall system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.
- C. Rainscreen Installation: Proceed with installation of manufacturer's dry seal horizontal joinery.

### 3.3 ACCESSORY INSTALLATION

- A. General: Install metal wall panel accessories with positive anchorage to building and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install related flashings and sheet metal trim per requirements of section Sheet Metal Flashing and Trim.
  2. Install components required for a complete metal wall panel assembly, including trim, copings, corners, lap strips, flashings, sealants, fillers, closure strips, and similar items.
  3. Comply with performance requirements and manufacturer's written installation instructions.
  4. Provide concealed fasteners except where noted on approved shop drawings.
  5. Set units true to line and level as indicated.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a service representative authorized by metal wall panel manufacturer to inspect completed installation. Submit written report.
- B. Correct deficiencies noted in manufacturer's report.

### 3.5 CLEANING AND PROTECTION

- A. Remove temporary protective films. Clean finished surfaces as recommended by metal wall panel manufacturer. Clear weep holes and drainage channels of obstructions, dirt, and sealant. Maintain in a clean condition during construction.
- B. Replace damaged panels and accessories that cannot be repaired by finish touch-up or minor repair.

## PART 4 - MEASUREMENT AND PAYMENT

- A. No separate measurement or payment will be made for items in Section 074213 Metal Wall Panels. Payment for all work shall be considered incidental to the Contract lump sum price for each Bus Rapid Transit Shelter Structural Glass Façade, as specified in Section 084427.

END OF SECTION 074213

## SECTION 074243 – COMPOSITE WALL PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.

#### 1.2 SUMMARY

- A. Section Includes:

1. Phenolic cladding panels for soffit.
2. Attachments and fasteners.

#### 1.3 ACTION SUBMITTALS

- A. Shop Drawings: Include plans, elevations, and details, size and layout panels, flashing, rainscreen airflow, supports and attachments.
- B. Product Data: Technical data, physical properties and installation instructions for each component.
- C. Color Charts: Manufacturers standard color options.
- D. Samples: Submit manufacturers finished samples 12-inch x 12-inch in specified color,
- E. Warranty:
  1. Manufacturer's warranty certificate.
  2. Installers written warranty statement.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Installer: Installation experience statement.
- B. Testing and Evaluation Reports: Independent testing laboratory for the following for ASTM E84 and NFPA 285.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  1. Minimum of 10 years successful experience producing phenolic materials.
  2. Domestic factory assembly, shop fabrication and pre-finishing.

B. Installer Qualifications:

1. Minimum 2-years installation experience of specified materials.

C. Single Source Responsibility:

1. Materials from a single manufacturer for each component and warranty.

D. Pre-Installation Conference: Convene to review the following:

1. Areas of installation.
2. Framing and rough carpentry.
3. Connections to adjacent surfaces and transitions.
4. Structural requirements and anchoring locations.

A. Mock-Up:

1. Full-size mockup erected at site, to verify color, workmanship and installation details as determined by architect.
2. Complete assembly, color, sheen and model.

1.6 FIELD CONDITIONS

- A. Do not install panels on wet or frozen surfaces.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials following manufacturer instructions.

- B. Immediately upon delivery notify the manufacturer of damaged or defective materials for replacement.

1. Verify manufacturer's labels meet approved product name, color, texture and finish.

- C. Store factory sealed materials indoors, above grade and protected from sun, weather and materials that could cause staining or discoloration of finish.

1. Maintain humidity levels less than 65 percent relative humidity prior to installation.

1.8 WARRANTY

- A. Manufacturer to warrant against material defects and manufacturing tolerances for a period of 10-years.

- B. Installer to warrant against installation defects for a period of 4-years. Repair or replace materials during warranty period at no cost to City.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. Basis of Design: Fibresin Industries, Inc. is manufacturer for the scope described in this Section.
- B. Subject to compliance with requirements, provide product indicated, or comparable product.

### 2.2 MATERIALS

- A. Phenolic Exterior Cladding: Solid phenolic laminate panel with UV protective clear coat.

- 1. Type 1

- a. Style: Stonewood Architectural Panels
- b. Color: Elephant 2378-AB
- c. Install Pattern: per drawings.
- d. Finish: Factory #60 matte
- e. Thickness: 3/8 inch (10mm)

- 2. Type 2

- a. Style: Stonewood Architectural Panels
- b. Color: Platinum 1520-CB
- c. Install Pattern: per drawings.
- d. Finish: Factory #60 matte
- e. Thickness: 3/8 inch (10mm)

- 3. Panel Core: Phenolic resin treated layer, black and natural brown kraft paper.

- 4. Decorative Layer: Melamine resin, proprietary pigmented and treated.

- 5. Weather and UV Resistant Layer: 2-mil, proprietary layer combining pigment protection, Ultraviolet light and weather resistant layer.

- B. Physical Properties

- 1. Flexural Strength, ASTM D790

- a. Machine Direction: 16,000 psi
- b. Cross Direction: 12,000 psi

2. Flexural Modulus, ASTM D790
  - a. Machine Direction: 1,500,000 psi
  - b. Cross Direction: 1,100,000 psi
3. Tensile Modulus, ASTM D638
  - a. Machine Direction: 15,000 psi
4. Fastening Strength, ASTM D1761
  - a. 1,260 pound-force
5. Structural Performance: Withstand design wind load based on building code, but not less than 23psf with maximum L/180 tested to ASTM E330.
6. Fire Performance:
  - a. Flame Spread/Smoke Developed: [Class A,] [Class B,] tested to ASTM E84.
  - b. Ignition Temperature: Greater than 650 degrees F (350 degrees C) above ambient, tested to ASTM D1929.
  - c. Extended Surface Burn: Max Flame Front less than 10 feet, tested to ASTM E2768.
  - d. When required for compliance with local building codes, wall assemblies shall not ignite when exposed to a radiant heat energy source, NFPA 268.
  - e. When required for compliance with local building codes, wall assemblies shall meet performance requirements of NFPA 285.
7. Finish Performance:
  - a. Humidity Resistance: No cracking, checking, crazing, erosion, delamination, distress, tested to ASTM D2247.
  - b. Salt Spray Resistance: No cracking, checking, crazing, Erosion, Delamination, or distress, tested to ASTM B117.
  - c. Weather Exposure: Maximum gray scale change of 3-4 according to DIN EN 438-2 when tested to ASTM D2244 at accelerated – 3000 Hours in Atlas Type Weatherometer using cycle of 102 minutes light and 18 minutes diminished light and demineralized water.

## 2.3 FABRICATION

- A. Panels: Solid phenolic impregnated kraft paper panels with no voids, air spaces or foamed insulation in the core material.

- C. Panel Dimensions: Field fabrication shall be allowed where necessary but, shall be kept to an absolute minimum.
  - 1. All fabrication shall be done under controlled shop conditions when possible.
- D. Fabrication Tolerances: Manufacturer to provide shop fabrication and pre-finishing for a warranted finish.
  - 1. NEMA Testing Results
    - a. Dimensional Change, 3.11 test
      - 1) Length (Machine Direction): 0.25 percent
      - 2) Width (Cross Direction): 0.50 percent
    - b. Weight Per Unit Area:
      - 1) Pounds/ square feet: 2.68
      - 2) Density: 86 pounds per cubic foot

## 2.4 ACCESSORIES

- A. Fasteners: Manufacturer approved austenitic stainless-steel fastener with bi-metal welded carbon steel point.
  - 1. Concealed fasteners / Attachment System: Manufacturer approved sub-frame system to support a cladding weight of up to 8 pounds per square foot, fabricated of 0.09-inches 6063 T5 extruded aluminum or 16-gauge G90 Galvanized steel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine materials, installation instructions, and review manufacturer's instructions on site.
- B. Verify panel style, color, and fasteners are approved by Architect.
- C. Verify substrates and adjacent surfaces are level and plumb for installation.
  - 1. Do not begin work until construction has progressed to allow installation of materials.
  - 2. Confirm sheathing is plumb and level, with no deflection greater than 1/4 inch in 20 feet.
  - 3. Verify manufacturers fastener spacing requirements.
  - 4. Verify proper hole diameter in panels per manufacturer's instructions.
- D. Proceed with work when construction has progressed to allow a warranted installation.
  - 1. Installation deems acceptance of work for a warranted installation.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions and Shop Drawings, maintaining required 1-inch ventilation spacing requirement.
- B. Fasten panels to an approved attachment system structurally supported by aluminum, galvanized steel, or wood stud supported wall.
- C. Install panel square, edges clean and true to size.
  - 1. Cut panels to fit at perimeter and around penetrations with minimum 3/8-inch gap.
  - 2. Re-chamfer field cut edges.
- D. Do not install damaged, irregular, or defective panels.

### 3.3 FIELD QUALITY CONTROL

- A. Inspect panel ventilation at top and bottom of wall for proper vertical air flow required for rainscreen systems.
- B. Comply with manufacturer's written installation instructions applicable to products and applications indicated.
- C. Verify installation, fasteners and connections with adjacent materials, and transitions have been completed in accordance with shop drawings.
- D. Installer is responsible for engineering the connection between the Stonewood system and the supporting wall.

### 3.4 ADJUSTING

- A. Modify, adjust and replace panels not within manufacturer's tolerances and as required by Architect.

### 3.5 PROTECTION

- A. Protect surface, corners and components from damage prior to Owner occupancy using temporary protection.

## PART 4 - MEASUREMENT AND PAYMENT

- 4.1 No separate measurement or payment will be made for items in Section 074243 Composite Wall Panels. Payment for all work shall be considered incidental to the Contract lump sum price for each Bus Rapid Transit Shelter Structural Glass Façade, as specified in Section 084427.

END OF SECTION 074243



## SECTION 076000 – SHEET METAL GUTTERS AND DOWNSPOUTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.

#### 1.2 DESCRIPTION

- A. This Section includes specifications for manufacturing and installation of the gutters and downspouts as indicated on the contract documents.
- B. Related Work Specified Elsewhere:
  - 5. Section 074113 Metal Roof Panels

#### 1.3 QUALITY CONTROL

- A. Installer Qualifications: Engage an experience Installer who has completed sheet metal work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. General: Install sheet metal to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.
- C. Comply with applicable provisions of the following specifications and documents:
  - 1. Architectural Sheet Metal Manual by SMACNA requirements.
  - 2. ASTM Specifications.

#### 1.4 SUBMITTALS

- A. Product Data: Product Data including manufacturer's material and finish data, installation instructions.
- B. Shop Drawings: Show layout and types of gutters and downspouts, anchorage details, methods of jointing, accessories, and attachments to other construction.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Gutters:

1. Fabricate to size and profile indicated, complete with end pieces, outlet tubes, and other accessories as required.
2. Gutters shall be complete with mitered corners, end caps, and outlets sized to fit downspouts.
3. Gutter Material: Coil-Coated Galvanized Steel Sheet: Zinc-coated, commercial-quality steel sheet conforming to ASTM A 755, G 90 (ASTM A 755M, Z 275) coating designation, oil coated with high-performance fluoropolymer coating as specified, not less than 0.0276 inch thick.
4. Fabricate sections in maximum lengths practical; not less than 96 IN long.
5. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice gutter thickness.
6. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
7. Gutter supports shall be adjustable minimum 1 IN wide by minimum .080 IN thick hanger, provided in sufficient number to be located at maximum 30 IN on center, or minimum 0.032 IN thick continuous cleats.

B. Downspouts:

1. Fabricate downspouts to size and profile indicated complete with formed or mitered elbows.
2. Downspout Material: Coil-Coated Galvanized Steel Sheet: Zinc-coated, commercial-quality steel sheet conforming to ASTM A 755, G 90 (ASTM A 755M, Z 275) coating designation, oil coated with high-performance fluoropolymer coating as specified, not less than 0.0276 inch thick.
3. Shape: Rectangular.
4. Furnish with metal hangers, from same material as downspouts, and anchors.
5. Downspouts shall be fabricated in minimum 10 FT lengths with section ends formed for minimum 1/2 IN telescoped and locked joints.
6. Downspouts shall be complete with indicated elbows and offsets.

2.2 COIL-COATED GALVANIZED STEEL SHEET FINISH

- A. High-Performance Organic Coating Finish: Apply the following system by coil-coating process on galvanized steel sheet as recommended by coating manufacturers and applicator.

1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.
  - a. Color and Gloss: As indicated by manufacturer's color and gloss designations.
  - b. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.
  - c. Resin Manufacturers: Subject to compliance with requirements, provide fluoropolymer coating systems containing resins produced by one of the following manufacturers:
    - 1) Ausimont USA, Inc. (Hylar 5000)
    - 2) Elf Atochem North America, Inc. (Kynar 500)
  - d. Coil-Coated Steel Sheet Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Atas Aluminum Corporation.
    - 2) Copper Sales, Inc.
    - 3) MM Systems Corporation.
    - 4) Petersen Aluminum Corporation.
    - 5) Vincent Metals.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Shop assemble work in largest practical sections; minimize field connections. Grind smooth parts exposed to view; remove weld marks and leave free of fabrication marks. Miter corners and edges unless otherwise shown. Make members true to length so assembling may be done without fillers. Bends, twists, open joints in finished members, or projecting edges or corners at connections will not be permitted. Miter, cope, and block carefully to produce tight joints. Provide lugs, clips, connections, bolts, and fastenings necessary to complete fabrication.
- B. General: Fabricate items in thickness or weight needed to comply with performance requirements but not less than that listed for each application and metal.

- C. Provide dissimilar metals and materials protection where dissimilar metals come in contact or where sheet metal contacts mortar, concrete masonry or concrete.
- D. Install products in accordance with manufacturer's instructions, SMACNA, and as indicated on Drawings.
- E. Installation – gutters and downspouts
  - 1. Install gutters below slope line of roof, supported on adjustable hangers spaced maximum 30 inches on center or by continuous cleats.
  - 2. Join gutter sections with flat locked, riveted and sealed joints with hard setting sealant fill to provide completely watertight system.
  - 3. Adjust gutters to slope uniformly to downspout outlets, with high point midway between outlets.
  - 4. Install downspouts in locations shown on the Drawings.
  - 5. Install downspouts supported by leader straps or concealed rack and pin type fasteners at top, bottom and intermediate points not exceeding 5 FT on center.
  - 6. Provide downspout anchor straps per SMACNA as appropriate for downspout style.
  - 7. Provide gutter to downspout connection per SMACNA Figure 1-33B, Detail 1.
  - 8. Seal all joints in downspout for a complete watertight system.
  - 9. Paint downspouts to match the canopy/roof.
  - 10. Provide all miscellaneous sheet metal items not specifically covered elsewhere, as indicated or required to provide a weather tight installation.

#### PART 4 - MEASUREMENT AND PAYMENT

- A. No separate measurement or payment will be made for items in Section 076000 Sheet Metal Gutters and Downspouts. Payment for all work shall be considered incidental to the Contract lump sum price for each Bus Rapid Transit Shelter Structural Glass Façade, as specified in Section 084427.

END OF SECTION 076000

## SECTION 079200 – JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.

#### 1.2 SUMMARY

- A. Section Includes:

1. Silicone joint sealants.
2. Non staining silicone joint sealants.
3. Urethane joint sealants.
4. Mildew-resistant joint sealants.
5. Butyl joint sealants.
6. Latex joint sealants.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct a conference at the Project site.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
  1. Joint-sealant application, joint location, and designation.
  2. Joint-sealant manufacturer and product name.
  3. Joint-sealant formulation.

4. Joint-sealant color.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
  1. Joint-sealant location and designation.
  2. Manufacturer and product name.
  3. Type of substrate material.
  4. Proposed test.
  5. Number of samples required.
- D. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
  1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
  2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
- E. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in “Preconstruction Testing” Article.
- F. Field-Adhesion-Test Reports: For each sealant application tested.
- G. Sample Warranties: For special warranties.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
  1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

#### 1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
  - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
  - 2. Conduct field tests for each kind of sealant and joint substrate.
  - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
  - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
    - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
      - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
  - 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
  - 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

#### 1.8 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

#### 1.9 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
  1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  2. Disintegration of joint substrates from causes exceeding design specifications.
  3. Mechanical damage caused by individuals, tools, or other outside agents.
  4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

### PART 2 - PRODUCTS

#### 2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Project Engineer from manufacturer's full range

#### 2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.



1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Dow Corning Corporation; 791.
  - b. Pecora Corporation; PCS.
  - c. Sika Corporation U.S.; Sikasil WS-295 or Sikasil WS-295 FPS.
- B. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Dow Corning Corporation; 758.
    - 2) Polymeric Systems, Inc.; PSI-631.
- C. Silicone, Acid Curing, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant: ASTM C 920, Type S, Grade NS, Class 25, Use NT.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Bostik, Inc.; Chem-Calk 1200.
    - b. Dow Corning Corporation; 999A.
    - c. Pecora Corporation; 860.
    - d. Polymeric Systems, Inc.; PSI-601.
    - e. Sika Corporation U.S.; Sikasil-GP.

## 2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Sika Corporation U.S.; Sikasil WS 290 FPS.
  - b. Pecora Corporation; 890FTS/TXTR.
  - c. Tremco Incorporated; Spectrem 1.
- C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; 756 SMS.
    - b. Sika Corporation U.S.; Sikasil WS 295 FPS.
    - c. Pecora Corporation ;864NST.
    - d. Tremco Incorporated; Spectrem 2.
- D. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; 790.

#### 2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. BASF Building Systems; MasterSeal TX1.
  2. Bostik, Inc.; Chem-Calk GPS1.
  3. Pecora Corporation; Dynatrol I-XL.
  4. Sherwin-Williams Company (The); Stampede-1.
  5. Sika Corporation U.S.; Sikaflex Textured Sealant.

6. Tremco Incorporated; Dymonic.
- C. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Building Systems; MasterSeal SL 1.
    - b. Pecora Corporation; NR-201.
    - c. Sherwin-Williams Company (The); Stampede 1SL.
- D. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Pecora Corporation; Dynatrol II.
- E. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Use NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Sherwin-Williams Company (The); Stampede-2NS.
- F. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Uses T and NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Tremco Incorporated; Dymeric 240.
- G. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 25, Uses T and NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Bostik, Inc.; Chem-Calk 505.
  - b. LymTal International, Inc.; Iso-Flex 881.
  - c. Sika Corporation U.S.; Sikaflex – 2c NS EZ Mix.
- H. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T and NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
- a. Bostik, Inc.; Chem-Calk 555-SL.
  - b. LymTal International, Inc.; Iso-Flex 880 GB.
  - c. Pecora Corporation; Dynatrol II SG
  - d. Sherwin-Williams Company (The); Stampede-2SL.
  - e. Tremco Incorporated; THC 900/901.

## 2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
- a. Dow Corning Corporation; 786-M White.
  - b. Sika Corporation U.S.; Sikasil GP.
  - c. Soudal USA; RTV GP.
  - d. Tremco Incorporated; Tremsil 200.
- C. STPE, Mildew Resistant, S, NS, 50, NT: Mildew-resistant, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. BASF Building Systems; MasterSeal NP 150.

- D. Sanitary Mildew Resistant Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Pecora Corporation; 898NST. USDA approved.

## 2.6 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Bostik, Inc.; Chem-Calk 300.

- b. Pecora Corporation; BC-98.

- c. Tremco Incorporated; Tremco Butyl Sealant.

## 2.7 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. BASF Building Systems; Sonolac.

- b. Pecora Corporation; AC-20.

- c. Sherwin-Williams Company (The); 850A.

- d. Tremco Incorporated; Tremflex 834.

## 2.8 JOINT SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. BASF Construction Chemicals, LLC, Building Systems.
  - b. Construction Foam Products, a division of Nomaco, Inc.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## 2.9 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
    - d. Exterior insulation and finish systems.
    - e. Remove laitance and form-release agents from concrete.
  3. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with ASTM C1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
    - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

### 3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
  - 1. Extent of Testing: Test completed and cured sealant joints as follows:



- a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
  - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
  - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
  - a. Whether sealants filled joint cavities and are free of voids.
  - b. Whether sealant dimensions and configurations comply with specified requirements.
  - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
6. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

PART 4 - MEASUREMENT AND PAYMENT

- A. The Work of this Section will not be measured for payment. The Work of this Section will be incidental to the work being performed.

END OF SECTION 079200

SECTION 084427 – BUS RAPID TRANSIT SHELTER STRUCTURAL GLASS FAÇADE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.

1.2 SUMMARY

- A. Work under this Section is the responsibility of the Specialty Structural Glass Manufacturer and consists of the furnishing and execution of the structural glass system and all accessory work. The complete structural glass system shall be furnished by the Specialty Structural Glass Manufacturer.
- B. The General Contractor as used herein refers to the entity contracting for the structural glass system.
- C. The work includes the following:
  - 1. The structural glass system and associated work as defined in this Section and indicated on the Contract Drawings.
  - 2. Engineering design and material supply of the structural glass system and all glazing components and accessory parts.
  - 3. Fabrication, packaging and delivery to job site.
  - 4. Installation by an installer under the direction of a technical advisor provided by the Specialty Structural Glass Manufacturer.

1.3 RELATED SECTIONS

- A. Section 074113 Metal Roof Panels
- B. Section 074213 Metal Wall Panels
- C. Section 074243 Composite Walls Panels

1.4 DESIGN RESPONSIBILITY

- A. The Specialty Structural Glass Manufacturer shall be responsible for complete system design, manufacturing, and to provide installation supervision services. The Specialty Glass Manufacturer shall not subcontract engineering or design services. Scope of services to include

structural design calculations, shop drawings, manufacturing and procurement of all glass wall components, coordination with the General Contractor and erector, and field supervision during erection.

## 1.5 PERFORMANCE REQUIREMENTS

- A. Structural Design: Design of the structural glass wall including comprehensive engineering analysis by a qualified professional engineer, employed by the Specialty Glass Manufacturer, using design and structural performance requirements outlined in these specifications.
  - 1. Design Loads: Determine design loading based according to ASCE/SEI 7, based on heights and configuration indicated on the drawings.
- B. General Performance: Comply with the performance requirements specified for this project without failure. Failure is defined as the inability of the glass wall system or its components to meet the performance criteria outlined in these specifications. Sources of failure include defective design, manufacture, fabrication, installation, and defects in construction.
  - 1. Failure also includes the following:
    - a. Glass breakage.
    - b. Noise or vibration created by wind and thermal and structural movements.
    - c. Loosening or weakening of fasteners, attachments, and other components.
- C. Structural Performance: Provide structural glass wall and glass support structure capable of withstanding the design loads and performance criteria outlined in these specifications. Glass wall to be designed within the limits indicated below:
  - 1. The glass sub-frame must be capable of supporting the self-weight of the glass elements, wind loads, earthquake loads, and load combinations as required by code.
  - 2. The deflection of the glass sub-frame, when the above-mentioned loads are applied, shall not exceed 1/175 of the span.
  - 3. The deflection of the glass shall not exceed L/100.
  - 4. Deflection of laminated glass panels shall be calculated using effective thickness calculations outlined in ASTM E-1300.
  - 5. The structural glass wall shall withstand the movements of the support structure as indicated on the structural drawings including, but not limited to, story drift, twist, column shortening, long-term creep, foundation settlement, and deflection from uniformly distributed and concentrated dead loads and live loads.

6. The Façade shall be seismically isolated in the direction parallel to the vision panels. Isolation from all adjacent building construction shall be achieved by means of slide bearing pads. Movement of adjacent walls, roof, or support structure shall not impose stress on the system other than that generated by friction of the slide bearing pads. All finish work around the supports shall be coordinated to allow for relative movement to occur.
  7. All overhead glass shall be laminated with SGP interlayers.
  8. The exterior laminate of glass designed with countersunk holes shall have a minimum thickness of 3/8" to ensure proper sitting of countersunk fasteners.
  9. All fittings and structural components used to support glass shall be tested by an accredited laboratory. Laboratory test results shall be submitted with the approval drawings.
- D. Design the structural glass system and components in accordance with the dimensions and conditions shown in the architectural and structural drawings and to the loading requirements and codes specified in the bid documents. In addition, if not specifically called for in the documents, consider the following:
1. Temperature variation: +/-70 degrees Fahrenheit from a medium temperature of 75 degrees Fahrenheit.
  2. Loads created by installation techniques and lifting devices.
- E. The Architectural and Structural Drawings shall indicate the following design criteria:
1. Deflections of edge and support beams due to applied loads
  2. Sides way movements of the adjacent and support structures due to wind and seismic load.
  3. Anticipated deflections due to the weight of the structural glass system.
  4. The structural glass wall shall be designed to accommodate these requirements.
- 1.6 SUBMITTALS
- A. Design Submittal: Set of drawings clearly describing the structural wall system and geometry, including all pertinent material and dimensional information; drawings to be signed and sealed by the registered professional engineer responsible for their preparation.
  - B. Structural Calculations: Prior to fabrication of the structural glass wall, submit design calculations prepared in accordance with applicable local codes and standards of practice.

Include analysis and design of all applicable loads and load combinations. Basic load conditions to include live, dead, wind, thermal, snow, seismic, and all other specified loads.

1. Supply structural reactions.
  2. Provide maximum glass deflections.
  3. Supply calculations for all connections and support conditions.
  4. Glass thickness shall be sized by the Specialty Structural Glass Manufacturer.
  5. Existing test reports are only acceptable as proof of capacity calculations but will not be acceptable in lieu of calculations.
- C. Shop Drawings: Submit complete set of shop drawings including glass panel layouts and details. Show dimensioned layout of structural glazing in relation to adjacent work such as walls, columns, beams, slabs, and other construction elements.
1. Include details of all supports and data to show provisions for vertical and horizontal expansion/contraction and building movements as necessary.
  2. Identify all materials, attachments devices, and accessories.
- D. Installation Drawings: After approval of shop drawings, provide a detailed set of field installation drawings and a written installation procedure. Identify each part by size and number.
- E. Product Data: Material description for fittings, glass, gaskets and other material.
1. Samples: Submit samples of glass and glazing materials required for the project.
    - a. Samples of glass shall be 12" x 12".
    - b. Samples of sealants or gaskets shall be 12" long.
    - c. Submit samples of fixing hardware assemblies, bolts and accessories.
    - d. Two glass samples of each glass type and one representative fitting sample shall be submitted for approval.
- F. Test Data: Provide reports of tests performed for all fittings and components supporting glass assemblies. Tests shall be performed by an accredited laboratory and must have been performed within the last five years.

## 1.7 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
  - B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State/Province where the project is built, who is employed by the Specialty Structural Glass manufacturer, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for design of structural glass systems that are similar to those indicated for this project in scope and extent.
  - C. Engineering services, including drawings, design calculations, and professional engineering stamping of the drawings, shall not be subcontracted by the Specialty Structural Glass manufacturer.
    - 1. Glazing systems and support fittings – Manufacturer shall confirm compatibility and suitability of application. Test data shall be provided for this purpose.
  - D. Fabricate glass associated with the system to minimum tolerances provided in ASTM C 1048, in no case shall glass manufacturing tolerances be less than those specified in section 2.2 of these specifications, or as otherwise required to produce a satisfactory installation.
  - E. Provide stainless steel connection fittings as shown in drawings. The connections of the fittings to the glass shall ensure that no overstressed conditions occur within the glass unit.
  - F. Provide glass that is fabricated using float glass from an approved float glass manufacturer. A list of approved float glass manufacturers is provided in Section 2.2-C of these specifications.
  - G. Glass bolted connections shall be designed as bearing connections; the use of friction connections is not permitted due to interlayer creep. Averaging of bolt forces on rows of multiple bolts is not permitted; for any given row of bolts, overall plate tension and compression forces shall be assumed to be transferred to the glass by a single bolt, and the glass stresses shall be calculated using this assumption.
  - H. Models of glass connections shall be performed using FEA and contact elements; alternatively, glass bearing stresses shall be limited to 4ksi.
  - I. Where glass is used as a structural support, including fins and diaphragms, the glass shall be laminated and designed for redundancy. The design of the laminated glass shall allow for survival of the system in case one of the plies is broken.
- 1.8 PRODUCT DELIVERY, STORAGE AND HANDLING
- A. Glass shall be manufactured, crated, stored, handled and shipped in a manner that will provide unscratched and undamaged units delivered to the site. Fittings which engage with the glass shall be individually boxed in a way to protect edges from damage and/or scratching.

- B. Time the delivery of materials to the site to ensure uninterrupted progress of the installation work.

#### 1.9 PROJECT CONDITIONS

- A. Field Measurements: Where the system is indicated to fit against walls and other construction, the installer shall verify dimensions by field measurements before installation and notify General Contractor of any deviations from approved shop drawings. General Contractor shall correct conditions to comply with the system tolerances specified for the project and as indicated in the approval drawings, which may be tighter than industry standard.
- B. Structural glass shall be fabricated in accordance with approved shop drawings which shall include dimensional approval from the Architect and General Contractor.
- C. Coordinate fabrication schedule with construction progress to avoid delaying the work.

#### 1.10 WARRANTY

- A. Provide a ten (10) year warranty on the design, engineering and installation workmanship.
- B. Provide the standard ten (10) year warranty on all laminated and insulated glass units.

### PART 2 - PRODUCTS

#### 2.1 STRUCTURAL GLASS CONTRACTOR/MANUFACTURER

- A. Structural Glass Contractor/Manufacturer: The standard of design is based on the Sentech Architectural Systems' Vetraspan System. Sentech Architectural Systems is a pre-approved Structural Glass manufacturer for the scope described in this Section.
- B. Other Structural Glass Contractor/Manufacturers: Subject to compliance with requirements of Part 1 Quality Assurance Article prior to bid, provide a comparable Glass Structure System by one of the following:
  - 1. Gartner/Permasteelisa Group.
  - 2. W & W Glass Systems, Inc.

#### 2.2 GLAZED STRUCTURAL SYSTEMS

- A. System Description:
  - 1. The vertical glass wall system is comprised of a series of clear spanning glass panels as shown in the contract drawings. Glass panels to be flush with adjacent panels, as shown in the contract documents. The wall shall conform to the geometric dimensions and arrangement shown in the contract drawings.



B. Metals:

1. The glass attachment shelves shall be grade A316 stainless steel. The stainless steel shall be separated from the glass with durable nylon or Delrin gaskets. Fittings shall be tested by an accredited US laboratory.
2. Glass support fittings shall be manufactured using A316 stainless steel, shall be tested by an accredited US laboratory, and shall have provisions for glass thermal movements and resist all design forces.
3. The system shall allow for a minimum post installation adjustment of +/- 2mm in the horizontal and vertical directions.
4. All glass fitting surfaces to be finished with an electrolytic polish or a satin finish, as selected by the architect.
5. All glass connections to be designed as bearing connections and shall be designed to avoid overstressing the glass. Glass allowable stresses to be designed in accordance with ASTM E1300
6. Perimeter Trim and Flashing: At the terminations of the glazing system to other trades, provide stainless steel or painted aluminum trim which is secured to the glass to prevent weather penetration. Additional flashing shall be as detailed in the construction documents.

C. Glass:

1. All glass must be low iron.
2. Laminated glass shall be either fully tempered and heat soaked, or heat strengthened. All laminated units shall be produced using either Eastman Saflex DG-41 interlayer or Dupont SG interlayer bonded via an autoclave heat and pressure process.
3. The façade glass shall be laminated. The minimum interlayer thickness is to be 0.060”.
4. Overall thickness of the glass is to be determined by the Structural Glass Manufacturer in accordance with specifications and drawings.
5. Tempered glass must be horizontally tempered, eliminating tong marks. All exposed edges must be polished. All other edges must be ground flat with a frosted appearance unless otherwise noted. Edgework, holes and notches in the tempered glass panels (vertical wall) will be completed before tempering and will comply with the requirements stated below:
  - a. ASTM C1036 Standard Specification for Flat Glass.

- b. ASTM C1048 Standard Specification for Heat-Treated Flat Glass.
  - c. ASTM C1172 Standard Specification for Laminated Architectural Flat Glass.
  - d. Safety glazing requirements as defined in ANSI Z97.1 and CPSC 16 CFR 1201.
6. The Structural Glass Manufacturer shall demonstrate that the stresses induced in the glass by the fittings are compatible with the strength of the glass and meets the performance section of this specification, especially at the holes (vertical wall fins). Provide finite element calculations to show compliance.
7. Float glass manufacturers are limited to:
- a. Pilkington
  - b. PPG
  - c. Guardian
  - d. AGC Europe
  - e. Saint Gobain
  - f. CSG
8. Glass tolerances:
9. Squareness of panels governs other tolerances and shall be within 1/8" of specified dimensions. Edge lengths shall be within 1/16" of specified dimensions. Holes shall be within 1/16" of specified locations. Bow shall be better than 0.15%.
- a. Drilled holes:
    - 1) Diameter: +/- 1/32"
    - 2) Location from single datum: +/- 1/16"
  - b. Local distortion (roller waves)
    - 1) Maximum allowable distortion is to be 0.003" over 12" measured length.

## 2.3 FABRICATION

- A. Provide glass and structural hardware, connectors, fasteners and accessories required for a complete installation of the structural glazing as indicated in approved shop drawings.

- B. Code each part for easy identification. Cross reference this coding to shop/installation drawings and to shipping lists.
- C. Fabricate components that, when assembled, have the following characteristics:
  - 1. Sharp profiles, straight and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Physical and thermal isolation of glazing from framing members.
  - 4. Accommodations for thermal and mechanical movements of glazing and framing to prevent glazing-to-glazing contact and to maintain required glazing edge clearances.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Structural Glass Manufacturer's Erector shall check all metal components upon delivery for dents, gouges or other imperfections which may result in rejection of the appearance or reduce strength.
- B. Structural Glass Contractor/Manufacturer's Erector shall check the glass panels upon delivery for scratches, imperfections and edge damage. Damaged glass shall not be installed.
- C. Structural Glass Contractor/Manufacturer's Erector shall examine areas, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Provide connections for temporary shoring, bracing and supports as noted on the installation drawings. Handle, lift and align pieces using padded slings, suction cups and other protection required to maintain the appearance of the system throughout the installation process.
- B. Only lift at connections as approved by the Specialty Structural Glass Manufacturer Design Engineer.

#### 3.3 INSTALLATION

- A. General:
  - 1. Comply with manufacturer's written instructions.
  - 2. Do not install damaged components.

3. Fit joints to produce joints free of burrs and distortion.
  4. Rigidly secure non-movement joints.
  5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- B. Erect structural glazing and accessory items in strict accordance with the approved shop/installation drawings and installation procedures.
1. Glass shall not be positioned by the use of force. Provide temporary bracing and support as required to ensure stability during installation process.
  2. Bolt Head Orientation: Exposed bolt heads shall be oriented as indicated on the approved drawings. Where bolt head alignment is specified, the orientation shall be noted for each connection on the installation drawings. Where not noted, the bolt heads in a given connection shall be oriented to one side.
  3. Bolts shall be fully tightened in accordance with methods indicated in the installation drawings.
  4. Clean glazing connectors receiving glazing materials of deleterious substances that might impair the work. Remove protective coatings that might fail in adhesion or interfere with bond of sealants. Comply with the manufacturer's instructions for final wiping of surfaces immediately before the application of primer and glazing sealants. Wipe metal surfaces with an appropriate cleaning agent.
  5. Sealants: Prime surfaces that are to receive glazing sealants in accordance with the manufacturer's recommendations, using recommended primers.
  6. Locate setting blocks, if required by the drawings. Use blocks of proper sizes to support the glass in accordance with the manufacturer's recommendations.
  7. Ensure nylon or delrin spacers separate the glass from attachment plates.
  8. Set the glass in a manner that produces the greatest possible degree of uniformity in appearance. Face all glass, which has a dissimilar face, with matching faces in the same direction. Carefully remove all stickers and clean affected area.
  9. Use masking tape or other suitable protection to limit the coverage of glazing materials on the surfaces intended for sealants.
  10. Tool exposed surfaces of glazing materials.
  11. Clean excess sealant from the glass and support members immediately after the application, using solvents or cleaners recommended by the manufacturers

12. Structural glazing shall be installed clean and in one visit. General Contractor shall provide protection measures for completed structural glazing and accessories to prevent damage or deterioration from subsequent work.
13. Obtain permission for any modification or field fabrication from the Engineer of the system. Glass shall not be modified.

#### PART 4 - MEASUREMENT AND PAYMENT

- A. Bus Rapid Transit Shelter Structural Glass Façade shall be paid for at the contract lump sum price for each location specified below. Payment shall include full compensation for all labor, equipment, material, tools, and incidentals necessary to construct Bus Rapid Transit Shelters as specified in the Contract Drawings and Contract Documents.
- B. The following Bus Rapid Transit Shelter locations shall be specified as a contract lump sum price for each location:
  1. North Beauregard Street at King Street – Northbound
  2. North Beauregard Street at King Street – Southbound
  3. North Beauregard Street at West Braddock Road – Northbound
  4. North Beauregard Street at West Braddock Road – Southbound
  5. North Beauregard Street at Fillmore Avenue – Northbound
  6. North Beauregard Street at Fillmore Avenue – Southbound
  7. North Beauregard Street at Rayburn Avenue – Northbound
  8. North Beauregard Street at Rayburn Avenue – Southbound
  9. Sanger Avenue at North Beauregard Street – Eastbound
  10. Sanger Avenue at North Beauregard Street – Westbound
  11. North Van Dorn Street at Sanger Avenue – Northbound
  12. North Van Dorn Street at Taney Avenue – Southbound
  13. North Van Dorn Street at Holmes Run Parkway – Northbound
  14. North Van Dorn Street at Holmes Run Parkway – Southbound
  15. South Van Dorn Street at Stevenson Avenue – Northbound
  16. South Van Dorn Street at Stevenson Avenue – Southbound
  17. South Van Dorn Street at South Pickett Street – Northbound
  18. South Van Dorn Street at South Pickett Street – Southbound

END OF SECTION 084427

SECTION 099000 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Contract Drawings and general special provisions of the Contract.

1.2 SECTION INCLUDES

- A. Exterior paint and coating systems including surface preparation

1.3 REFERENCES

- A. Steel Structures Painting Council (SSPC):

1. SSPC-SP 1 - Solvent Cleaning.
2. SSPC-SP 2 - Hand Tool Cleaning.
3. SSPC-SP 3 - Power Tool Cleaning.
4. SSPC-SP5/NACE No. 1, White Metal Blast Cleaning.
5. SSPC-SP6/NACE No. 3, Commercial Blast Cleaning.
6. SSPC-SP7/NACE No. 4, Brush-Off Blast Cleaning.
7. SSPC-SP10/NACE No. 2, Near-White Blast Cleaning.
8. SSPC-SP11, Power Tool Cleaning to Bare Metal.
9. SSPC-SP12/NACE No. 5, Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating.
10. SSPC-SP 13/NACE No. 6 Surface Preparation for Concrete.

- B. Material Safety Data Sheets / Environmental Data Sheets: Per manufacturer's MSDS/EDS for specific VOCs (calculated per 40 CFR 59.406). VOCs may vary by base and sheen.

- C. California Department of Public Health(CDPH):

1. CDPH v1.1-2010 and V1.2-2017

1.4 SUBMITTALS

- A. Submit under provisions of 013300 Submittal Procedures.
- B. Product Data: For each paint system indicated, including.
  - 1. Product characteristics.
  - 2. Surface preparation instructions and recommendations.
  - 3. Primer requirements and finish specification.
  - 4. Storage and handling requirements and recommendations.
  - 5. Application methods.
  - 6. Cautions for storage, handling and installation.
- C. Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer's products, colors and sheens available.
- D. Verification Samples: For each finish product specified, submit samples that represent actual product, color, and sheen.
- E. Coating Maintenance Manual: Upon conclusion of project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin- Williams, "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used."
- F. Only submit complying products based on project requirements (i.e., LEED). One must also comply with the regulations regarding VOCs (CARB, OTC, SCAQMD, LADCO). To ensure compliance with district regulations and other rules, businesses that perform coating activities should contact the local district in each area where the coating will be used.
- G. USGBC LEED V4 Submittals:
  - 1. MRc2 Environmental Product Declaration Product Language: Products shall be selected with a preference to products that have product-specific environmental product declaration documentation.
  - 2. EQc2 Low Emitting Materials: The VOC content of all adhesives, sealants, paints and coatings in this Section shall not exceed the VOC limits established in Division 01 Sustainable Design sections.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Paint exposed surfaces. If a color of finish, or a surface is not specifically mentioned, Architect will select from standard products, colors and sheens available.

- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels unless indicated.
- D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
  - 1. Finish surfaces for verification of products, colors and sheens.
  - 2. Finish area designated by Architect.
  - 3. Provide samples that designate primer and finish coats.
  - 4. Compatibility and Adhesion: Check after one week of drying and curing by testing in accordance with ASTM D3359; Adhesion by tape test. If coating system is incompatible, additional surface preparation up to and including complete removal may be required.
  - 5. Do not proceed with remaining work until the Architect approves the mock-up.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information.
  - 1. Product name, and type (description).
  - 2. Application and use instructions.
  - 3. Surface preparation.
  - 4. VOC content.
  - 5. Environmental handling.
  - 6. Batch date.
  - 7. Color number
- B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction
- C. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.
- D. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

#### 1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.



1.8 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
- B. Furnish Owner with an additional one percent of each material and color, but not less than 1 gal (3.8 l) or 1 case, as appropriate.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Sherwin-Williams, which is located at: 101 Prospect Ave.; Cleveland, OH 44115; ASD Toll Free Tel: 800-524-5979; Tel: 216-566-2000; Fax: 440-826-1989; Email: request infospecifications@sherwin.com; Web: www.swspecs.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 APPLICATIONS/SCOPE

- A. Exterior Paint and Coating Systems:
  - 1. Metal: Miscellaneous iron, ornamental iron, ferrous metal.

2.3 PAINT MATERIALS – GENERAL

- A. Paints and Coatings:
  - 1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
  - 2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color. Or follow manufacturer's product instructions for optimal color conformance.
- B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.
- D. Color: SW 7074 Software.
- E. LEED Requirements: LEED V4 and V4.1 EQ Credit: Indoor Environmental Quality-Low Emitting Materials.

2.4 EXTERIOR PAINT AND COATING SYSTEMS

- A. Metal: Miscellaneous. Iron, Ornamental Iron, Structural Iron and Steel, Ferrous Metal.
  - 1. Latex Systems: Basis of Design the Sherwin Williams Company Gloss Finish:
    - a. Primer, zinc-rich coating, MPI-191 (BOD SW Zinc Clad XI).
    - b. Intermediate Coat-1: Epoxy, MPI #108, (BOD SW Macropoxy 646 Fast Cure Epoxy).
    - c. Intermediate Coat-2: High Solids Polyurethane (MPI#174), matching topcoat. (BOD: SW High Solids Polyurethane 250).
    - d. Topcoat: High Solids Polyurethane (MPI#174), matching topcoat. (BOD: SW High Solids Polyurethane 250).

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared; notify Architect of unsatisfactory conditions before proceeding. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- B. Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.
- C. Previously Painted Surfaces: Verify that existing painted surfaces do not contain lead-based paints, notify Architect immediately if lead based paints are encountered.

#### 3.2 SURFACE PREPARATION

- A. General: Surfaces shall be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.
  - 1. Prior to attempting to remove mildew, it is recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions are advised.
  - 2. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply solution and scrub the mildewed area. Allow solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow surface to dry before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.
  - 3. Remove items including but not limited to thermostats, electrical outlets, switch covers and similar items prior to painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
  - 4. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50 degrees F (10 degrees C), unless products are designed specifically for these conditions. On large expanses of metal

siding, the air, surface and material temperatures must be 50 degrees F (10 degrees F) or higher to use low temperature products.

- B. Aluminum: Remove all oil, grease, dirt, oxide and other foreign material by cleaning per SSPC-SP1, Solvent Cleaning.
- C. Steel: Structural, Plate, And Similar Items: Should be cleaned by one or more of the surface preparations described below. These methods are used throughout the world for describing methods for cleaning structural steel. Visual standards are available through the Society of Protective Coatings. A brief description of these standards together with numbers by which they can be specified follow.
  - 1. Solvent Cleaning, SSPC-SP1: Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation.
  - 2. Hand Tool Cleaning, SSPC-SP2: Hand Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
  - 3. Power Tool Cleaning, SSPC-SP3: Power Tool Cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1.
  - 4. White Metal Blast Cleaning, SSPC-SP5 or NACE 1: A White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
  - 5. Commercial Blast Cleaning, SSPC-SP6 or NACE 3: A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
  - 6. Brush-Off Blast Cleaning, SSPC-SP7 or NACE 4: A Brush-Off Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.
  - 7. Power Tool Cleaning to Bare Metal, SSPC-SP11: Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products, and other

foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.

8. Near-White Blast Cleaning, SSPC-SP10 or NACE 2: A Near White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
9. High- and Ultra-High Pressure Water Jetting for Steel and Other Hard Materials: SSPC-SP12 or NACE 5: This standard provides requirements for the use of high- and ultra-high pressure water jetting to achieve various degrees of surface cleanliness. This standard is limited in scope to the use of water only without the addition of solid particles in the stream.
10. Water Blasting, SSPC-SP12/NACE No. 5: Removal of oil grease dirt, loose rust, loose mill scale, and loose paint by water at pressures of 2,000 to 2,500 psi at a flow of 4 to 14 gallons per minute.

### 3.3 INSTALLATION

- A. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendations.
- B. Do not apply to wet or damp surfaces. Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days. Test new concrete for moisture content. Wait until wood is fully dry after rain or morning fog or dew.
- C. Apply coatings using methods recommended by manufacturer.
- D. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.
- E. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.
- F. Regardless of number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance.
- G. Inspection: The coated surface must be inspected and approved by the Architect just prior to the application of each coat.

### 3.4 PROTECTION

- A. Protect finished coatings from damage until completion of project.

- B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

PART 4 - MEASUREMENT AND PAYMENT

- A. No separate measurement or payment will be made for items in Section 099000 Painting. Payment for all work shall be considered incidental to the Contract lump sum price for each Bus Rapid Transit Shelter Structural Glass Façade, as specified in Section 084427.

END OF SECTION 099000

## SECTION 101430 – SPECIALTY SIGNAGE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.

#### 1.2 SUMMARY

- A. Section Includes: Requirements for furnishing and installing signage described in Contract Drawings. The extent, types, and location of signage is indicated on the Contract Drawings, and include the following types listed below.

- 1. Sign Type:

- a. Station Signs

- B. Unless otherwise specified, the contents within Section 101430 apply to Station Signage only.

#### 1.3 SUBMITTALS

- A. Product Data: Submit, the manufacturer's technical data, catalog cuts, installation instructions, maintenance instructions for all sign types specified and indicated on the Drawings. Include sign materials, coating systems, fillers, and fasteners.

- B. Shop Drawings:

- 1. Submit shop drawings of all sign components, fittings, parts, wiring, and installation procedures jointing, and complete anchoring and supporting systems for the various applications and mounting details.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 3. Drawings shall clearly show provisions for all performance functions described herein.
  - 4. Provide details and sections at full size. Differences from the contract drawings shall be clearly identified and brought to the COTR's attention in writing.
  - 5. Show general assembly of components; relationship to adjoining construction; complete fabrication details of sign housing, hangers, mounting, lighting, and schematic and wiring diagrams for each type of sign.
  - 6. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

- C. Production-ready Media: Provide production-ready artwork, text, graphics in PDF and EPS format of all signs in actual size.

D. Station Sign Face Patterns:

1. Submit accurate full-size sign face drawings of each sign type accurately showing the relationship of all text, symbols, and parts to each other, including the sign border, and a description of the method of executing the work.
2. Obtain the COTR's approval of all patterns before proceeding with the work.

E. Station Sign Samples:

1. Submit samples, of the color and finish of exposed materials and accessories required for pylon/porcelain enamel signs for approval before proceeding.
  - a. The review of samples will be for color, gloss, finish, and texture.
  - b. Compliance with all other requirements is the exclusive responsibility of the contractor.
  - c. When requested, furnished full-size samples of sign materials.
2. Submit two samples each for approval of the following materials and assemblies prior to proceeding with the work (minimum 12" x 12" plates):
  - a. Porcelain Enamel Panel. The sample shall show the finished color, galvanized surface of the back face, and stepped to show the prime and finish coats of enamel on the front side. Accepted samples to be retained by the Engineer.
  - b. White translucent acrylic plastic letter pushed through curved and routed aluminum sign face. Accepted samples to be retained by the Engineer.

F. Certifications: Submit certificates indicating that all materials and products used on the project meet or exceed specified requirements.

G. Buy America Act Certification: Provide written certification that the products provided under this Section meet the requirements of 49 CFR 661 Buy America Act.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Buy America Act: Comply with 49 C.F.R. Part 661, Buy America Requirements.

B. Reference Standards: Adhere to the following: Adhere to the following codes, regulations, reference standards and specifications.

1. Americans with Disabilities Act (ADA).
2. ASTM International (ASTM):
  - a. ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

- b. ASTM A424 Standard Specification for Steel, Sheet, for Porcelain Enameling.
  - c. ASTM A499, Standard Specification for Steel Bars and Shapes, Carbon Rolled from “T” Rails.
  - d. ASTM A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - e. ASTM B209. Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- 3. Porcelain Enamel Institute (PEI):
  - a. PEI 101 - Design & Fabrication of Metal of Porcelain Enamel.
  - b. PEI 201 - Selection of Porcelain Enamel Steels.
  - c. PEI 1001 - Specifications for Architectural Porcelain Enamel.
- C. Station Sign Fabricator Qualifications: The sign company shall be an established firm regularly engaged in the fabrication and installation of signs. They shall have five years minimum experience in fabricating and installing signage units of a type and size similar to those shown in the contract drawings. The company shall also submit a list of sizable installations in which they provided signs and have successfully completed over a period of at least five years.
- D. Station Sign Lettering and Graphics:
  - 1. Lettering and other sign graphics shall be computer generated and photographically reproduced. Hand-rendered or other graphics are not acceptable.
  - 2. Type Face: Helvetica Bold, sizes as indicated on the drawings.
- E. Station Sign Welding: Perform welding in accordance with AWS D1.0, Welding in Building Construction. Welding procedures which conform in all respects to the provision of the AWS Standard Specification mentioned above will be deemed as prequalified.
- F. Station Sign Prototype Signs:
  - 1. Fabricate and submit for approval a completed sign of each type specified and shown on the Contract Drawings, complete with all specified components and graphics before proceeding with fabrication of subsequent signs.
  - 2. After completion of fabricating all prototype signs, convene a conference at the sign fabricator's production facility. The COTR will review and approve or reject each of the prototype signs. Prototype signs that are rejected shall be refabricated and made available for the COTR's review and approval.
    - a. Approved prototype signs will be counted as completed units. The approved prototype signs will serve as a basis of acceptance of the subsequent signs.
    - b. Approved one of a kind signs may be incorporated into the Work.



- c. Do not commence production runs of signs until all prototype signs have been approved by the COTR.
  3. After completion of production run for all signs and prior to delivery to the City, convene a conference at the sign fabricator's production facility. The City will review the completed production of all signs and approve or reject signs. Signs that are rejected shall be refabricated and made available for the City's review and approval.
- G. Station Sign Braille and Raised Lettering Standards:
  1. Furnish Braille texts in Grade 2 Braille and standard dimensions in accordance with the Braille Authority of North America (BANA).
  2. Make raised surfaces of lettering 1/32 inch above the background surface in accordance with the Accessibility Guidelines of the Americans with Disabilities Act (ADA).
  3. Furnish to the Engineer independent laboratory results of Braille copy accuracy.
    - a. Raised letter and Braille layouts will not be accepted for review under "SUBMITTALS", "Shop Drawings," full size layout of sign graphics, without a 100 percent accuracy rating for the Braille, to be supported by the accompanying results.
    - b. Font: As specified by COTR.

#### 1.5 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication and indicate measurements on Shop Drawings.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Ensure that all signs are adequately protected from damage during fabrication and until installation. Deliver signs in cartons or crates to provide protection during transit and storage at the work site.
- B. Storage of fabricated items is the responsibility of the Contractor. Protect stored materials against corrosion, deterioration of any kind, and damage.
- C. Inspect signs upon delivery for damage. If damaged, sign panels shall not be repaired but shall be replaced.
- D. Signs, and associated framing, fastening, hardware and adhesives, shall be delivered to a City designated facility in original unopened packages, clearly labeled with manufacturer's name, brand, specification identification data, and identification as shown on approved shop drawings or submittals.
  1. Packaging shall be made with labels fixed identifying clearly the type and quantity of the signs, and the station where these signs will be installed.

- E. Store signs under cover. Place all units on at least 4-inch high sills on floors in a manner that will prevent damage and rusting. Avoid the use of non-vented plastic or canvas shelters, which could create a humidity chamber or contact with soil or exposure to the elements.
- F. Protect signs to prevent scratches, stains, discoloration, or other damage. Protect finished surfaces from soiling and damage during delivery, storage, and handling. Keep covered with polyethylene film or other protective covering. Replace items damage during fabrication, handling, shipment, storage or erection.
- G. Protect products from damage during field handling and installation. Handle panels and other components in a manner to prevent bending, buckling, marring, "oil canning", and other damage.

#### 1.7 WARRANTY

- A. Signs shall be warranted for four years in addition to the one-year requirement of the General Provisions, for a total of five years.
- B. Warranty shall cover defects in materials and application including functionality, fading, discoloration, peeling, cracking, blistering, delamination from the substrate and decrease of retroreflective qualities.
- C. Non-Reflective and Reflective Systems:
  - 1. Non-reflective system shall be warranted for four years in addition to the one-year requirement of the General Provisions, for a total of five years.
  - 2. Reflective system shall be warranted for six years in addition to the one-year requirement of the General Provision, for a total of seven year.
  - 3. Warrant both systems against defects in materials and application including fading, discoloration, peeling, cracking, blistering, delamination from the substrate and decrease of retroreflective qualities.
- D. During the warranty period, the Contractor shall restore defective sign surfaces to original condition at no cost to the City.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Station Signs
  - 1. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
    - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces, without causing buckling of signage panels, opening of joints, undue stress on fasteners, failure of sealants, and other detrimental effects.

- b. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners.
  - 1) High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
  - 2) Low Exterior Ambient-Air Temperature: 0 deg F.

## 2.2 STATION SIGNAGE MATERIALS

### A. Steel:

- 1. ASTM A36 hot-dip galvanize with two ounces of zinc per square foot.
- 2. Sheet: ASTM A653.
- 3. Shapes and Fabrications: ASTM A123.
- 4. Hardware: ASTM A153.
- 5. Where shown to be painted, prime with one coat of manufacturer's standard inorganic zinc silicate followed by primer and finish coat.

### B. Steel Tubing: ASTM A519 ground seamless mechanical tubing. Hot-dip galvanized in accordance with ASTM A123.

### C. Enameling Steel: ASTM A424.

### D. Stud Anchors: Stainless steel, minimum pull-out strength of 2,000 pounds, Hilti Kwik-bolt SS14-158 or equal.

### E. Aluminum:

- 1. Sheet Aluminum: ASTM B209, Alloy 3003-H14, standard one-side bright finish, flat sheet, size and thickness as shown, otherwise with 0.80 inch thickness.

## 2.3 FASTENING, HARDWARE AND ADHESIVES

### A. Stainless Steel:

- 1. Bolts: ASTM F593.
- 2. Nuts: ASTM F594.
- 3. Washers: Material to match bolts.

### B. Exposed Fasteners and Screw Heads: Tamper-resistant, Allen head type. Finish to match color of sign to which applied.

### C. Nylon Washers: Manufacturer's standard.

- D. Silicone Adhesive Sealant: Non-acid curing silicone adhesive sealant, either clear color of match the substrate, General Electric brand or equal.
- E. Epoxy Adhesive to Secure Mounting Studs in Substrate: Non-staining, waterproof epoxy adhesive recommended by the manufacturer for adhesion to the substrate shown, color to match substrate.
- F. Acrylic Adhesive for Securing RLB.SNH and RLB.SND.D signs to pylons: 3M VHB 4950 multi-purpose tape, or equal.

## 2.4 PORCELAIN ENAMEL SIGNS

- A. General: Provide materials and workmanship for porcelain enamel work in strict accordance with the applicable requirements of the Specifications for Architectural Porcelain Enamel PEI 1001.
- B. Fabricate signs of the material and to the dimensions shown, with straight lines and flat planes.
- C. Porcelain Enamel Panels: Laminated type, 1-1/8 inch thick in sizes and shapes as shown; free from warping or defects that would be visible under conditions of final installation; and conforming with PEI Standards for Class A acid resistant porcelain enamel finish.
- D. Thickness: Provide 0.0025-inch minimum thickness porcelain enamel on enameling steel where shown.
- E. Base Metal for Porcelain: 16-gauge vitreous enameling steel of low metallic and copper content specially manufactured and processed for the production of porcelain enamel units for architectural purposes, ASTM A424.
- F. Back Face of Panels: 16-gauge galvanized steel sheet, ASTM A653; weight of zinc coating two ounces per square foot.
- G. Panel Core and Adhesive: 80-pound Kraft paper honeycomb, 3/8-inch cell with 15 percent phenolic resin impregnation, laminated to the porcelain enamel face and the galvanized steel back with an epoxy adhesive as recommended by the porcelain enamel and honeycomb manufacturers for fabrication of architectural porcelain enamel panels for exterior use.
- H. Color Schedule: In accordance with COTR direction.

## 2.5 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:
  - 1. Noticeable variations in same piece are not acceptable.
  - 2. 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.

- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

## 2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm, or thicker.
- B. Color Anodic Finish: AAMA 611, Class I, 0.018 mm, or thicker.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

## 2.7 GRAPHICS COLORS

- A. Colors Schedule: In accordance with Contract Documents.

## 2.8 PAINT FOR METAL SIGNS

- A. Primer: High-build epoxy polyamide corrosion-resistant prime coating for galvanized steel and non-ferrous metal.
  - 1. Dry film thickness: Three to 5 mils per coat.
  - 2. Source: 66 Hi-build Epoxoline Primer by Tnemec or equal.
- B. Finish Coat: Acrylic aliphatic polyurethane enamel, semi-gloss finish.
  - 1. Dry film thickness: 1.5 to 2.5 mils per coat.
  - 2. Colors: As shown, matching porcelain enamel colors.
  - 3. Source: Series 70 and 71 Endura-Shield by Tnemec or equal.
- C. Ultraviolet Inhibitor Coat:
  - 1. Dry film thickness: 1.5 to 2.5 mils per coat.
  - 2. Color: Clear.
  - 3. Source: Series 76 Endura-Clear by Tnemec or equal.

## 2.9 VINYL GRAPHICS

- A. General:
  - 1. Provide vinyl graphics materials, including films, adhesives, inks, infills and coatings by one manufacturer to assure compatibility of sign system components.

B. Adhesives:

1. Either pressure-sensitive or dry vacuum applied and heat activated adhesive may be used, subject to the recommendations of the manufacturer.
2. For field applied graphics, use repositionable adhesive film, Controltac by 3M or equal.

C. Non-Reflective Vinyl:

1. Surface Printed: Adhesive backed vinyl equal to Controltac, Scotchcal or Scotchcal Electrocut by 3M with graphics screen- or surface-printed with permanent vinyl inks as recommended by film manufacturer.
2. Die Cut: Adhesive backed vinyl film as above in color shown, or with permanent ink color coat. Graphics die cut and carrier mounted in shop. Use SCPM-3 Scotchcal Premask application tape or equal.
3. Clear Coating: Clear coat vinyl ink with UV inhibitors, equal to Scotchcal Screen Printing in by 3M.

D. Reflective Vinyl:

1. General: Adhesive backed, reflective plastic sheeting equal to Scotchlite Engineer Grade Reflective Vinyl Film as shown, with graphics silk-screened or surface applied in transparent vinyl ink colors equal to Scotchlite inks.
2. Die Cut: Adhesive backed.
3. Durability and reflective qualities: FS L-S-300C.
4. Clear Coating: Clear coat vinyl ink with UV inhibitors, equal to Scotchcal Screen printing ink by 3M.

2.10 SIGN POSTS AND TUBULAR STEEL ASSEMBLIES

A. Fabricate from steel shapes and tubing as shown.

B. Hot-dip galvanize posts and assemblies after fabrication with extra-smooth zinc coating, ASTM A123, zinc coating G90, extra smooth; applied in accordance with the standards of the AGA.

1. Locate vent holes where they will not be visible and will not admit precipitation to the interior of assembly.
2. Touch-up zinc coating at fabrication cuts and at abrasions with DOD-P-21035 galvanizing repair paint applied in tow coats, minimum 5 mil dry film thickness each coat.

C. Factory paint prior to attaching signs.

2.11 FABRICATION

- A. Brackets, Clips: Fabricate brackets, clips, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required. Concealed fasteners shall not telegraph through to the surfaces exposed to view.
  - 1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish [to match sign-background color] [to match Architect's sample] color unless otherwise indicated.
  - 2. Stainless-Steel Brackets: Factory finish brackets [to match sign background] [to match Architect's sample] [with No. 4] finish unless otherwise indicated.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Deliver approved signage to the location designated by the COTR.
- B. Signage will be installed by the Contractor.
- C. Inspection: Inspect surfaces and conditions under which the work will be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Prepare surfaces and apply paint, vinyl film and other finishes in strict accordance with the product manufacturer's printed instructions.

#### 3.3 INSTALLATION

- A. Station Signs
  - 1. Install signs as shown and in accordance with sign manufacturer's recommendations. Use nylon washers both sides at screws or bolts through porcelain enamel. Use a washer diameter equal to or only slightly exceeding the diameter of screw or bolt head.
    - a. Position signs so as not to catch clothing on edges or otherwise create a hazardous condition.
  - 2. Install work plumb, level, true and straight with no distortion, Shim as required using concealed stainless steel shims.
    - a. Install panels, trim, and other exposed metal components to minimize stresses on members and to prevent "oil canning" in compliance with the accepted shop drawings and manufacturer's printed recommendations and as follows:
      - 1) Ensure support systems are properly aligned as specified hereinbefore.
      - 2) Handle panels as specified hereinbefore.

- 3) Do not over-engage side joints of panels greater than that designated by the manufacturer.
- 4) Do not over-drive fasteners. Ensure fasteners are driven at the same level of tension throughout the metal roofing system.
- b. Require manufacturer's representative to visit the Site for the purposes of:
  - 1) Attending meetings.
  - 2) Inspecting substrates prior to installation.
  - 3) Advising installer on proper procedures and precautions for use of products and for avoiding "oil canning" and other defects.
  - 4) Observing handling and installation procedures to minimize "oil canning" and other defects.
  - 5) Ensuring that the installation complies with the manufacturer's requirements including those of the warranty.
  - 6) Final inspection of the installation to verify acceptability of the installation for issuance of the manufacturer's warranty.

### 3.4 STUD MOUNTED SIGNS

- A. Secure mounting studs for stud-mounted wall signs with epoxy adhesive.
- B. Drill holes slightly larger in diameter than mounting studs. Drill holes using drilling methods to ensure that the substrate will not be chipped or otherwise damaged and that holes will not be oversized nor visible after graphics are installed.
- C. Fill holes with adhesive and place additional adhesive in the threads of the studs. Insert studs in holes and support graphics firmly in place until adhesive sets. Immediately remove excess adhesive. Use non-staining temporary shims, washer and masking as required to prevent misalignment of graphics.

### 3.5 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

## PART 4 - MEASUREMENT AND PAYMENT



- A. No separate measurement or payment will be made for items in Section 101430 Specialty Signage. Payment for all work shall be considered incidental to the Contract lump sum price for each Bus Rapid Transit Shelter Structural Glass Façade, as specified in Section 084427.

END OF SECTION 101430

## SECTION 101453 – TRAFFIC SIGNAGE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications) Section 700 – General and Section 701 – Traffic Signs.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Furnishing and installing sheet aluminum signs on wood or square perforated tubular steel supports.
  - 2. Furnishing and installing internally illuminated Light Emitting Diode (LED) street name signs.
  - 3. Removal and disposal of post mounted signs.

#### 1.3 DEFINITIONS

- A. Remove: Demolish items as necessary and detach items from existing mounting and dispose of off-site unless indicated to be salvaged or reinstalled.

#### 1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

#### 1.5 PREINSTALLATION MEETINGS

- A. Project stakeout
  - 1. Unless otherwise indicated, conduct stakeout at Project site.
  - 2. For installation of signs, arrange a meeting with the COTR to stakeout all items indicated on the contract drawings and in the specifications.
  - 3. This meeting shall occur after the notice to proceed prior to any work. No work shall proceed before the stakeout is approved by the COTR.
  - 4. The Contractor shall have the utilities marked by MISS UTILITY prior to the meeting.

#### 1.6 ACTION SUBMITTALS

A. Shop Drawings

1. The Contractor shall furnish shop drawings and catalog cuts as specified. Materials shall not be ordered until shop drawings and catalog cuts are approved.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Sign Panels: A firm that is on VDOT's Materials Approved Lists for Sign Sheeting and Ink Qualified Products.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Sign panels shall be stored in a safe area away from traffic until ready to erect at new location.
- B. Signs should be stored such that the sign face is not scratched or damaged.
- C. Signs that are covered should be done in a manner that no adhesives are applied directly to the sign face.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The following Traffic Signage materials shall be in accordance with VDOT Specification Section 700 – General and Section 701 – Traffic Signs.
  1. Sign Panel.
  2. Sign Posts STP-1, 2 ½", 12 gauge.
  3. Concrete Foundations STP-1, Type A.

2.2 MANUFACTURES

- A. Source Limitations: Obtain each color, material, finish, type, and variety of product from a single source and from a signal manufacturer with resources to provide consistent quality in appearance and physical properties.

2.3 SIGN PANELS

- A. Non-Overhead Permanent Signs shall use ASTM D4956 reflective sheeting. Refer to VDOT Specification 701 – Traffic Signs.
- B. The City of Alexandria currently uses Temple Edge-Lit Internally Illuminated LED street name signs (Flip™) for overhead street name signs. Street name signs shall be single-sided panels or double-sided panels as specified in the contract drawings.

2.4 SIGN POSTS

- A. Use materials as specified in VDOT Specification Section 700 – General.

2.5 CONCRETE MATERIAL

- A. Use materials as specified in VDOT Specification Section 700 – General.

2.6 RELATED MATERIALS

- A. Use materials as specified in VDOT Specification Section 700 – General, for dissimilar metals, anchor bolts or other material incidental to the installation of products in this Section.

PART 3 - EXECUTION

3.1 REMOVAL OF SIGN PANELS AND POSTS

- A. Per the Contract Drawings, remove and dispose of sign panels at approved locations.
- B. Remove and dispose of existing sign posts as shown in the contract drawings.
- C. Remove associated foundational elements to at least two feet below the top of grade.

3.2 INSTALLATION

- A. The following Traffic Signage materials shall be installed per VDOT Specification Section 700 – General and Section 701 – Traffic Signs.
  - 1. Sign Panels.
  - 2. Sign Posts STP-1, 2 ½”, 12 gauge.
  - 3. Concrete Foundations STP-1, Type A.

PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 700 – General and Section 701 – Traffic Signs for Measurement and Payment.
- B. For internally illuminated LED street name signs, VDOT Specification Section 701 measurement and payment is amended to include additional pay items NS STREET NAME SIGN INTERNALLY ILLUMINATED (SINGLE-SIDE) and NS STREET NAME SIGN INTERNALLY ILLUMINATED (DOUBLE-SIDED). Measurement and payment shall include sign housing, LED lighting, electrical hookup and termination, and testing and acceptance by the COTR. Conductor cable to power the assembly will be measured and paid for separately according to the cable specified in the contract drawings.

END OF SECTION 101453

SECTION 107343 – TRANSPORTATION STOP SHELTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. The Contractor shall coordinate with Brasco International for Eclipse Shelter Product as specified in the Contract Drawings.

1.2 PRODUCTS

- A. The Contractor shall coordinate with Brasco International for Eclipse Shelter Product as specified in the Contract Drawings.

1.3 EXECUTION

- A. The Contractor shall coordinate with Brasco International for Eclipse Shelter Product as specified in the Contract Drawings.

PART 2 - MEASUREMENT AND PAYMENT

- A. Transportation Stop Shelters shall be measured and paid for at the Contract unit price for each shelter of the type and size specified in the Contract Drawings. Payment shall include full compensation for all labor, equipment, material, tools, and incidentals necessary to complete the Work.
- B. The following Transportation Stop Shelter locations shall be specified as contract unit price for each shelter:
  - 1. Mark Center Avenue

END OF SECTION 107343

SECTION 121000 – ART

To be prepared by Public Art Project Task Force, as needed.

END OF SECTION 121000

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## SECTION 129313 – SITE BICYCLE RACKS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. ASTM International (ASTM)
  - 1. A36 - Carbon Structural Steel
  - 2. A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
  - 3. A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - 4. D2247 - Testing Water Resistance of Coatings in 100% Relative Humidity
  - 5. D7803 - Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating

#### 1.2 SECTION INCLUDES

- A. Furnishing and installing bicycle racks.
- B. The COTR shall have final determination on the location and orientation of bicycle racks.

#### 1.3 SUBMITTALS

- A. Submit in accordance with Section 013300 Submittal Procedures.
- B. Product data: Include physical characteristics such as shape, dimensions, material, bicycle parking capacity, and finish for bicycle rack.
- C. Submit shop drawings.
  - 1. Furnish overall plan showing location of bicycle rack indicated.
  - 2. Show layout, grid, spacing of components, accessories, and anchorage for bicycle rack. Include detailed drawings of components for bicycle rack.
  - 3. Key all locations and details to types and details shown on the Contract Drawings.
- D. Samples: Submit two complete sets of finish samples for review and verification. Each set to include colors indicated.

- E. Submit manufacturer's installation instructions and procedures, including standard details of installation for bicycle rack.
- F. Maintenance Data: For bicycle rack.
  - 1. Include recommended methods for repairing damage to the finish.
- G. Submit qualifications of the manufacturer and installer.

#### 1.4 QUALITY CONTROL

- A. Installer Qualifications: An experienced installer who has completed installation of bicycle racks similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing bicycle racks similar to those required for this project and with a record of successful in-service performance.
- C. Source Limitations: Obtain color, finish, shape and type of bicycle rack from a single source with resources to provide components of consistent quality in appearance and physical properties.
- D. Product Options: Contract Drawings indicate size, shape and dimensional requirements of bicycle rack and are based on the specific system indicated.

#### 1.5 WARRANTY

- A. Provide manufacturer's standard warranty:
  - 1. Warranty terms: one (1) year from date of Substantial Completion against defects in materials and workmanship.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Bicycle rack
  - 1. Body – 1.5" OD 11-gauge steel tube.
  - 2. Flange mount – two 0.25" x 2.5" x 6" fee – anchors.
  - 3. Seat – 0.25" thick plate steel.
  - 4. All ends are capped and ground smooth.
  - 5. All components to be hot-dipped galvanized.

#### 2.2 FINISHES

- A. Polyester powder coated finish



1. Prepare part for painting with hard sandblasting.
2. Electrostatically apply epoxy primer.
3. Apply final UV resistant polyester powder coat.
4. Final coating thickness shall be no less than 6 mils.
5. Color as indicated on the Contract Drawings.

## 2.3 FABRICATION

- A. Fabricate for installation without field cutting.

## 2.4 MISCELLANEOUS PRODUCTS

- A. Stainless steel anchor bolts and screws of size called for and of type for anchoring to materials indicated.

## PART 3 - EXECUTION

### 3.1 PRE-INSTALLATION

- A. Verify dimensions at locations where bicycle racks are to be installed by field measurement.
- B. The COTR shall have final determination on the location and orientation of bicycle racks.

### 3.2 INSTALLATION

- A. Install bicycle racks according to manufacturer's specifications and instructions.
- B. Install bicycle racks level and plumb and anchored as detailed.
- C. Install by methods and products indicated for bicycle rack type.

### 3.3 Re-fabricate if needed to install without field cutting or damage to coatings.

- A. CLEANING AND WASTE MANAGEMENT
- B. Protect finished installation from construction operations until Final Acceptance.
- C. Clean bicycle racks prior to Final Inspection.
- D. Replace any bicycle racks damaged prior to Final Acceptance with new products.

## PART 4 - MEASUREMENT AND PAYMENT

- A. Bicycle racks will be measured and paid for at the contract unit price per each. This price shall include furnishing, installing, and testing of all materials, and for all material, labor, equipment, tools, shop -drawings, documentation, and incidentals necessary to complete the work.

END OF SECTION 129313

## SECTION 129323 – TRASH AND LITTER RECEPTORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. 60-gallon, split-stream receptacle with powder coated stainless steel body/door.

#### 1.3 SUBMITTALS

- A. Provide submittals in accordance with Section 013300 Submittal Procedures.
- B. Product data:
  - 1. Manufacturer's standard product literature.
  - 2. Shop drawings.
  - 3. Installation instructions.
  - 4. Maintenance instructions.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  - 1. Minimum 15 years experience in the manufacture of litter and recycling receptacles.
  - 2. Provide reference list of at least ten major transportation authorities, municipalities, universities, or other high-use public environments currently using litter and recycling receptacles fabricated by the manufacturer.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Handle products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's original packaging until ready for installation.
- C. Protect products from impacts and abrasion during storage.

#### 1.6 WARRANTY

- A. Provide manufacturer's standard warranty.

1. Warranty terms: three years from date of invoice against defects in materials and workmanship.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. Basis-of-design product: provide Tonyo Receptacle(s) based on the product named:

1. Tonyo Receptacle by Forms+Surfaces

- B. Receptacles

1. Materials:

- a. Internal frame: stainless steel.
- b. Sidebars: extruded aluminum.
- c. Lid & base: corrosion-resistant cast aluminum.
- d. Body & doors
  - 1) Stainless steel.
- e. Liner(s): black polyethylene.
- f. Hardware & latch: stainless steel.

2. Finishes:

- a. Body/doors (and lid when applicable)
  - 1) Polyester powdercoat
    - a) Standard Texture from Forms+Surfaces Powdercoat Chart.
- b. Base, sidebars:
  - 1) Polyester powdercoat
    - a) Standard Texture from Forms+Surfaces Powdercoat Chart.
- c. Body/Door perforation pattern
  - 1) No perforation
- d. Latch:
  - 1) Limited-access latch (operated by flathead screwdriver or similar).
- e. Overall Dimensions

- 1) 60-gallon, split-stream receptacle with powdercoated stainless steel body/door, without rain hat: 36.5" wide x 23.1" deep x 38.5" high
3. Instructional Graphics:
  - a. Apply instructional graphics to lids as specified to indicate the intended waste or recycling stream.
  - b. Graphics type: back-printed polycarbonate.
  - c. Letters and symbols color: White.
  - d. Graphics background colors:
    - 1) **Black.**
    - 2) **Blue.**
    - 3) **Green.**
4. Installation
  - a. Surface mount: with Stainless steel anchors and mounting screws.

#### PART 3 - EXECUTIO

##### 3.1 EXAMINATION

- A. Verify that substrates are stable and capable of supporting the weight of items covered under this section.
- B. Verify that substrates have been adequately prepared to securely anchor those items that will be surface-mounted.

##### 3.2 INSTALLATION

- A. Install according to the manufacturer's installation instructions.
- B. Install in conformance to applicable ADA Guidelines and End User's established Accessibility policies.

#### PART 4 - MEASUREMENT AND PAYMENT

- A. Trash and litter receptors will be measured and paid for at the contract unit price per each. This price shall include furnishing, installing, and testing of all materials, and for all material, labor, equipment, tools, shop drawings, documentation, and incidentals necessary to complete the work.

END OF SECTION 129323

## SECTION 129343 – SITE SEATING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. 4 foot, FSC 100% Cumaru hardwood slats, wall-mounted, no seat backs

#### 1.3 SUBMITTALS

- A. Provide submittals in accordance with Section 013300 Submittal Procedures.

- B. Product data:

- 1. Manufacturer's standard product literature.
  - 2. Shop drawings.
  - 3. Installation instructions.
  - 4. Maintenance instructions.

- C. Submit powdercoat finish samples for approval.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications:

- 1. Minimum 15 years experience in the manufacture of site seating.
  - 2. Forest Stewardship Council (FSC) Certified Supplier. Provide manufacturer's FSC certification number.
  - 3. Provide reference list of at least ten major transportation authorities, municipalities, universities, or
  - 4. other high-use public environments currently using site seating fabricated by the manufacturer.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Handle products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's original packaging until ready for installation.

- C. Protect products from impacts and abrasion during storage.

## 1.6 WARRANTY

- A. Provide manufacturer's standard warranty:
  - 1. Warranty terms: three years from date of invoice against defects in materials and workmanship.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. Basis-of-design product: provide backed and/or backless benches based on the product named:
- B. Vector Seating System by Forms+Surfaces.

- 1. Manufacturer Contact:

Forms+Surfaces  
30 Pine Street  
Pittsburgh, PA 15223  
phone: 800-451-0410

- C. Benches

- 1. Materials:
    - a. Bench frame: aluminum.
    - b. Bench slats:
      - 1) FSC 100% Cumaru hardwood (FSC License Code: FSC-C004453).
    - a. Intermediate and end seat dividers: cast aluminum
    - b. Seat backs: aluminum
    - c. Side panels
      - 1) Stainless steel side panels.
  - 2. Finishes
    - a. Bench frame: polyester powdercoat.
      - 1) Standard Texture from Forms+Surfaces Powdercoat Chart.
    - b. Bench slats:
      - 1) Aluminum: Polyester powdercoat.

- a) Standard Texture from Forms+Surfaces Powdercoat Chart.
- c. Seat dividers:
  - 1) Polyester powdercoat to match bench frame.
- d. Seat backs:
  - 1) Polyester powdercoat to match bench frame.
- e. Side Panels:
  - 1) Polyester powdercoat:
    - a) Standard Texture from F+S Powdercoat Chart.
- 3. Patterns
  - a. Optional Side Panels:
    - 1) No perforation
- 4. LED Accent Lighting:
  - a. 3000K
- 5. Dimensions:
  - a. 4 foot, wall-mounted, no seat backs
    - 1) Overall dimensions: 49.2” long, 16.9” deep, 1.5” high
- 6. Mounting:
  - a. Surface mount. Stainless steel anchors and mounting bolts are sold separately.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that substrates are stable and capable of supporting the weight of items covered under this section.
- B. Verify that substrates have been adequately prepared to securely anchor those items that will be surface mounted.

#### 3.2 INSTALLATION

- A. Install according to the manufacturer’s installation instructions.
- B. Install in conformance to applicable ADA guidelines and End User’s established Accessibility policies.



PART 4 - MEASUREMENT AND PAYMENT

- A. No separate measurement or payment will be made for items in Section 129343 Site Seating. Payment for all work shall be considered incidental to the Contract lump sum price for each Bus Rapid Transit Shelter Structural Glass Façade, as specified in Section 084427.

END OF SECTION 129343

SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.

1.2 SUMMARY

- A. Furnishing and installing electrical equipment as shown on the Contract Drawings or as directed by the Engineer.
- B. Related Requirements:
  - 1. Section 260519 Low Voltage Electrical Power Conductors and Cables for furnishing, installing, and testing low voltage (600 volt) wire and cable.
  - 2. Section 260543 Underground Conduits for Electrical Systems for electrical conduit, junction boxes, and wiring.
  - 3. Section 265613 Lighting Poles and Standards for permanent lighting along publicly owned and maintained roadways and parking lots.
  - 4. Section 272100 Data Communications Network Equipment for communications equipment.
  - 5. Section 330500 Common Work Results for Utilities for underground detection for new and repaired utility installation.

1.3 REFERENCES

- A. Abbreviations and Acronyms
  - 1. ANSI: American National Standards Institute
  - 2. ASTM: American Society for Testing and Materials
  - 3. ASIC: American Society for Industrial Security
  - 4. BICSI: Building Industry Consulting Services International
  - 5. CPP: Certified Protection Professional
  - 6. CTS: Certified Technology Specialist
  - 7. EMT: Electrical Metallic Tubing
  - 8. ENT: Electrical Nonmetallic Tubing

9. GRC: Galvanized Rigid Steel Conduit
10. HDPE: High-density Polyethylene
11. IBC: International Building Code
12. IEEE: Institute of Electrical and Electronics Engineers
13. IMC: Intermediate Metal Conduit
14. LFMC: Liquidtight Flexible Metal Conduit
15. LFNC: Liquidtight Flexible Nonmetallic Conduit
16. NEC: National Electrical Code
17. NEMA: National Electrical Manufacturers Association
18. NESC: National Electrical Safety Code
19. NFPA: National Fire Protection Association
20. OSHA: Occupational Safety and Health Administration
21. PSP: Physical Security Professional
22. PVC: Polyvinyl Chloride Conduit
23. RNC: Rigid Nonmetallic Conduit
24. RTRC: Reinforced Thermosetting Resin Conduit
25. RCDD: Registered Communications Distribution Designer
26. UL: Underwriters Laboratories

B. Reference Standards:

1. All equipment furnished under this Section shall be in accordance with the latest applicable standards of the IEEE, ANSI, NFPA, NEMA, ASTM, UL, and National Electrical Code with regard to material, design, construction, and testing.
2. NEMA TC2 for PVC conduits.
3. UL 651 for PVC conduits.
4. ASTM D638 for tensile strength.
5. ASTM D790 for flexural strength.
6. ASTM D695 for compressive strength.

7. ASTM D149 for dielectric strength.
8. NEMA TC3 for fittings.
9. UL 514B for fittings.
10. NFPA 70 (NEC) for exterior installation work.
11. NEC for interior work.
12. IBC interior work.

#### 1.4 COORDINATION

- A. Submittals shall be made in accordance with Section 013300 Submittal Procedures.

#### 1.5 ACTION SUBMITTALS

- A. Provide manufacturer's standard catalog data for all items described in this specification indicating conformance and compliance with standards and criteria indicated.
- B. Manufacturer's description, shop drawings, installation, and operational instructions.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Proof of compliance with NEC requirements for listing by a recognized testing laboratory.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications
  1. Products furnished shall be standard products that the manufacturer regularly engages in the production of materials specified.

### PART 2 - PRODUCTS (NOT USED)

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Exterior installation work shall be in accordance with applicable requirements of NFPA 70 (NEC). Interior work shall comply with the regulations of NEC and the IBC.
- B. Conduits shall be sloped to manholes or hand boxes for drainage.
- C. Buried conduit depth shall comply with NEC or Contract Drawings, whichever is more restrictive takes precedence.
- D. Materials and equipment shall be applied, installed, and connected as recommended by the manufacturer.

PART 4 - MEASUREMENT AND PAYMENT

- B. The Work of this Section will not be measured for payment. The Work of this Section will be incidental to the work being performed.
- C. Utility connection coordination with the utility company will be considered incidental to the appropriate work item.
- D. Utility company energization, connection, and disconnection costs will be the responsibility of the Utility Owner.

END OF SECTION 260500

SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 238 – Electrical and Signal Components and Section 700 – General.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

1.2 REFERENCES

- A. National Electric Code (NEC), National Fire Protection Association (NFPA 70), 2020.
- B. ASTM International (ASTM).
  - 1. B8 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
  - 2. B33 Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes
- C. Institute of Electrical and Electronic Engineers, Inc. (IEEE): 383, Vertical Tray Flame Test.
- D. Insulated Cable Engineers Association / National Electrical Manufacturer's Association (ICEA/NEMA).
  - 1. S-95-658/WC-70 Power Cables Rated 2000 Volts or less for the Distribution of Electrical Energy
  - 2. S-73-532/WC-57 Control, Thermocouple Extension, and Instrumentation Cables
- E. Insulated Cable Engineers Association (ICEA): T-33-655, Low-Smoke, Halogen-Free (LSHF) Polymeric Cable Jackets.
- F. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
- G. Underwriters Laboratories (UL).
  - 1. 44 Thermoset-Insulated Wires and Cables
  - 2. 83 Thermoplastic-Insulated Wires and Cables
  - 3. 854 Service Entrance-Cables

1.3 SUMMARY

- A. Furnishing, installing, and testing low voltage (600 volt) wire and cable.
- B. Submit results of wire and cable factory testing in accordance with Section 013300 Submittal Procedures.

1.4 WARRANTY

- A. Provide 2-year warranty from the date of Substantial Completion.
- B. Warranty to cover low-voltage electrical power conductors and cables.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Electrical Wire and Cable:

- 1. Shall be copper conforming to UL 44 Type XHHW, UL 44 Type RHH, UL 83 Type THWN, or UL854 Type RHW-2.
- 2. Number 10 AWG and larger shall be stranded; other sizes shall be solid.
- 3. Power feeders and branch circuit conductors shall have green insulated grounding conductors. Conductors including neutral conductors shall be the same size as branch circuit conductors. Reduced ground conductor sizes are acceptable as per the NFPA 70 (NEC).
- 4. Phase conductors for light and power circuits shall be color coded as follows:

Phase	208/120 Volts
A	Black
B	Red
C	Blue
Neutral	White
Ground	Green

- 5. Connectors:
  - a. Shall be insulated and rated for voltage.
  - b. Connectors for signs and fixtures shall be rated for 600 volts, be designed for copper-to-copper connection and be long barrel compression type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Mandrel, rod, and swab new conduits before installing wire and cable.
2. Install wiring in conduits and raceways, unless otherwise specified herein.
3. Install in such a manner as to prevent damage to insulation or breaking of wire and cable.
4. Connect installed products to the permanent power source and ground after installation has been accepted.

B. Terminations:

1. If the connector is a pressure type, twist wire together and insert into the connector, then complete the splice.
2. If the connector is an insulated compression type, splice it in accordance with the connector manufacturer's printed installation instructions.
3. If the connector is a non-insulated compression type, splice it in accordance with the connector manufacturer's printed installation instructions and wrap the splice with cross-linked tape, mastic, and insulating, self-adhesive, plastic tape.
4. Compression connections shall be completed with ratcheted tools using proper dies for each specific connector in accordance with the connector manufacturer's printed instructions.

3.2 REPAIR/RESTORATION

- A. If a product is not compliant with section or fails test, remove product, and install new.

PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 238 – Electrical and Signal Components and Section 700 – General, for Measurement and Payment.
- B. Payment shall include full compensation for all labor, materials, equipment, and incidentals necessary for providing fully functional electrical items.
1. Electrical wire and cable shall be measured and paid for at the contract unit price per linear foot of the type and size specified installed and accepted. This is inclusive of conductor cables, detection cables, and other related cables.

END OF SECTION 260519



## SECTION 260543 - UNDERGROUND CONDUITS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 700 – General.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 REFERENCES

- A. National Electric Code (NEC), National Fire Protection Association (NFPA 70), 2020.
- B. National Electrical Manufacturers Association (NEMA), NEMA 250 Enclosures for Electrical Equipment.

#### 1.3 SUMMARY

- A. Section Includes:
  - 1. Underground Conduit.
  - 2. Junction Box.
- B. Related Requirements:
  - 1. Section 260500 Common Work Results for Electrical for furnishing and installing electrical equipment.
  - 2. Section 311000 Site Clearing for site clearing and removal of above- and below-grade site improvements.
  - 3. Section 312000 Earth Moving for execution of excavation, backfill procedures, and compaction standards for structural stability.
  - 4. Section 329200 Turf Grasses and Section 329300 Plants for restoration of vegetation.
  - 5. Section 321216 Asphalt Paving for asphalt paving and patching existing pavement.
  - 6. Section 330500 Common Work Results for Utilities for underground detection for new and repaired utility installation.

#### 1.4 ACTION 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 junction boxes, and other utility structures.
3. Include underground-line warning tape.

B. Shop Drawings:

1. Electrical connections and conduit layout:
  - a. Include plans, elevations, sections, details, attachments to other work, and accessories.
  - b. Include conduit entry provisions, including locations and conduit sizes.
  - c. Include grounding details.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by the City or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
1. Notify the COTR no fewer than two (2) days in advance of proposed interruption of electrical service.
  2. Do not proceed with interruption of electrical service without the COTR's written permission.

PART 2 - PRODUCTS

2.1 UNDERGROUND CONDUIT

- A. Conduits must conform to NEMA TC-6 specifications for type EB PVC or better, such as Schedule 40; Schedule 80 for areas with less than 1-foot of cover.
- B. Provide conduit plugs or moldable sealing putty (Duct Seal) that must have the following characteristics:
1. Contains no asbestos.
  2. Designed for use with electrical and telecommunications cables house in conduits.

3. Adheres to various conduit materials, including PVC, high density polyethylene (HDPE) and galvanized steel.
4. Forms a moisture barrier.
5. Requires no mixing or additives (single component) and requires no volatile solvents.
6. Can be applied by hand.

## 2.2 CONDUIT ACCESSORIES

### A. Detectable Underground Warning Tape (DUWT):

1. DUWT must be with aluminum backing or solid aluminum core laminated with a protective clear film on both sides, sealing and protecting the graphics from underground moisture, acids, alkalis, and other soil substances.
2. Color: Red (In accordance with American Public Works Association).
3. Thickness: 5 mil overall.
4. Provide 3-inch DUWT at depths between 12 and 18 inches.
5. Provide 6-inch DUWT at 24 inches depth.
6. All DUWT must be printed with black ink with "ELECTRIC".

## 2.3 JUNCTION BOX

### A. Non-Vehicular Load Rated Junction Boxes

1. General
  - a. The work shall comply with VDOT Specification Section 238 for junction boxes.
  - b. Do not provide sealant compound between junction boxes and covers.
  - c. The junction boxes must conform to the requirements of ANSI/SCTE 77 2007 and Tier 15 loading.
  - d. The junction boxes shall be open bottom.
2. Junction Box (JB-S2): Provide VDOT Standard JB-S2 with covers for cable pulling, with minimum inside dimensions of 30" (length) x 17" (width) x 30" (depth) that meet or exceed the requirements of VDOT Specification Section 238. JB-S2 junction boxes must be polymer concrete with straight sides or polymer concrete with flared or straight fiberglass sides.
3. Junction Box (JB-S3): Provide VDOT Standard JB-S3 with covers for cable pulling, cable storage, and splice enclosures, with minimum inside dimensions of 36" (length) x

24" (width) x 36" (depth) that meet or exceed the requirements of VDOT Specification Section 238. JB-S3 junction boxes must be fiberglass with flared fiberglass sides. The frames and covers shall be Polymer concrete.

B. Vehicular Load Rated Junction Boxes

1. Provide H-20 structural load rated electrical structures to be located in roadways and other deliberate traffic paths. Submit shop drawings for the COTR's approval.

2.4 TEST HOLES

- A. Provide test holes where the proposed conduit crosses any water, gas, telecommunications, electrical power, fiber-optic cable, traffic communications cable, or sanitary/storm sewer mains and laterals. Test holes are considered incidental to installation of conduit.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate layout and installation of electrical equipment, underground conduits and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify the COTR if there is a conflict between areas of excavation and existing structures or if archaeological resources are encountered.
- B. Coordinate elevations of conduit entrances into junction boxes or with final locations and profiles of conduits, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions as approved by the COTR.
- C. Clear and grub vegetation to be removed and protect vegetation to remain according to Section 311000 Site Clearing. Remove and stockpile topsoil for reapplication according to Section 311000 Site Clearing.

3.2 TEST HOLE

- A. Survey to locate utility crossing (test hole location).
- B. Excavate to the bottom of the existing utility with the minimum surface area needed to expose the utility to be measured.
- C. Investigate, measure, and record horizontal and vertical location of the top and bottom of the utility, the utility structure material (when reasonably ascertainable), type of utility, and utility City.
- D. Backfill and restore test hole area in accordance with Section 312000 Earth Moving.

3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Section 312000 Earth Moving, but do not use heavy-duty, hydraulic-operated, compaction equipment. Ensure that compaction of the backfill does not damage the conduit.
- B. Restoration: Restore disturbed ground to its original condition as determined and approved by the COTR immediately after backfilling is completed or after construction vehicle traffic in immediate area is complete.
- C. Restore surface features at areas disturbed by excavation and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- D. For unpaved areas, restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 Turf and Grasses and Section 329300 Plants. If unpaved area was not grassed, replace the original ground cover in-kind as directed by the COTR.
- E. For paved areas, replace removed or damaged pavement with in-kind materials, matching the elevation, color, texture/finish, and general appearance of the surrounding pavement. Cut and patch existing pavement in the path of underground conduit and structures according to Section 321216 Asphalt Paving.

#### 3.4 UNDERGROUND CONDUIT INSTALLATION

- A. Install longitudinal runs of conduit with a minimum of 2-foot cover below final grade, a minimum of 3-foot offset from asphalt, concrete, concrete curb and retaining wall, and a minimum of 1-foot separation from other utilities. A minimum of 5-foot separation is preferred when longitudinal runs of conduit are parallel with other utilities.
- B. Do not install conduit directly beneath locations of tree plantings.
- C. All conduits terminating ends must be plugged to prevent entrance of foreign material. All conduits must be sealed to prevent water from entering.
- D. Joints: Use solvent-cemented joints for conduit fittings and make watertight according to manufacturer's written instructions.
- E. Curves and Bends: All turns in conduit larger than two 2-inches diameter must be made using 45-degree, 36" minimum sweeps. For larger radius, sweeps must be made with 45-degree bends, normally 10' to 20' radius. When using 2-inch diameter conduit, the 45-degree end will have a minimum of 24-inch radius.
- F. Sealing: Provide temporary closure at terminations of conduit with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- G. Pulling Cord: Install 200-lbf- (1000-N-) test nylon cord in empty conduits.
- H. Conduit must be free of water and debris before pulling cables.

3.5 INSTALLATION OF JB-S2 AND JB-S3 JUNCTION BOXES

- A. The Contractor shall comply with VDOT Specification Section 700 for junction boxes, except as noted below:
1. VDOT Specification Section 700.05(i) Junction Box Covers is replaced with the following:
  2. Junction Boxes must be installed as follows:
    - a. The junction box site must be excavated such that the depth of the excavation shall be the height of the junction box plus at least twelve inches to allow for bedding aggregate material and such that the width shall be six to eight inches wider than the junction box.
    - b. Bedding material shall be No. 68, No. 78, or No. 8 aggregate conforming to No. 78, or No. 8 gradation requirements. Aggregate shall be a minimum of twelve inches in depth and entirely cover the bottom of the junction box excavation. The bedding aggregate shall be leveled and tamped prior to installing the junction box.
    - c. Junction box shall be installed and leveled to grade prior to backfilling.
    - d. Prior to backfilling the interior of polymer concrete junction boxes (JB-S2 and JB-S3) shall be braced internally with 2 inches by 4-inch lumber using two braces across the width and one brace across the length of the box or as required by the manufacturer. Bracing must be installed to facilitate removal once back filling and compaction have been completed. The Contractor must remove internal bracing after the backfilling and compacting operation has been completed.
    - e. The cover of the junction box shall be installed prior to backfilling.
    - f. The junction box shall be backfilled and compacted around its perimeter utilizing six-to-eight-inch horizontal lifts to where the concrete collar is to begin. Once the concrete collar has cured, the remaining area around the collar shall be backfilled and compacted as stated above. Compaction shall be at least ninety percent of the theoretical maximum density. A mechanical tamping device shall be used to compact the backfill and soil layer by layer around the perimeter of the junction box. The wheel of a backhoe or other type vehicle shall not be used for compaction of backfill and soil. The internal bracing shall be removed after backfilling and compaction has been completed. The area around the junction box shall be graded and restored as stated in the Specifications.
    - g. Junction boxes must not be installed or backfilled in standing water. Backfill material shall be free of large stones, wood, or other debris and must not be saturated with water. If a special tool or wrench is required to remove the cover, provide the COTR with five such tools.
    - h. Install junction boxes flush with finished grade.

3. Do not install sealant compound between junction boxes and covers. Do not install concrete collars in areas surrounded by brick or masonry work.

### 3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installation of conduits and upon completion of tamping and backfilling, the Contractor must perform a mandrel test on each conduit to ensure no conduit has been damaged (this is also referred to as “proofing” the conduit). The Contractor must furnish a non-metallic mandrel having a diameter of approximately 50% of the inside diameter of the conduit in which it is to be pulled through. If damage has occurred, replace the entire length of conduit. The Contractor must ensure pull line (also known as a pull tape or mule tape) is re-installed.
2. Coordinate with the COTR for inspection in accordance with electrical permit requirements.

B. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Prepare test and inspection reports.

D. Upon Final Completion of the project, Record Drawings furnished to the COTR shall include detailing of both the horizontal and vertical (i.e., depth) locations of the conduit system.

### PART 4 - MEASUREMENT AND PAYMENT

A. See VDOT Specification Section 700 – General, for Measurement and Payment.

B. Payment shall include full compensation for all labor, materials, equipment, and incidentals necessary for providing specified items.

1. Underground Conduit will be measured per linear foot and will be paid for at the contract unit price per linear foot for the type and size specified. Payment includes providing conduit, fittings, DUWT, No. 8 locator wire, equipment grounding conductor, bonding systems, and pull rope or tape. The determination of feasibility shall be the responsibility of the contractor, per COTR’s approval, at no additional cost.

END OF SECTION 260543

## SECTION 262713 - ELECTRICITY METERING AND PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 700 – General.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 REFERENCES

- A. National Electric Code (NEC), National Fire Protection Association (NFPA 70), 2020.
- B. National Electrical Manufacturers Association (NEMA), NEMA 250 Enclosures for Electrical Equipment.

#### 1.3 SUMMARY

- A. Section includes electrical metering work to accommodate Dominion Energy revenue meters and panelboard for distribution of the electrical power system.

#### 1.4 ACTION SUBMITTALS

- A. Product Data:
  - 1. For metering infrastructure components.
- 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.
  - 3. Wire Termination Diagrams and Schedules: Include diagrams for power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
  - 4. Include short circuit rating data for modular meter centers with main disconnect device.

#### 1.5 CLOSEOUT SUBMITTALS



- A. Operation and Maintenance Data.

#### 1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metering equipment that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Cost to repair or replace any parts for two years from date of Substantial Completion.

#### 1.7 COORDINATION

- A. Electrical Service Connections.
  - 1. Coordinate with Dominion Energy and utility-furnished components.
    - a. Comply with requirements of utility providing electrical power services.
    - b. Coordinate installation and connection of utilities and services, including provision for electricity-metering components. Obtain available fault current rating from the utility company.

### PART 2 - PRODUCTS

#### 2.1 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.

#### 2.2 UTILITY METERING INFRASTRUCTURE

- A. Housing: NEMA 250, Type 3R enclosure, provided by utility company, picked up by Contractor at utility company facility, and installed in this contract.
- B. Meter Socket Rating: Coordinated with connected feeder circuit rating.
- C. Minimum Short-Circuit Rating: 10,000 A symmetrical at rated voltage. Confirm available fault current with utility company and provide equipment that exceeds the utility company available fault current at each meter location.
- D. Steady-state and short-circuit current ratings shall have ratings that match connected circuit ratings.
- E. Surge Protection at Main Terminal Box: Factory installed, integrally mounted, UL 1449 Type 1.

#### 2.3 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces.

- B. Enclosures: Surface-mounted cabinets.
  - 1. Rated for environmental conditions at installed location.
    - a. Control Panel Interior Mounting: NEMA 250, Type 1.
  - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions.
  - 3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to supports.
  - 4. 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.
  - 5. Directory Card: Inside panelboard door, mounted in transparent card holder.
- C. Incoming Mains Location: Top or Bottom as required.
- D. Phase, Neutral, and Ground Buses:
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
  - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- E. Conductor Connectors: Suitable for use with conductor material and sizes.
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
  - 2. Main and Neutral Lugs: Mechanical type.
  - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
- F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals as determined by utility company. Series ratings are not permitted.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.

- B. Install raceways and equipment according to utility company's written instructions. Provide grounding connections as required by utility company.
- C. Install arc-flash labels as required by NFPA 70.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Prepare test and inspection reports.

PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 700 – General, for Measurement and Payment.

END OF SECTION 262713

## SECTION 265613 – LIGHTING POLES AND STANDARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 700 – General and Section 705 – Lighting Systems.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA), NEMA 250 Enclosures for Electrical Equipment.
- B. National Electric Code (NEC).

#### 1.3 SUMMARY

- A. Section Includes
  - 1. Permanent lighting along publicly owned and maintained roadways and parking lots.
- B. Related Requirements
  - 1. Section 260500 Common Work Results for Electrical for furnishing and installing electrical equipment.
  - 2. Section 260542 Underground Conduits for Electrical Systems for electrical conduit, junction boxes, and wiring.
  - 3. Section 330500 Common Work Results for Utilities for underground detection for new and repaired utility installation.

#### 1.4 PREINSTALLATION MEETINGS

- A. Project stakeout
  - 1. Unless otherwise indicated, conduct stakeout at Project site.
  - 2. For installation of signs, arrange a meeting with the Engineer and/or representative(s) from the City to stakeout all items indicated on the sketches, plans and in the specifications.

3. This meeting shall occur prior to any work after the notice to proceed. No work shall proceed before the stakeout is approved by the Engineer.
4. The Contractor shall have the utilities marked by MISS UTILITY prior to the meeting.

#### 1.5 SUBMITTALS

##### A. Product Data Sheets:

1. Including: preparation instructions and recommendations, finishes, installation procedures, recommended environmental conditions for approval.
2. Submit certification that products furnished comply with requirements and are recommended by manufacturer for uses indicated for approval.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

##### A. The following roadway lighting material shall conform to VDOT Specifications:

1. Concrete foundations.
2. Grounding.
3. Electrical conduit and fittings.
4. Luminaires.
5. Lighting Structure.
6. Electrical Service Equipment.
7. Electrical cable, wire, and connectors.
8. Electrical handholes, manholes, pullboxes, and junction boxes.
9. Breakaway base support system.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- ##### A.
- All components integral to the installation of the roadway lighting system shall be installed per VDOT Specifications Section 700 – General and Section 705 – Lighting Systems and per Section 260543 Underground Conduits for Electrical Systems herein.

### PART 4 - MEASUREMENT AND PAYMENT

- ##### A.
- See VDOT Specification Section 700 – General and Section 705 – Lighting Systems, for Measurement and Payment.

END OF SECTION 265613

## SECTION 271116 – COMMUNICATIONS CABINETS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 801 – ITS Infrastructure Components.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA), NEMA 250 Enclosures for Electrical Equipment.

#### 1.3 SUMMARY

- A. Section Includes:
  - 1. ITS Controller Cabinets.
- B. Related Requirements:
  - 1. Section 312000 Earth Moving for execution of excavation, backfill procedures and compaction standards for trenching.

#### 1.4 SUBMITTALS

- A. Product Data: For fittings, boxes, and cabinets.
- B. Shop Drawings: Show fabrication and installation details of components for fittings, boxes, and cabinets.

#### 1.5 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of boxes and cabinets with other construction including station amenities.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: NEMA/ANSI C80.1.
- B. Fittings: NEMA/ANSI FB 1; compatible with conduit and tubing materials.

### 2.2 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA/ANSI OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA/ANSI FB 1, Type FD, with gasketed cover.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA/ANSI OS 1.
- D. Cast-Metal Pull and Junction Boxes: NEMA/ANSI FB 1, cast aluminum with gasketed cover.
- E. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

### 2.3 FACTORY FINISHES

- A. Finish: For cabinet components, provide manufacturer's standard gray paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Direct-Buried Conduit:
  - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 Earth Moving for pipe less than 6 inches in nominal diameter.
  - 2. After installing conduit, backfill and compact. Firmly hand tamp backfill around conduit to provide maximum supporting strength.
  - 3. Install manufactured rigid steel elbows for stub-ups at poles and equipment canopy entrances.
- B. Installation of underground handholes and boxes.
  - 1. Install handholes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper clearances.



2. Support boxes on a level bed of crushed stone or gravel, graded from ½ inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
3. Elevation: Set so cover surface will be flush with finished grade.
- C. Protect stub-ups from damage where conduits rise through slabs. Arrange so that curved portions of bends are not visible above the finished slab.
- D. Make bends and offsets so that ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- E. Install pull wires in empty conduits. 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.
- F. Communications Conduits: 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways with a maximum of three 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- G. Stub-up Connections: Extend conduits through concrete for connection to freestanding equipment. Extend conductors to equipment with rigid steel conduit.

### 3.2 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

### 3.3 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

## PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 801 – ITS Infrastructure Components, for Measurement and Payment.

END OF SECTION 271116

SECTION 272100 – DATA COMMUNICATIONS NETWORK EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 238 – Electrical and Signal Components, Section 700 – General, Section 808 – Fiber Optic Cable and Interconnect, and Section 809 – Managed Field Ethernet Switch.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA), NEMA 250 Enclosures for Electrical Equipment.

1.3 SUMMARY

- A. Section Includes:
  - 1. Communication equipment.

1.4 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 power distribution units.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer. Maintain a service center capable of providing training, parts, and on-site repairs in less than 24 hours maximum response time.
- B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1.6 EQUIPMENT

- A. No discontinued equipment or materials shall be installed under this Project.

- B. All equipment shall be produced new, within six months of install date, and warehoused by the manufacturer with lot numbers traceable to production dates and quality test dates.
- C. Fiber Optic Drop Cable (12 strand)
  - 1. To be compatible with City-owned fiber optic network cabling.
- D. Fiber Optic Splice Enclosure
  - 1. To be compatible with City-owned fiber optic network cabling.
- E. Fiber Optic Terminations / Patch Panels
  - 1. To be compatible with City-owned fiber optic network cabling.
- F. Ethernet Communications Switch
  - 1. To be compatible with City-owned fiber optic communications network switches.
- G. Surge Suppressor
  - 1. Minimum 12 outlets
  - 2. Operating Environment: 5 to 122 deg F, 0 to 95% humidity, noncondensing
  - 3. UL 497B compliant
- H. Power Distribution Unit
  - 1. 120VAC, 20A max
  - 2. (8) NEMA 5-20R connectors, minimum
  - 3. Environmental Conditions: Power Distribution Units shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability.
    - a. Operating Temperature Range: -40 to 140 deg F
    - b. Relative Humidity Range: 0 to 95 percent, noncondensing

## 1.7 LABELING

- A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## PART 2 - PRODUCTS

### 2.1 Ethernet Communications Switch

- A. The City currently uses Hardened Networks ITS Express 8042+ and Calix 716GE Optical Network Terminal Ethernet field switches.
- B. Where Calix brand switches are proposed for use, the Contractor shall provide the following ancillary equipment to achieve a complete and functional installation in the signal cabinet:
  - 1. Part 100-03248 716GE ONT, 2 POTS, 4GE-CE
  - 2. Part 100-01409 700 ONT Structured Wiring Enclosure Bracket
  - 3. Part 100-01582 ONT Splice Tray SFU with SC/APC Adaptor
  - 4. Part 100-01979 ONTCMN-PS 100-240 VAC 50/60 Hz to 12 VDC Adapter - 2 Wire, C-temp (No battery backup)

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Coordinate layout and installation of communications equipment with City's network equipment.
- C. Comply with Fiber Optic Cable, Fiber Patch Panel, and Underground Splice Enclosure Requirements in VDOT Specification Section 808.
- D. Comply with Fiber Conduit Installation Requirements in VDOT Specification Section 812.03 Procedures.
- E. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

#### 3.2 GROUNDING

- A. Comply with TIA-607-B.

#### 3.3 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B.
- B. Labels shall be preprinted or computer-printed type.

#### 3.4 WARRANTY

- A. Unless otherwise required herein, the contractor shall provide manufacturer's warranties on furnished equipment for material and workmanship that are customarily issued by the equipment manufacturer and that are at least one (1) year in length from the date of Substantial Completion.

- B. The contractor shall include unconditional coverage for all parts and labor necessary or incidental to repair of defective equipment or workmanship and malfunctions that arise during the warranty period.
- C. The contractor shall track all equipment installation date and times for warranty purposes. The contractor tracking list shall be updated and submitted to the designated maintaining agency at the final acceptance of the system.
- D. Upon successful completion of the 90 day observation period, the contractor shall transfer manufacturer's warranties with proper validation by the manufacturer to the Owner of the system or its designated maintaining agency.

PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 700 – General, Section 808 – Fiber Optic Cable and Interconnect, and Section 809 – Managed Field Ethernet Switch, for Measurement and Payment. Ancillary switch equipment noted above shall be considered incidental to the cost for furnishing and installing a functional Field Ethernet Switch.

END OF SECTION 272100

## SECTION 274216 – TRANSPORTATION INFORMATION DISPLAY SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 238 – Electrical and Signal Equipment and Section 804 – Dynamic Message Signs.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 REFERENCES

- A. National Electrical Manufacturers Association (NEMA), NEMA 250 Enclosures for Electrical Equipment.

#### 1.3 SUMMARY

- A. Section Includes
  - 1. Furnishing materials and installation of Transportation Information Display Systems.
- B. Related Requirements:
  - 1. Section 260542 Underground Conduits for Electrical Systems for electrical conduit, junction boxes, and wiring.
  - 2. Section 272100 Data Communications Network Equipment for communications equipment.

#### 1.4 ACTION SUBMITTALS

- A. Product Data:
  - 1. Include construction details, material descriptions, dimensions, physical attributes, display characteristics, connectivity, and power.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Subject to compliance with requirements, available manufacturers offering products may be incorporated into the Work include, but are not limited to the following:

1. Connectpoint Inc.  
175 Cremona Drive  
Suite 160  
Goleta, CA 93117  
Telephone: 805.682.8900 (Ext 125)
2. Contractor may submit a different Manufacturer and Display meeting the criteria below as an Approved Equal for review and approval by the COTR and the Engineer.

#### 1.6 MATERIAL

- A. Digital signs shall offer scheduled bus arrival and departure information, real-time alerts, visual mapping, ADA-compliant text-to-speech device, and advertising imagery.
- B. Content should be remotely managed by a cloud-based Asset Management System (cost to be incurred by the City of Alexandria as an annual operating cost of the system).

### PART 2 - PRODUCT

#### 2.1 PRODUCTS

- A. Display Characteristics
  1. Digital Signs shall have portrait or landscape orientation capabilities.
  2. A resolution of at least 2880 x 2160 pixels.
  3. IK10 rated, tempered and anti-reflective.
  4. Ultra-wide 178° viewing angle.
  5. Direct Light Guide screen illumination.
  6. Full-color.
  7. 55” screen size.
  8. IP 68 rating.
  9. Operating Temperature of -31°F to 140°F / -35°C to 60°C.
- B. Power Requirements
  1. 110V AC
- C. Connectivity
  1. Cellular, Wi-Fi, and Ethernet capable.

2. Text-to-Speech (TTS) capable with audio push button option powered using a 3-position sensor/actuator M8MS cable connecting to the sign button.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install per manufacturer's specifications in accordance with the location and orientation information specified in the Contract Drawings and as directed by the COTR.
- B. Digital signs shall have installation options including, but not limited to, flush mount or downward mounting bracket.

#### 3.2 TESTING

- A. The Contractor shall conduct field tests to verify compliance with the Contract Drawings and all manufacturer requirements.

#### 3.3 SPARE SCREENS

- A. The Contractor shall supply two spare screens as part of this project.

#### 3.4 WARRANTY

- A. The Contractor and Transportation Information Display Systems sign manufacturer shall agree to repair or replace components that fail with the specified warranty period.
- B. The Transportation Information Display Systems shall be warrantied against any defects in material and workmanship, under normal use, for a period of two years from the date of acceptance. If the system is found by the manufacturer to be defective within the warranty period, the manufacturer shall repair and/or replace any defective parts.

### PART 4 - MEASUREMENT AND PAYMENT

- A. Transportation Information Display Systems will be measured and paid for at the contract unit price per each. The payment will be full compensation for Transportation Information Display Systems, ADA-compliant text-to-speech device with audio push button, warranty, labor, materials, equipment, tools, and incidentals necessary to complete the work and provide a fully functional sign system.
- B. The Cloud-based Asset Management System will not be included as part of the cost of the project and will be paid for by the City of Alexandria as an annual operating cost.

END OF SECTION 274216



## SECTION 311000 – SITE CLEARING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 301 – Clearing and Grubbing.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Protection of existing vegetation to remain.
  - 2. Clearing and Grubbing procedures.
  - 3. Stripping and stockpiling Topsoil and Rock.
  - 4. Removing above- and below-grade site improvements.
  - 5. Disconnecting, capping or sealing, and removing or abandoning site utilities
- B. Related Requirements:
  - 1. Section 015639 Temporary Tree and Plant Protection to verify vegetation to remain and tree protection.
  - 2. Section 024113 Paving Removal for the demolition and removal of pavement.
  - 3. Section 024119 Selective Demolition for the partial removal of site improvements.
  - 4. Section 312000 Earth Moving for execution of excavation, backfill procedures, and compaction standards for structural stability.

#### 1.3 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. 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 in diameter; and free of weeds, roots, toxic materials, or other non-soil materials.

- C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected as per landscape guidelines and as indicated on Contract Drawings.
- D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction per City of Alexandria Landscape Guidelines (February 2019), or latest revision.
- E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

#### 1.4 PREINSTALLATION MEETINGS

- A. Pre-construction Meeting: The Contractor must stake limits of clearing, grubbing, and stripping, prior to meeting the COTR onsite to review the project requirements. Trees, other vegetation, and structures to be removed or altered will also be marked. The condition of upstream and downstream storm structures, pipe systems, natural channels and outfalls must be documented and submitted to the COTR for review. Do not proceed with Site Clearing or Demolition Operations without approval of the COTR.

#### 1.5 MATERIAL OWNERSHIP

- A. Except for materials indicated to be stockpiled or otherwise remain City's property, cleared materials shall become Contractor's property and shall be removed from Project site.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record Drawings, according to Section 017839 Project Record Documents, identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.
- C. Certification: Submit written certification by qualified arborist that trees indicated to remain have been protected during the course of construction in accordance with recognized standards and that where damage did occur, trees were promptly and properly treated. Indicate which damaged trees (if any) are incapable of retaining full growth potential and are recommended to be replaced.

#### 1.7 QUALITY ASSURANCE

- A. Arborist Qualifications: Engage a licensed arborist who has successfully completed tree protection and trimming, to perform the following work:
  - 1. Remove branches from trees that are to remain, if required.
  - 2. Recommend procedures to compensate for loss of roots and perform initial pruning of branches and stimulation of root growth where removed to accommodate new construction.

3. Recommend procedures for excavation and grading work juxtaposed to established plants.
  4. Perform tree repair work for damage incurred by new construction.
- B. Upstream and Downstream Inspection: Document the condition of upstream and downstream storm structures, pipe systems, natural channels and outfalls through photographs and measurements prior to the initiation and after the termination of site clearing activities.

## 1.8 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 City and authorities having jurisdiction.
  2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction. Detour routes shall be identified by adequate signs in accordance with the MUTCD and VWAPM.
- B. Protect areas outside limits of disturbance from encroachment by construction personnel or equipment, regardless of property ownership. Access shall be by specific, written permission or easement only.
- C. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining City's property will be obtained by City before award of Contract.
1. Do not proceed with work on adjoining property until directed by COTR.
- D. Public Utility Locator Service: Notify for area where Project is located before site clearing.
1. Private Utilities may require an additional locator service.
- E. Salvageable Improvements: Carefully remove items indicated to be salvaged and deliver to storage location defined on the Contract Drawings or specified here in.
- F. Do not commence site clearing operations until temporary erosion and sediment controls, pedestrian protection, and plant-protection measures are in place.
- G. Contractor shall verify existing grades prior to performing work under this section. If existing grades are at variance with the Contract Drawings, notify the City and receive instructions prior to proceeding. No additional compensation will be considered resulting from grade variances once site clearing has commenced.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction. Benchmarks impacted by Contractor operations shall be reset at the Contractor's expense.
- 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 015639 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 COTR.
- D. Any site clearing which is necessary to install sediment controls, pedestrian protections, or vegetative protection must be discussed and agreed to by the COTR at the pre-installation meeting.
- E. Prior to commencing site clearing operations, the contractor shall inspect, photograph, and submit documentation to the COTR of the condition of upstream and downstream storm inlets, pipe systems, natural channels and outfalls. Once site clearing operations have been completed, the Contractor must document the condition of structure and removed accumulated sediment and debris.

### 3.2 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 Contract Drawings and requirements of authorities having jurisdiction.
  - 1. All sediment controls and associated installation, maintenance and removal activities must be in compliance with the Virginia Erosion and Sediment Control Handbook, latest edition.
- 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.

### 3.3 TREE AND PLANT PROTECTION

- A. Protect trees and plants remaining on-site according to requirements in Section 015639 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 015639 Temporary Tree and Plant Protection.

### 3.4 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
  - 1. Arrange with utility companies to shut off indicated utilities.
- B. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by City or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify the COTR not less than 2 days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without COTR's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

### 3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
  - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  - 2. Use only hand methods or air spade for grubbing within protection zones.
  - 3. Chip removed tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated. Follow the placement and compaction standards described in the Section 312000 Earth Moving.
- C. If unanticipated site improvements, hazardous contaminations, or other conditions, which are not anticipated in the scope of work are encountered, stop work and immediately notify the COTR. No payment shall be made for additional work performed without approval of the COTR.

### 3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to the full depth of the layer in a manner to prevent intermingling with underlying subsoil or other waste materials.
  - 1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
  - 1. Limit height of topsoil stockpiles to 6 feet unless otherwise approved by the COTR.
  - 2. Do not stockpile topsoil within protection zones.
  - 3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

### 3.7 STOCKPILING ROCK

- A. Remove naturally formed rock according to Section 312000 Earth Moving.
  - 1. When indicated to be salvaged, separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- B. Stockpile rock without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.
  - 1. Do not stockpile rock within protection zones.
  - 2. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.

### 3.8 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
  - 1. Paving shall be removed according to Section 024113 Paving Removal or Section 024119 Selective Demolition, when applicable.
  - 2. Structures shall be removed according to Section 024119 Selective Demolition, when applicable.

### 3.9 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 City's property.
  - 1. 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.
- B. Burning tree, shrub, and other vegetation waste, other waste and debris is not permitted.

## PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 301 – Clearing and Grubbing, for Measurement and Payment.

END OF SECTION 311000

## SECTION 312000 –EARTH MOVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 303 – Earthwork.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 SUMMARY

##### A. Section Includes:

- 1. Preparation of the site for rough grading, excavation, and embankment fill.
- 2. Protection of existing utilities, persons, and property.
- 3. Drainage and dewatering guidelines to facilitate general earthwork.
- 4. General Excavation, Fill, Backfill, embankment and Grading procedures.
- 5. Compaction and Grading tolerances for Turf and Unpaved Areas.
- 6. Protection of Site Work and Clean Up procedures.

##### B. Related Requirements:

- 1. Section 311000 Site Clearing for site clearing and removal of above- and below-grade site improvements.
- 2. Section 315000 Slope Protection for shoring, bracing, and sheet piling of excavations.
- 3. Section 329200 Turf and Grasses for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
- 4. Section 329300 Plants for finish grading in planting areas and tree and shrub pit excavation and planting.

#### 1.3 DEFINITIONS

- A. 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 COTR.
  2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by COTR. Unauthorized excavation, as well as remedial work directed by COTR, shall be without additional compensation.
- B. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that cannot be excavated without systematic drilling, ram hammering, ripping, or blasting and exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D1586.
- C. Fill: Soil materials used to raise existing grades.
- D. Backfill: Soil material or controlled low-strength material used to fill an excavation.
- E. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- F. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- G. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- H. Structures: Buildings, footings, foundations, slabs, tanks, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- 1.4 ACTION SUBMITTALS
- A. None
- 1.5 INFORMATIONAL SUBMITTALS
- A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
1. Classification according to ASTM D2487 including gradation analysis.
  2. Laboratory compaction curve according to ASTM D1557.
- 1.6 QUALITY ASSURANCE
- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.
- B. Field Reports: In-place soil density test, calibrated from the modified proctor laboratory compaction test.
- 1.7 PROJECT REQUIREMENTS

- A. The Contractor shall accept the site in the condition in which it exists at the time of the award of the Contract.
  - 1. Notify the COTR of any unexpected subsurface condition encountered during earth moving operations. Do not proceed with excavation without approval from the COTR.
  - 2. The Engineer shall determine the suitability of materials that are to be used in the work and should any materials encountered be unsatisfactory for the purpose intended, they shall be removed from the site at the Contractor's expense.
- B. 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 COTR and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by COTR or authorities having jurisdiction.
  - 3. Operate warning lights as recommended by authorities having jurisdiction.
- C. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining City's property will be obtained by COTR before award of Contract.
  - 1. Do not proceed with work on adjoining property until directed by COTR.
- D. Protection of Persons and Property:
  - 1. Barricade open excavations occurring as part of this work, and post with warning lights.
  - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
  - 3. Perform excavation within drip-line of large trees to remain by hand and protect the root system from damage or dry out to the greatest extent possible. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1-inch diameter and larger with emulsified asphalt tree paint.
  - 4. Cut and protect roots according to requirements in Section 015639 Temporary Tree and Plant Protection.
  - 5. Provide planking at all walks, pavements, and curbs to be crossed by equipment.

#### 1.8 PRECONSTRUCTION CRITERIA

- A. Existing Utilities: Notify utility locator service "Miss Utility" for area where Project is located before beginning earth-moving operations.
  - 1. If utilities are to remain in place, provide adequate support and protection during earthwork operations, comply with OSHA requirements.

2. Coordinate interruption and/or termination of utilities with the utility companies and the COTR.
  3. Provide a minimum of 48 hours' notice to the COTR and receive written notice to proceed before interrupting any utility.
  4. Demolish and completely remove from the site any existing underground utilities designated to be removed as shown on the Contract Drawings.
  5. Repair any damaged utilities as acceptable to the Engineer, at no additional cost to the City.
- B. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures are in place.
- C. Do not commence earth-moving operations until plant-protection measures are in place.
1. The following practices are prohibited within protection zones:
    - a. Storage of construction materials, debris, or excavated material.
    - b. Parking vehicles or equipment.
    - c. Foot traffic.
    - d. Erection of sheds or structures.
    - e. Impoundment of water.
    - f. Excavation or other digging unless otherwise indicated.
    - g. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
  2. Do not direct vehicle or equipment exhaust towards protection zones.
  3. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
- 1.9 PREINSTALLATION MEETINGS
- A. Pre-installation Conference: Conduct conference at Project Site prior to the start of excavation
  - B. Review geotechnical report.
  - C. Review existing utilities and subsurface conditions.
  - D. Review coordination for interruption, shutoff, capping, and continuation of utility services.
  - E. Review proposed excavations.
  - F. Review proposed equipment.

- G. Review monitoring of excavation support and protection systems.
- H. Review abandonment or removal of excavation support and protection system.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials only when sufficient satisfactory soil materials are not available from excavations. Remove and legally dispose of unsatisfactory soil material.
- B. Satisfactory Soils: Soil Classification Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
  - 1. Liquid Limit: Per Geotech Recommendation.
  - 2. Plasticity Index: Per Geotech Recommendation.
- C. Unsatisfactory Soils: Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, 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. Selected Fill: Sound, durable, sand, gravel, stone, or blends of these materials, free from organic, frozen, or other deleterious materials.

<b>SIEVE</b>	<b>PERCENT PASSING</b>
4"	100
No. 40	0 – 70
No. 200	0 – 10

- 1. Fines passing No. 200 shall be non-plastic.
  - 2. Particle size analysis shall show no gap grading.
- E. Select Granular Material: Sound, durable, sand, gravel, stone or blends with these materials, free from organic, frozen, or other deleterious materials, conforming to the requirements of VDOT and meeting the following gradation requirements:

SIEVE	PERCENT PASSING
2"	100
1/4"	30 – 65
No. 40	5 – 40
No. 200	0 – 10

- F. 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 sieve and zero to 5 percent passing a No. 4 sieve.
- G. Sand: ASTM C33/C33M; fine aggregate.
- H. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## 2.2 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; ASTM D4632.
    - b. Sewn Seam Strength: 142 lbf; ASTM D4632.
    - c. Tear Strength: 56 lbf; ASTM D4533.
    - d. Puncture Strength: 56 lbf; ASTM D4833.
  - 3. Apparent Opening Size: No. 60 sieve, maximum; ASTM D4751.
  - 4. Permittivity: 0.5 per second, minimum; ASTM D4491.
  - 5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

## 2.3 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils 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 deep; colored as follows:
  - 1. Red: Electric.
  - 2. Yellow: Gas, oil, steam, and dangerous materials.

3. Orange: Fiber Optic, Telephone, and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

### PART 3 - EXECUTION

#### 3.1 PRECONSTRUCTION MATERIAL QUALIFICATION TESTING

- A. A 100-pound minimum representative sample shall be obtained from each potential borrow source. If different material gradations are known to exist in the pit, samples shall be obtained for each material. Each sample shall be mixed thoroughly and reduced to test specimen size, in accordance with AASHTO T87. The test shall be performed in the order shown. Failure to pass any test is grounds for disqualification and shall lead to cessation of the test program for that material.
  1. Particle Size Analysis:
    - a. Method: ASTM D422.
    - b. Number of Tests: One (1) per potential source.
    - c. Acceptance Criteria: Gradation within specified limits.
  2. Maximum Density Determination:
    - a. Method: ASTM D1557, Modified Proctor.
    - b. Number of Tests: One (1) per potential source.
  3. Re-establish gradation and maximum density of fill material if source is changed during construction.

#### 3.2 PREPARATION

- A. Establish required lines, levels, contours, and datum.
- B. Maintain benchmarks and other elevation control points. Re-establish, if disturbed or destroyed, at no additional cost to the City.
- C. Establish location and extent of utilities before commencement of grading operations.
- D. 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. Damage to facilities not shown as impacted in the Contract Documents shall be restored to their original condition, at no additional cost to the City.
- E. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- F. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### 3.3 DRAINAGE AND 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. Damage to the surrounding area not shown as impacted in the Contract Documents, shall be restored to their original condition, at no additional cost to the City.
- 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.

### 3.4 EXPLOSIVES

- A. Explosives: Do not use explosives.

### 3.5 GENERAL EXCAVATION

- A. Excavation shall consist, in general, of the excavation of whatever substance is encountered to the lines, grades, and sections shown on the Contract Drawings including excavation as necessary for grading and other similar features.
- B. All suitable materials removed in excavation shall be used in the construction of embankments, subgrade, shoulders, slopes, and at such other places as directed. The COTR shall be the sole judge of what constitutes suitable material.
- C. During construction, the grading operations shall be executed in such a manner that the excavation will be well drained at all times. All grading shall be finished on neat, regular lines conforming to the sections and contours shown on the Contract Drawings.
- D. Removal of materials beyond the indicated subgrade elevations, without authorization by the COTR, shall be classified as unauthorized excavation and shall be performed at no additional cost to the City.
- E. Excavation shall be performed in proper sequence with all other associated operations.
- F. Maintain the slopes of excavation in a safe condition until completion of the grading operation.
- G. All excavation work shall be inspected and approved by the COTR before proceeding with construction.

- H. Any excess excavation shall be removed from the site to disposal areas at the Contractor's expense.

### 3.6 SUBGRADE INSPECTION

- A. Notify City when excavations have reached required subgrade.
- B. If City determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
  - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by COTR, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by COTR, without additional compensation.

### 3.7 ROCK EXCAVATION

- A. The Contractor shall cease excavation and notify the COTR when material meeting the definition for Rock is encountered. Additional testing may be ordered to determine if the materials meet the definition for Rock.
- B. Prior to excavation of Rock, the COTR and Contractor shall agree to a maximum limit of excavation. Excavation beyond these limits shall be considered unauthorized excavation.

### 3.8 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. Sufficient grading must be done during the progress of the work so that the entire site shall be well drained and free from water pockets.
- C. All cutting, filling, backfilling and grading necessary shall be done to bring the area to the following grade or subgrade levels:



1. For roadway surface areas to the finished subgrade levels specified on the Contract Drawings.
  2. For areas to be topsoiled and seeded to within 6 inches of the finished grade.
  3. For other surface treatments as detailed on the Contract Drawings.
- D. Under Turf or Unpaved areas, finish subgrades to elevations required to achieve indicated finish elevations within a tolerance of plus or minus 1 inch.
- E. Inside Building Lines, Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.
- F. Finish grading, including dressing swales, cleaning up excess footing excavation, dressing terraces, disposing of excess material and all other work necessary to prepare the site for topsoil and seeding shall be done after construction of structures and roadway surface areas is substantially complete.

### 3.9 FILL

- A. All site fill shall be “selected fill” unless otherwise shown on the Contract Drawings or directed by the Engineer. “Select granular fill” shall be placed in lieu of selected fill where directed by the COTR.
- B. Before depositing fills, the surface of the ground shall be cleared of all refuse, brush, and large stones. Conform to Section 311000 Site Clearing.
- C. Prior to placing fill over undistributed material, scarify to a minimum depth of 6 inches.
- D. Where fills are made on hillsides or slopes, the slope of the original ground upon which the fill is to be placed shall be plowed or scarified deeply or where the slope ratio of the original ground is steeper than 2 horizontal to 1 vertical, the bank shall be stepped or benched. Refer to VDOT Specification 303.04 for benching requirements.
- E. The original ground shall be proof rolled until the underlying soil is thoroughly compacted to the satisfaction of the COTR before any filling is begun. A steel-wheel tandem roller weighing 8 to 10 tons or equipment capable of obtaining the same effort shall be used to obtain a thoroughly compacted subgrade. Remove or recompact any soft or loose soils as determined by the COTR prior to filling.
1. A thoroughly and satisfactorily subgrade is defined as having a minimum dry density of 95 percent of the maximum density of the material used. The subgrade material shall be compacted at a moisture content suitable for obtaining the required density.
- F. Place backfill and fill materials in layers not more than 12 inches in loose depth unless shown otherwise on the Contract Drawings. Lift height shall be governed by the ability of the compaction equipment to obtain the required compaction with 8 inches as a maximum lift height. Before compaction, moisten or aerate each layer as necessary to facilitate compaction to the required density. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost, ice, ponded water, or extraneous debris.

- G. When work is suspended during periods of freezing weather, measures shall be taken to prevent fill already in place from freezing. Upon resumption of work after any inclement weather, prepare the exposed surface by proof rolling to identify any zones of soft/loose soils. Soft/loose materials or frozen soils shall be removed and replaced by compacted granular fill.
- H. Moisture Control:
  - 1. Where fill or backfill must be moisture conditioned before compaction, uniformly apply water to the surface and to each layer of fill or backfill to within 2 percent of optimum moisture content. Prevent ponding or other free water on surface subsequent to, or during, compaction operations.
  - 2. Remove and replace, or scarify and air dry, soil that is too wet to permit compaction to specified density. Soil that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a value which will permit compaction to the percentage of maximum density specified.
- I. All fill shall be thoroughly and satisfactorily compacted to 95 percent of the maximum density of material used unless otherwise specified.

### 3.10 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, damp proofing, 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.

### 3.11 EMBANKMENTS

- A. Prior to placing embankment, scarify the area of muck, frozen material, roots, sod or other deleterious material. Embankment shall not contain any of the aforementioned material nor shall it be placed on frozen ground or areas covered by ice or snow.
- B. Placing and uniformly compacting approved material within roadway area where unsuitable material has been removed; and placing and compacting of approved materials in holes, pits, utility trenches, basements, and other depressions within the roadway area.

1. Shall be placed adjacent to structures in the same manner as for 'fill' described herein.
- C. Where geotextile is required for either drainage or embankment stabilization, it shall be placed as shown on the plans and in accordance with VDOT Specification Section 245.
- D. The surface area directly underneath the pavement and shoulders on which embankment of less than 5 feet in depth are to be constructed shall be denuded of vegetation, scarified, and compacted to a depth of 6 inches to the same degree as the material to be placed thereon.
  1. Areas unsuitable for foundations for embankments shall be undercut and backfilled in accordance with VDOT Specification Section 303.03 (e) and (f).
- E. Scarify existing unpaved road to such a degree as will permit an ample bond between the old and new material. Demolish hydraulic cement concrete and asphalt concrete pavement structures within the proposed roadway in accordance with VDOT Specification Section 508.02 (a).
- F. Slopes requiring benching shall be done in accordance with VDOT Specification Section 303.04.
- G. When excavated material consists predominately of soil, embankment shall be placed in successive uniform layers not more than 8 inches in thickness before compaction over the entire roadbed with a tolerance of +/-20 percent of optimum moisture content to a minimum density of 95 percent of the maximum density.
  1. Do not place material with an optimum moisture content above 30 percent on a previously placed layer for drying. Determine field density as specified in VDOT Specification Section 303.04
- H. Construction equipment shall be routed uniformly over the entirely surface of each layer, scarified to its full depth, with continuous leveling and manipulating to ensure uniform density.
- I. Rock fragments of the same size as the thickness of embankments layers, shall not be placed:
  1. Crushed glass shall not be used in embankment.
  2. Rock, broken concrete or other solid materials shall not be placed in embankment areas where piling is to be placed or driven.
- J. The best material shall be reserved for finishing and dressing the surface of embankments. Work necessary to ensure the reservation of such material shall be the responsibility of the Contractor.

### 3.12 REMEDIATION OF 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 3000 psi, may be used when approved by COTR.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by COTR.

### 3.13 FIELD QUALITY CONTROL

- A. Notify the COTR at least one (1) working day in advance of all phases of filling and backfilling operations.
- B. Compaction testing shall be performed to ascertain the compacted density of the fill and backfill materials in accordance with the following methods:
  1. In-place relative density:
    - a. Method: AASHTO T310, Nuclear Method.
      - 1) Number of Tests: One (1) per 8-inch vertical lift.
      - 2) Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one (1) test for every 2,000 square feet or less of paved area of building slab, but in no case fewer than three (3) tests.
- C. The COTR may direct additional tests to establish gradation, maximum density, and in-place density as required by working conditions, at the Contractor's expense. Acceptance Criteria: The sole criterion for acceptability of in-place fill shall be in situ dry density. Minimum dry density for all fill or backfill shall be 95 percent of the maximum dry density unless otherwise indicated or superseded by structural, pavement or vegetative compaction standards. If a test fails to qualify, the fill shall be further compacted and retested. Subsequent test failures shall be followed by removal and replacement of the material.

### 3.14 COMPACTION EQUIPMENT

- A. Compaction equipment used for the Work is subject to approval by the COTR. Any equipment not originally manufactured for compaction purposes and equipment which is not in proper working order will not be approved. Furnish manufacturer's specifications covering data not obvious from a visual inspection of the equipment and necessary to determine its classification and performance characteristics.

### 3.15 COMPACTION OF SOIL BACKFILLS AND FILLS UNDER UNPAVED AREAS

- A. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent of maximum dry unit weight according to ASTM D1557.

### 3.16 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.

3.17 SUBSURFACE DRAINAGE

- A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
  - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698.
- B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
  - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698.
  - 2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.18 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 COTR; 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.

3.19 CLEAN UP

- A. Provide and maintain protections or newly filled areas against damage. Upon completion or when directed, correct all damaged and deficient work by building up low spots and remove temporary protections, fencing, shoring and bracing.
- B. Remove all surplus excavated material not required for filling and backfilling and legally dispose of same away from premises.
- C. Leave the premises and work in clean, satisfactory condition, ready to receive subsequent operations.

PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 303 – Earthwork, for Measurement and Payment.
- B. For the following items, payment shall include full compensation for all labor, materials, equipment, third party testing as necessary to ensure compliance with material, compaction, and other applicable standard and incidentals necessary for earthwork operations.
  - 1. Additional Authorized Excavation will be measured and paid for at the contract unit price per cubic yard of material excavated. Payment will include full compensation for all excavation, removal and disposal of unsuitable and surplus materials, loading, moving, grading and handling of all cut and fill material, placement, spreading, and compaction. Additional Authorized Excavation will be requested and authorized by the COTR prior to the commencement of work.
  - 2. Unauthorized Excavation will not be measured, and no payment must be made. Restoration of all Unauthorized Excavation to acceptable conditions will be at the Contractor's expense.
  - 3. Geotextile fabric will not be measured, and payment will be incidental to the respective work being performed.
  - 4. Detectable Warning Tape will not be measured, and payment will be incidental to price bid for General Earthwork.

END SECTION 312000

## SECTION 312333 – TRENCHING AND BACKFILLING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications).
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).
- D. Trenching operations shall be performed in accordance with the Occupational Safety and Health Administration (OSHA) Technical Manual Section V: Chapter 2 Excavations: Hazard Recognition in Trenching and Shoring, latest edition.

#### 1.2 SUMMARY

- A. This section includes supplemental instructions to those provided in Section 312000 Earth Moving for:
  - 1. Trench Excavation and Dewatering.
  - 2. Backfilling of Trenches and Compaction.
- B. Related Requirements:
  - 1. Section 013200 Construction Progress Documentation for recording pre-excavation and earth-moving progress.
  - 2. Section 312000 Earth Moving for execution of excavation, backfill procedures, and compaction standards for structural stability.
  - 3. Section 315000 Slope Protection for shoring, bracing, and sheet piling of excavations.
- C. DEFINITIONS
- D. 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 COTR. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the COTR. Unauthorized excavation, as well as remedial work directed by the COTR, shall be without additional compensation.
  - E. Fill: Soil materials used to raise existing grades.
  - F. 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.
  - G. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
  - H. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- 1.3 ACTION SUBMITTALS
- A. None.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
    1. Classification according to ASTM D2487 including gradation analysis.
    2. Laboratory compaction curve according to ASTM D1557.
  - B. Field Reports: In-place soil density test, calibrated from the modified proctor laboratory compaction test.
- 1.5 QUALITY ASSURANCE
- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.
- 1.6 PROJECT REQUIREMENTS
- A. Notify the COTR of any unexpected subsurface conditions.
  - B. Protect Excavations by shoring, bracing, sheet piling, underpinning, or by other methods as required to ensure the stability of the excavation according to Section 315000 Slope Protection.
  - C. Protect Existing Utilities, Persons, and Property according to Section 312000 Earth Moving.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS



- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
  - 1. Liquid Limit: Per Geotech Recommendation.
  - 2. Plasticity Index: Per Geotech Recommendation.
- C. Selected Fill: Sound, durable, sand, gravel, stone, or blends of these materials, free from organic, frozen, or other deleterious materials.

SIEVE	PERCENT PASSING
4"	100
No. 40	0 – 70
No. 200	0 – 10

- 1. Fines passing No. 200 shall be non-plastic
  - 2. Particle size analysis shall show no gap grading
- D. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand meeting the specifications for No. 8 Stone as defined by the Virginia Department of Transportation Road and Bridge Specifications, latest edition.
- E. Sand: ASTM C33/C33M; fine aggregate.

## 2.2 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils 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 deep; colored as follows:
  - 1. Red: Electric.
  - 2. Yellow: Gas, oil, steam, and dangerous materials.
  - 3. Orange: Fiber Optic, Telephone and other communications.
  - 4. Blue: Water systems.
  - 5. Green: Sewer systems.

## PART 3 - EXECUTION

### 3.1 TRENCH EXCAVATION

- A. Unless explicitly superseded within this section or by the contract documents, trench excavation must:
  - 1. Be completed as described in Section 312000 Earth Moving, including but not limited to:
    - a. Preconstruction Material Qualification Testing and Field Quality Control Testing.
    - b. Preparations.
    - c. General Excavation, Fill, Backfill and Grading.
    - d. Drainage Control, Soil Moisture Control and Dewatering.
    - e. Subgrade Inspection and Field Quality Control Procedures.
    - f. Storage of Materials.
    - g. Protection and Clean Up.
  - 2. Conform to the City of Alexandria Transportation and Environmental Services Detail CSJT-1, “Joint and Bedding for Pipe and Trench Sections”.
  - 3. Conform to all applicable OSHA regulations as described in the OSHA Technical Manual Section V: Chapter 2.
- B. Excavate trenches and trenches for utilities to indicated gradients, lines, depths, and elevations.
  - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- C. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit.
  - 1. Clearance: As indicated.
- D. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
  - 1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
  - 2. For pipes and conduit 6 inches or larger in nominal diameter, excavate trenches 6 inches deeper than elevation required to allow for bedding course.
  - 3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
- E. Trenches in Tree- and Plant-Protection Zones:

1. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
2. Cut and protect roots according to requirements in Section 015639 Temporary Tree and Plant Protection.

### 3.2 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill voids with satisfactory soil while removing shoring and bracing.
- D. Initial Backfill:
  1. Place and compact initial backfill of Bedding Material to:
    - a. 12 inches over Sanitary Sewer pipe or conduit.
    - b. The center line of Storm Sewer pipe or conduit.
  2. Coordinate backfilling with utilities testing.
- E. Final Backfill:
  1. Place and compact final backfill of Satisfactory Soil to final subgrade elevation. When directed by the COTR, Select Fill must be used.
- F. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### 3.3 COMPACTION OF SOIL BACKFILLS AND FILLS FOR CONDUIT

- A. Place and compact initial and final backfill materials in layers not more than 6 inches layers.
  1. Pipe bedding material shall be compacted at 85 percent of the maximum dry unit weight according to ASTM D1557
  2. Final Backfill must be compacted to 95 the maximum dry unit weight according to ASTM D1557
- B. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit.

## PART 4 - MEASUREMENT AND PAYMENT

- A. Trenching will not be measured, and payment will be incidental to price bid for the pipe or conduit installed.
- B. Select Fill, when ordered by the COTR, shall be measured, and paid for according to Section 312000 Earth Moving.

END OF SECTION 0312333

## SECTION 315000 - SLOPE PROTECTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications).
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).
- D. Excavation Support and Protection must conform to the Occupational Safety and Health Administration (OSHA) Technical Manual Section V: Chapter 2 Excavations: Hazard Recognition in Trenching and Shoring, latest edition.

#### 1.2 SUMMARY

- A. Section includes temporary excavation support and protection systems.
- B. Related Requirements:
  - 1. Section 020113 Maintenance of Utilities for support and protection of utilities.
  - 2. Section 312000 Earth Moving for execution of excavation, backfill procedures, and compaction standards for structural stability.

#### 1.3 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: At the request of the City or when required to sufficiently review the installation, removal, or abandonment the excavation support system, conduct a conference at Project Site.

#### 1.4 ACTION SUBMITTALS

- A. Delegated-Design Submittal: For excavation support and protection systems, including analysis data signed and sealed by the qualified professional engineer licensed in the Commonwealth of Virginia responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer licensed in the Commonwealth of Virginia responsible for their preparation.
- B. 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.

1.6 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.

1.7 FIELD CONDITIONS

- A. Survey Work: Engage a qualified land surveyor or professional engineer licensed in the Commonwealth of Virginia 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.

1.8 PRODUCTS

PART 2 - PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 Quality Requirements, licensed in the Commonwealth of Virginia 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 OSHA Technical Manual Section V: Chapter 2 Excavations: Hazard Recognition in Trenching and Shoring
  - 3. Compliance with AASHTO Standard Specification for Highway Bridges or AASHTO LRFD Bridge Design Specification, Customary U.S. Units.
  - 4. Compliance with requirements of authorities having jurisdiction.
  - 5. Compliance with utility company requirements.
  - 6. Compliance with railroad requirements.

PART 3 - EXECUTION

3.1 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. Damage to facilities not shown as impacted in the Contract Documents shall be restored to their original condition, at no additional cost to the City.
  - 1. Shore, support, and protect utilities encountered. Refer to Section 020113 Maintenance of Utilities.

### 3.2 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 City 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. Damage to facilities not shown as impacted in the Contract Documents shall be restored to their original condition, at no additional cost to the City.

### 3.3 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.
- 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 Contract Drawings and secure to soldier piles.

### 3.4 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.
  - 2. Accurately align exposed faces of sheet piling.

- C. Cut tops of sheet piling to uniform elevation at top of excavation.

### 3.5 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 City.
  - 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.

### 3.6 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.

### 3.7 FIELD QUALITY CONTROL

- A. Survey-Work Benchmarks: Resurvey benchmarks 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 COTR 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. Damage repairs shall be done at no additional cost to the City.

### 3.8 INSECTIONS

- A. Refer to OSHA Technical Manual Section V: Chapter 2 Excavations: Hazard Recognition in Trenching and Shoring, Section J, Inspections
- B. At a minimum, inspections by a qualified professional must be performed at the following frequency:
  - 1. Daily and before the start of each shift.



2. As dictated by the work being done in the trench or excavation.
  3. After every rainstorm.
  4. After other events that could increase hazards, e.g., snowstorm, windstorm, thaw, earthquake, etc.
  5. When fissures, tension cracks, sloughing, undercutting, water seepage, bulging at the bottom, or other similar conditions occur.
  6. When there is a change in the size, location, or placement of the spoil pile.
- C. When there is any indication of change or movement in adjacent structures.
1. Failure of the excavation and associated remedial work shall be the sole responsibility of the Contractor, regardless of the Contractor's diligence with respect to inspections.

### 3.9 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 24 inches below overlying construction, and abandon remainder.
  3. Fill voids immediately with approved backfill compacted to density specified in Section 312000 Earth Moving.
  4. Repair or replace, as approved by COTR, adjacent work damaged or displaced by removing excavation support and protection systems.

### PART 4 - MEASUREMENT AND PAYMENT

- A. Payment for all items shall include full compensation for all labor, materials, equipment, and incidentals necessary to complete the work.
1. Slope Protection will not be measured and will be incidental to the price bid for Section 312000 Earth Moving. Payment shall include full compensation for design and certification of the excavation support and protection system.

END OF SECTION 315000

## SECTION 321216 - ASPHALT PAVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 201 – Mineral Filler, Section 202 – Fine Aggregate, Section 203 – Coarse Aggregate, Section 210 – Asphalt Materials, Section 211 - Asphalt Concrete, Section 308 – Subbase Course, Section 315 - Asphalt Concrete Placement, and Section 515 – Planing or Milling Pavement.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Hot-mix asphalt paving.
  - 2. Hot-mix asphalt overlay.
  - 3. Cold milling of existing asphalt pavement.
  - 4. Hot-mix asphalt patching.
  - 5. Asphalt traffic-calming devices.
  - 6. Asphalt surface treatments.
- B. Related Requirements:
  - 1. Section 024119 Selective Demolition for demolition and removal of existing asphalt pavement.
  - 2. Section 312000 Earth Moving for execution of excavation, backfill procedures, and compaction standards for structural stability.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

- a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
- b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: Include technical data and tested physical and performance properties.
- B. Hot-Mix Asphalt Designs:
  1. Certification: The Contractor must secure the COTR's approval of the job mix formula for each type of asphalt concrete in the contract prior to being used.
  2. For each hot-mix asphalt design proposed for the Work.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For paving-mix manufacturer and testing agency.
- B. Material Certificates: Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.
  1. Aggregates.
  2. Asphalt binder.
  3. Asphalt cement.
  4. Cutback prime coat.
  5. Emulsified asphalt prime coat.
  6. Tack coat.
  7. Fog seal.
  8. Undersealing asphalt.
- C. Field quality-control reports.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: VDOT REGISTERD AND APPROVED.
- B. Testing Agency Qualifications: Qualified in accordance with ASTM D3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of VDOT for asphalt paving work.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Per VDOT Specification Section 315.04—Placement Limitations.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. Coarse Aggregate shall conform to the requirements of VDOT Specification Section 211.02.
- B. Fine Aggregate shall conform to the requirements of VDOT Specification Section 211.02.
- C. Mineral Filler shall conform to the requirements of VDOT Specification Section 211.02.
- D. Aggregate for asphalt concrete shall conform to the requirements of VDOT Specification Section 211.02.

2.2 ASPHALT MATERIALS

- A. Asphalt materials shall conform to the requirements of Section 210 and Section 211 of VDOT Specification.

2.3 AUXILIARY MATERIALS

- A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement, reclaimed, unbound-aggregate base material, and recycled asphalt shingles shall be per VDOT Specification.
- B. Joint Sealant shall conform to the requirements of VDOT Specification.

2.4 MIXES

- A. Recycled Content of Hot-Mix Asphalt: Per VDOT Section 211.
- B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes per VDOT Section 211.

PART 3 - EXECUTION

3.1 ASPHALT CONCRETE PLACEMENT

- A. Per VDOT Specification Section 315 - Asphalt Concrete Placement.

3.2 COLD MILLING

- A. Per VDOT Specification Section 515 – Planing or Milling Pavement.

PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specifications Section 308 – Subbase Course, Section 315 - Asphalt Concrete Placement, and Section 515 – Planing or Milling Pavement, for Measurement and Payment.

END OF SECTION 321216

## SECTION 321723 - PAVEMENT MARKINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 704 – Pavement Markings and Markers.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Painted markings applied to asphalt concrete and concrete paving.
- B. Related Requirements:
  - 1. Section 024113 Paving Removal for the demolition and removal of pavement.
  - 2. Section 321216 Asphalt Paving for asphalt paving and patching existing pavement.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: Include technical data and tested physical and performance properties.
  - 1. Pavement-marking paint, alkyd.
  - 2. Red Methyl Methacrylate (MMA) pavement marking paint.
  - 3. Glass beads.
- B. Shop Drawings:
  - 1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
  - 2. Indicate, with international symbol of accessibility, parking spaces allocated for people with disabilities.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of VDOT Materials Approved Lists for pavement-marking work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40° F for alkyd materials, 55° F for water-based materials, and not exceeding 95° F.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in VDOT.

#### 2.3 PRODUCT

- A. White and yellow pavement marking materials shall be per VDOT Specification Section 246.02.
- B. Thermoplastic pavement marking materials shall be per VDOT Specification Section 246.02.
- C. Construction pavement marking materials shall be per VDOT Specification Section 246.02.
- D. Red Methyl Methacrylate (MMA) pavement marking material shall be approved by COTR.
- E. Glass Beads: AASHTO M 247, Type 1.
- F. Approval of pavement markings shall be per VDOT Specification section 246.02 (a).

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

#### 3.2 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with COTR.
- B. Allow asphalt paving or concrete surfaces to age for a minimum of 7 days before starting pavement marking.

- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
  - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
  - 2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.
- E. Red MMA pavement markings shall be applied per the manufacture recommendations. Any deviations in application shall be approved in writing by the COTR.

### 3.3 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

### PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 704 – Pavement Markings and Markers, for Measurement and Payment.
- B. Red Methyl Methacrylate (MMA) pavement markings shall be measured and paid for at the contract unit price per square foot. This price shall include surface preparation, premarking, furnishing, installing, quality control tests, daily log, guarding devices, primer/adhesive, glass beads, reflective optics (when required) and warranty. The cost shall include all labor, equipment, material, tools and incidentals necessary to complete the work.

END OF SECTION 321723



## SECTION 321726 - TACTILE WARNING SURFACE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Specification Section 504 – Sidewalks, Steps and Handrails.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).
- D. U.S. Access Board, Public Right-of-Way Accessibility Guidelines.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Cast-in-place detectable warning tiles at platform edge, curb ramps, and median cut-throughs.
- B. Related Requirements:
  - 1. Section 033000 Cast-in-Place Concrete for concrete materials, reinforcement, mixture design, and placement.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for each type of exposed finish requiring color selection and for the specified tile.
- C. Shop Drawings: Submit Manufacturer Shop Drawings showing all pertinent characteristics of the tactile warning surface unit including profile, sound on cane contact amplification feature, and installation methods.
- D. Material Test Reports: Submit current test reports from qualified independent testing laboratory in accordance with ASTM guidelines and indicating that materials proposed for use are in compliance with specification requirements and meet the properties indicated. All test reports submitted shall be representative of the tactile warning surface product delivered to the Project and shall be no more than one (1) year old from the time of the submittal.
- E. Submit full color selection options for manufacturer's epoxy grout recommendation for selection by the COTR.
- F. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile edge tile and accessory as required.

## PART 2 - PRODUCTS

### 2.1 TACTILE WARNING SURFACING

- A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural and Transportation Barriers Compliance Board's Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG) for tactile warning surfaces.
  - 1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.
- B. American Society for Testing and Materials (ASTM) Test Methods B117, C1028, D543, D570, D638, D695, D790, D1308, GI51, GI55, and E84.

### 2.2 DETECTABLE WARNING TILES

- A. Cast-in Place Detectable Warning Tiles: Accessible detectable warning tiles shall be manufactured using a matte finish exterior grade homogeneous (uniform throughout thickness of product) glass and carbon reinforced polyester based SMC composite material. Truncated domes must contain fiberglass reinforcement within the truncated dome for superior structural integrity and impact resistance. A matte finish will be required on the tactile warning surface for slip resistance performance superior to that offered by a gloss finish. Use of tactile warning surface products employing coatings or featuring layers of material with differing composition, performance, or color properties is expressly prohibited. Tiles shall be configured for setting flush in new concrete platform surfaces.
  - 1. Material: Molded glass- and carbon-fiber-reinforced polyester.
  - 2. Color:
    - a. Typical Warning Tile: Yellow – Federal Color No. 33538
    - b. Accent Warning Tile (ADA Boarding Edge): Black – Federal Color No. 37038
  - 3. Shapes and Sizes: Rectangular panel, 24 by 36 inches.
  - 4. Dome Size and Configuration: Square grid pattern of raised truncated domes of 0.2 inches nominal height, base diameter of 1 inches, and top diameter of 0.5 inches. Truncated domes shall have a center-to-center (horizontally and vertically) spacing of 2.35 inches, measures between the most adjacent domes on square grid.
  - 5. Mounting: Permanently embedded detectable warning tile wet-set into freshly poured concrete.
  - 6. Cleaning Materials: All cleaning materials used on site shall have code acceptable low VOC solvent content and low flammability.
    - a. On completion of placement tile, clean all surfaces so they are free of foreign matter.

- b. Remove epoxy grout residue from tile as soon as possible.
- c. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned.

## 2.3 ACCESSORIES

- A. Epoxy Grout: Epoxy grout shall be water cleanable conforming to ANSI A118.3 standards as recommended by tile manufacturer.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF TACTILE WARNING SURFACING

- A. General: Rough structural concrete and prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.
- B. Place tactile warning surfacing units in dimensions and orientation indicated on Contract Drawings.
- C. Comply with location requirements of AASHTO MP 12.
- D. Cast-in-Place Detectable Warning Tiles: Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedment in wet concrete by tamping or vibrating.
- E. Set surface of tile flush with surrounding concrete and adjacent tiles. Remove concrete from tile finish surfaces and clean using methods recommended in writing by manufacturer.
- F. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint unless otherwise approved by the COTR. Replace using tactile warning surfacing installation methods acceptable to the COTR.
- G. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

## PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 504 – Sidewalks, Steps and Handrails, for Measurement and Payment of detectable warning tiles at platform edge, curb ramps, and median cut-throughs.

END OF SECTION 321726

SECTION 328400 – PLANTING IRRIGATION

Placeholder – Reserved for future use, as needed.

## SECTION 329113 – SOIL PREPARATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 602 – Topsoil.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### SUMMARY

- D. Section includes:
  - 1. Planting soils specified by composition of the mixes.
- E. Related Requirements:
  - 1. Section 311000 Site Clearing for site clearing and removal of above- and below-grade site improvements.
  - 2. Section 329200 Turf and Grasses for placing planting soil for turf and grasses.
  - 3. Section 329300 Plants for placing planting soil for plantings.

#### 1.2 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. **Manufactured Soil:** Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.
- H. **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.
- I. **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."
- J. **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.
- K. **RCRA Metals:** Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- L. **SSSA:** Soil Science Society of America.
- M. **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.
- N. **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.
- O. **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.
- P. **USCC:** U.S. Composting Council.

### 1.3 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 and 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 SU1P #25.

- c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

#### 1.4 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 City under the direction of the testing agency.
  - 1. Number and Location of Samples: Minimum of three 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 City 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.

#### 1.5 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

#### 2.1 PLANTING SOILS SPECIFIED BY COMPOSITION

- A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.

- B. Planting-Soil Type A: Existing, on-site surface soil, with the duff layer, if any, retained; and stockpiled on-site; modified to produce viable planting soil. Blend existing, on-site surface soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
1. Ratio of Loose Compost to Soil: 1:3 by volume.
  2. Ratio of Loose Muck Peat to Soil: by volume.
  3. Ratio of Loose Wood Derivatives Soil: by volume.
  4. Weight of Lime: per 1000 sq. ft. per 6 inches of soil depth.
  5. Weight of Iron Sulfate: per 1000 sq. ft. per 6 inches of soil depth.
  6. Weight of Agricultural Gypsum: per 1000 sq. ft. per 6 inches of soil depth.
  7. Weight of Superphosphate: 20% or as recommended.
  8. Weight of Commercial Fertilizer: Recommended weight per 1000 sq. ft.
  9. Weight of Slow-Release Fertilizer: As recommended per 1000 sq. ft.
  10. Bulk Density maximum 1.4 grams/cubic centimeter (g/cc) for topsoil and 1.6 g/cc for subsoil.
  11. The minimum soil sample depth required for bulk density testing is twelve (12) inches.
  12. Testing is to be performed no more than four (4) weeks prior to plant installation. 3. For the purposes of bulk density, topsoil is considered to extend to a depth of fourteen (14) inches.
  13. For the purposes of bulk density, topsoil is considered to extend to a depth of fourteen (14) inches.
- C. Planting-Soil Type B: Imported, naturally formed soil from off-site sources and consisting of sandy loam or sandy loam soil according to USDA textures; and modified to produce viable planting soil.
1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from 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 brome grass.
  2. Additional Properties of Imported Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 6 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
  3. Unacceptable Properties: Clean soil 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 3 inches in any dimension.
4. Amended Soil Composition: Blend imported, unamended soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
  5. Ratio of Loose Compost to Soil: 1:3 by volume.
  6. Ratio of Loose Sphagnum Peat to Soil: 1:1 by volume.
  7. Ratio of Loose Wood Derivatives to Soil: As recommended or approved by the City
  8. Weight of Lime: As recommended or approved by the lab results or City.
  9. Weight of Iron Sulfate: As recommended or approved by the lab results or City.
  10. Weight of Agricultural Gypsum: As recommended or approved by the lab results or City.
  11. Weight of Superphosphate: As recommended or approved by the lab results or City.
  12. Weight of Commercial Fertilizer: As recommended or approved by the lab results or City
  13. Weight of Slow-Release Fertilizer: As recommended or approved by the lab results or City.
  14. Bulk Density maximum 1.4 grams/cubic centimeter (g/cc) for topsoil and 1.6 g/cc for subsoil.
  15. The minimum soil sample depth required for bulk density testing is twelve (12) inches.
  16. Testing is to be performed no more than four (4) weeks prior to plant installation. 3. For the purposes of bulk density, topsoil is considered to extend to a depth of fourteen (14) inches.
  17. For the purposes of bulk density, topsoil is considered to extend to a depth of fourteen (14) inches.

## 2.2 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content less than or equal to 30 percent by weight; 98 percent passing through 1-inch sieve;

soluble salt content of less than 5 deciSiemens/m (dS/m); not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

- B. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials
- C. Organic matter shall constitute a minimum of five (5) percent of soil volume.

## 2.3 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
  - B. Class: T, with a minimum of 99 percent passing through No.8 sieve and a minimum of 75 percent passing through No.60 sieve.
  - C. Class: O, with a minimum of 95 percent passing through No.8 sieve and a minimum of 55 percent passing through No.60 sieve.
- D. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No.6 sieve and a maximum of 10 percent passing through No. 40 sieve.
- E. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- F. Aluminum Sulfate: Commercial grade, unadulterated.
- G. Perlite: Horticultural perlite, soil amendment grade.
- H. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.
- I. Sand: Clean, washed, natural or manufactured, and free of toxic materials.
- J. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- K. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Place planting soil and fertilizers according to requirements in other Specification Sections.
- 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.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

- A. Unacceptable Materials: Clean soil of 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: Clean soil to contain a maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.
- C. Screening: Pass unamended soil through a 3-inch sieve to remove large materials.

3.3 APPLYING COMPOST TO SURFACE OF PLANTING SOIL

- A. Application: Apply compost component of planting-soil mix 4 inches of compost to surface of in-place planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Finish Grading: Grade surface to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 PROTECTION

- A. Protection Zone: Identify protection zones according to Section 015639 Temporary Tree and Plant Protection.
- B. 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.
- C. If planting soil or subgrade is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by COTR and replace contaminated planting soil with new planting soil.

3.5 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 City's property unless otherwise indicated.
  - 1. Dispose of excess subsoil and unsuitable materials on-site, where directed by City.

PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 602 – Topsoil, for Measurement and Payment.

END OF SECTION 329113

PART 1 - SECTION 329200 - TURF AND GRASSES

1.1 GENERAL

A. RELATED DOCUMENTS

- B. Contract Drawings and general provisions of the Contract.
- C. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 603 – Seeding, Section 604 – Sodding, and Section 607 – Herbicide Spraying.
- D. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).
- E. City of Alexandria Landscape Guidelines (February 2019).
- F. AOSA Rules for Testing Seeds (October 2023).
- G. TPI's Guideline Specifications to Turfgrass Sodding.

1.2 SUMMARY

A. Section Includes:

- 1. Seeding.
- 2. Hydroseeding.
- 3. Sodding.
- 4. Mulching.
- 5. Plugging.
- 6. Sprigging.
- 7. Meadow grasses and wildflowers.
- 8. Turf renovation.
- 9. Erosion-control materials.
- 10. Grass-paving materials.

B. Related Requirements:

- 1. Section 329113 Soil Preparation for soil composition of mixes and turf area preparation.
- 2. Section 329300 Plants for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

### 1.3 DEFINITIONS

- A. AOSA: Association Official Seed Analysts
- B. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- C. Finish Grade: Elevation of finished surface of planting soil.
- D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- E. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- F. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- G. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 Soil Preparation, City of Alexandria Landscape Guidelines (February 2019), or latest revision and Contract Drawings designations for planting soils.
- H. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- I. 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.
- J. 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.

### 1.4 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.
  - 1. Certification of each seed mixture for turfgrass sod plugs. Include identification of source and name and telephone number of supplier.
- B. Product Certificates: For fertilizers, from manufacturer.
- C. Material Test Reports.
- D. Installer Qualifications.

- E. Product Data, including application rates.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Warranty Information.

#### 1.6 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress. Supervisor must have 3 years of experience and successful installing jobs of commensurate scale and scope.

- 1. Pesticide Applicator: City Approved, State licensed, commercial.

- B. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.

- 1. Contractor to obtain representative soil samples and submit to soil laboratory for analysis.
  - 2. Report suitability of tested soil for turf growth.
    - a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable turf.
    - b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.
    - c. A pH range appropriate to the plant species proposed, based on a site soil sample.
  - 3. Bulk Density maximum 1.4 grams/cubic centimeter (g/cc) for topsoil and 1.6 g/cc for subsoil.
  - 4. The minimum soil sample depth required for bulk density testing is twelve (12) inches.
  - 5. Testing is to be performed no more than four (4) weeks prior to plant installation.
  - 6. For the purposes of bulk density, topsoil is considered to extend to a depth of fourteen (14) inches.
  - 7. Organic matter shall constitute a minimum of five (5) percent of soil volume.

#### 1.7 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 compliance 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"

sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. 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.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.8 FIELD CONDITIONS

A. Planting Restrictions: Refer to City of Alexandria Landscape Guidelines for planting seasons and restrictions. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. Turfgrass:
  - a. Install/plant between March 1 and May 15 and/or September 15 and October 15.
  - b. Do not install/plant seed or sod turfgrass areas when ambient air temperature is below forty (40) degrees Fahrenheit or is forecast for a twelve (12) hour period after completion of work.
2. Do not install plantings or turfgrasses between June 15 and September 15, or November 15 and March 1, without prior written approval by the City.
3. Exceptions will be evaluated based on the following criteria:
  - a. Type of plants to be installed outside of the planting installation seasons.

B. Proposed maintenance plan, including extra measures to ensure the health of the plantings. 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.

1.9 WARRANTY

A. Special Warranty: Contractor 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, lack of adequate maintenance by the Contractor, except for defects resulting from incidents that are beyond Contractor's control.



2. Warranty Periods from Date of Planting Completion:

- a. Seeded Turf: 12 months, or completion of a single growing season, whichever is greater.
- b. Sodded Turf: 12 months, or completion of a single growing season, whichever is greater.

1.10 MAINTENANCE SERVICE

A. Initial Turf 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 turf is established but for not less than the following periods:

1. Seeded Turf: From date of installation to end of Warranty Period.
2. Sodded Turf: From date of installation to end of Warranty Period.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

1. Procure from new of the year seed crops, free of foreign material or weed seeds.
2. Replacement or overseeding mixes shall match or complement original installation.
3. Provide continuous uniform and consistent coverage.
4. Shall be 'blue tag' certified by the Virginia Crop Improvement Association (VCIA) to be free of noxious weeds, non-turfgrass plants, unspecified growth, and soil borne insects and disease.
5. Shall be listed on the current Virginia Turfgrass Variety Recommendations from the Virginia Cooperative Extension or the Maryland Recommended Turfgrass Varieties.

B. Seed Species:

1. Quality, Non-State Certified: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
2. Full Sun, Warm-Season Grass: Bermudagrass (*Cynodon dactylon*).
3. Full Sun, Cool-Season Grass: Kentucky bluegrass (*Poa pratensis*), a minimum of three cultivars.
4. Sun and Partial Shade, Cool-Season Grass: Proportioned by weight as follows:

- a. 80-95% Certified Tall Fescue
- b. 5-10% Certified Kentucky Bluegrass
- c. 0-10% Certified Perennial Ryegrass \*

\*Note: The routine inclusion of perennial ryegrass is not recommended but may be added to the mixture when the seeding site is at high risk for soil erosion or when cool temperatures may hinder establishment of tall fescue and Kentucky bluegrass. One cultivar of tall fescue and one cultivar of Kentucky bluegrass may be used, but the inclusion of two or more tall fescue cultivars is recommended. The seeding rate of this mixture shall be 5.0 to 7.0 lbs. per 1000 Sq. Ft

5. Shade, Cool-Season Grass: Proportioned by weight as follows:

- a. 50 percent chewings red fescue (*Festuca rubra* variety).
- b. 35 percent rough bluegrass (*Poa trivialis*).
- c. 15 percent redtop (*Agrostis alba*).

C. Grass-Seed Mix: Proprietary seed mix as follows:

- 1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work.

2.2 TURFGRASS SOD

A. Turfgrass Sod: Certified. Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod of grass species as follows:

- 1. To be determined by the City of Alexandria Parks and Recreation Field Coordinator.

C. Sod:

- 1. Of a uniform non-varying density and continuous texture quality capable of growth and development immediately upon installation.
- 2. Specified from varieties listed on the current Virginia Turfgrass Variety Recommendations from the Virginia Cooperative Extension or University of Maryland Recommended Turfgrass Varieties

2.3 SPRIGS

A. Sod Sprigs: Healthy living stems, rhizomes, or stolons with a minimum of two nodes and attached roots free of soil, of the following turfgrass species:

- 1. Turfgrass Species, Warm-Season Grass: Carpetgrass (*Axonopus affinis*).

2. Turfgrass Species, Cool-Season Grass: Creeping bentgrass (*Agrostis palustris*).

## 2.4 FERTILIZERS

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. 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: Application rates must be determined by required soil tests.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
- E. No fertilizers shall be used within an RPA/near waterbodies.

## 2.5 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.
- C. Non-asphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

## 2.6 GRASS-PAVING MATERIALS

- A. Grass Paving: Cellular, nonbiodegradable plastic mats, designed to contain small areas of soil and enhance the ability of turf to support vehicular and pedestrian traffic, of 1-3/4-inch to 2-inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.
- B. Soil for Paving Fill: Planting soil

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

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. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  3. Uniformly moisten excessively dry soil that is not workable, or which is dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. 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 COTR and replace with new planting soil.

### 3.2 PREPARATION

- A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
1. Protect adjacent and adjoining areas from hydroseeding and hydro mulching overspray.
  2. 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.

### 3.3 TURF AREA PREPARATION

- A. Preparation:
1. Soil: see Section 319113 Soil Preparation.
  2. Harrow, disc, or otherwise loosen subsoil to depth of 4 inches
  3. Turf and groundcover Areas: One (1) foot minimum of continuous vertical depth of planting media.
  4. Spread topsoil evenly over prepared subsoil to following depths.
  5. Topsoil:
    - a. Slopes 3:1 or steeper: 4 inches after compaction.
    - b. Slopes flatter than 3:1: 4 inches after compaction.
  6. Where existing topsoil does not meet these requirements, provide required topsoil to meet above minimum thicknesses.
  7. Remove and dispose of objectionable material such as stones 2 inches or larger, clods, brush, roots, and trash from top 4 inches of soil.

8. Perform harrowing, discing, scarifying, and raking on contour of slopes steeper than 3:1.

B. Amendments:

1. Apply lime and fertilizer at rates determined by soil tests as specified in PART 2, PRODUCTS, and thoroughly mix into top 4 inches.
  - a. Scarify area and rake until surface is leveled to give a maximum of 2 inches in variation, and soil is easily crumbled and uniform fine texture.

C. Seed Application:

1. Apply mixture uniformly with mechanical power-driven seeders, mechanical cyclone hand seeders or hydroseeding equipment.
2. Slurry for hydroseeder may contain seed, tackifier, and fertilizer only.
3. Rake seed 1-inch into soil in floodplain areas.
4. Rake, roll, or drag seedbed in all other areas, if hydroseeder or cyclone seeder is used. Moisten seedbed during periods of drought and/or high temperatures.

D. Mulch Application:

1. Apply at rates specified by the City of Alexandria Parks and Recreation Field Coordinator.
2. Anchor as specified by the City of Alexandria Parks and Recreation Field Coordinator.
3. Apply Excelsior blanket and anchor per manufacturer's specification on all slopes 3:1 or steeper.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in Section 3.3 Turf Area Preparation.
- B. 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.
- C. Fill cells of erosion-control mat with planting soil and compact before planting.
- D. 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.
- E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
  - 1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
  - 2. Do not use wet seed or seed that is moldy or otherwise damaged.
  - 3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of 3 to 4 lb/1000 sq. ft.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes exceeding 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.
- E. Protect seeded areas with erosion-control mats where indicated on Contract Drawings; install and anchor according to manufacturer's written instructions.
- F. Protect seeded areas from hot, dry weather or drying winds by applying within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 4 inches, and roll surface smooth.
- G. Maintain seeded and sodded areas until accepted in writing by the City.
  - 1. Water seeded and sodded areas as necessary to establish growth.
- H. Inspect seeded and sodded areas for failures and necessary repairs.
- I. Provide replacements during specified planting seasons.
- J. Turf installations must meet the following criteria as determined by the City:
  - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
  - 2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- K. When the City determines stand of turf is inadequate: Overseed and fertilize using 1/2 of rates originally applied. Resod.
- L. When the City determines stand is over 60 percent damaged: Reestablish following original lime, fertilizer, and seed. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

### 3.6 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, commercial fertilizer slow-release fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
  - 1. Mix slurry with non-asphaltic tackifier.
  - 2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

### 3.7 SODDING

- A. Preparation:
  - 1. Harrow, disc, or otherwise loosen subsoil to depth of 4 inches.
  - 2. Harrow, disc, scarify, and rake on contour of slopes steeper than 3:1.
  - 3. Remove objectionable material such as stones, clods, brush, roots, and trash from top 4 inches of sub-soil.
- B. Amendments:
  - 1. Apply lime and fertilizer at application rates determined by required soil tests, and thoroughly mix into loosened subsoil.
  - 2. Scarify area and rake until surface is leveled to a maximum of 2 inches in variation, and soil is easily crumbled and uniform fine texture.
- C. Sodding:
  - 1. Lay between September 1 - November 30 and/or March 1 – May 15.
  - 2. Deliver to site within 24 hours, and install within 36 hours, after cutting.
  - 3. During wet weather, dry sod sufficiently to prevent tearing during handling and placing.
    - a. During dry weather, water sod sufficiently before lifting to insure its vitality and to prevent dropping off of soil during handling.
  - 4. Desiccated sod will be rejected and replaced at no cost to the City.
  - 5. Place sod in straight lines parallel to one another.
    - a. Stagger lateral joints and butt tight.
    - b. On slopes 5:1 and steeper place sod with long edges parallel to contour starting at top of slope.
    - c. In drainage ditches and sodded channels, place sod with long edge parallel to flow of water.

6. On slopes 2:1 and steeper and in surface drainage V-shaped or flat-bottomed ditches, stake each strip of sod with at least 2 biodegradable stakes, spaced not more than 2 feet apart, or wire staples.
  7. Immediately after completing section of sodding, roll, tamp, and water until underside of sod pad and soil surface beneath it are thoroughly wet and in contact with each other to eliminate air pockets.
  8. Completion of placing, rolling, tamping, and watering: within 8-hour period.
  9. Moisten dry sod bed during periods of drought or high temperatures.
- D. Lay sod within 36 hours of harvesting unless a suitable preservation method is accepted by COTR prior to delivery time. Do not lay sod if dormant or if ground is frozen or muddy.
- E. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
1. Lay sod across slopes exceeding 1:3.
  2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.
- F. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

### 3.8 SPRIGGING

- A. Plant freshly shredded sod sprigs in furrows 1-1/2 to 2 inches, 2-1/2 to 3 inches deep. Place individual sprigs with roots and portions of stem in moistened soil, 6 inches apart in rows 10 inches to 18 inches apart, and fill furrows without covering growing tips. Lightly roll and firm soil around sprigs after planting.

### 3.9 TURF RENOVATION

- A. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
  2. Install new planting soil as required.
- B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.



- C. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- D. Mow, dethatch, core aerate, and rake existing turf.
- E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off City's property.
- G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.
- H. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.
  - 1. Soil Amendment(s): according to requirements of Section 329113 Soil Preparation (Performance Specification). Apply at application rates determined by required soil tests.
  - 2. Initial Fertilizer: Slow-release fertilizer applied according to manufacturer's recommendations.
- I. Water newly planted areas and keep moist until new turf is established.

3.10 TURF MAINTENANCE

- A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth turf. 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 turf damaged or lost in areas of subsidence.
  - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
  - 3. Apply treatments as required to keep turf 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 turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
  - 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 turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowing. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowing to maintain the following grass height:
  1. Turfgrass specification (sod and seed) shall be of superior specification as approved and certified by the Virginia Department of Agriculture, Virginia Cooperative Extension Service and/or University of Maryland.
  2. Sod:
    - a. Of a uniform non-varying density and continuous texture quality capable of growth and development immediately upon installation.
    - b. Specified from varieties listed on the current Virginia Turfgrass Variety Recommendations from the Virginia Cooperative Extension or University of Maryland Recommended Turfgrass Varieties
  3. Seed:
    - a. Procure from new of the year seed crops, free of foreign material or weed seeds.
    - b. Replacement or overseeding mixes shall match or complement original installation.
    - c. Provide continuous uniform and consistent coverage.
    - d. Shall be 'blue tag' certified by the Virginia Crop Improvement Association (VCIA) to be free of noxious weeds, non-turfgrass plants, unspecified growth, and soil borne insects and disease.
    - e. Shall be listed on the current Virginia Turfgrass Variety Recommendation
  4. Turf Postfertilization: Apply commercial fertilizer after initial mowing and when grass is dry.
    - a. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

### 3.11 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by COTR.
  1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
  3. Satisfactory Plugged Turf: At end of maintenance period, the required number of plugs has been established as well-rooted, viable patches of grass, and areas between plugs are free of weeds and other undesirable vegetation.
  4. Satisfactory Sprigged Turf: At end of maintenance period, the required number of sprigs has been established as well-rooted, viable plants, and areas between sprigs are free of weeds and other undesirable vegetation.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.12 MULCH ONLY

- A. Grade as required.
- B. Place and anchor mulch only at rates specified and where indicated and directed by the City of Alexandria Parks and Recreation Field Coordinator.
- C. Shredded Pine Bark Mulch is recommended.

3.13 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off City's property.
- C. 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.
- D. Remove nondegradable erosion-control measures after grass establishment period.

3.14 TIME RESTRICTIONS

- A. As per City of Alexandria Landscape Guidelines (February 2019), or latest revision.
- B. When permanent seeding or sodding is specified or directed and is not allowed because of time restrictions specified in City of Alexandria Landscape Guidelines (February 2019), or latest revision, utilize one or more of following methods to prevent erosion and sedimentation until permanent seeding or sodding is allowed.
  1. Place and anchor straw mulch.
  2. Apply temporary seeding and mulch.

3. Prepare soil as for permanent seeding and then mulch as specified herein; overseed during next seasonal seeding period.
4. Provide other erosion control measures acceptable to the City.
5. Remove straw or wood chips used as temporary mulch or work into subsoil minimum depth of inches before initiation of permanent seeding or sodding application.

PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 603 – Seeding, Section 604 – Sodding, and Section 607 – Herbicide Spraying, for Measurement and Payment.

END OF SECTION 329200

## SECTION 329300 - PLANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications) Section 605 – Planting and Section 607 – Herbicide Spraying.
- C. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).
- D. City of Alexandria Landscape Guidelines (February 2019), or latest revision.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Plants.
- B. Related Requirements:
  - 1. Section 015000 Temporary Facilities and Controls for erosion control.
  - 2. Section 312000 Earth Moving for execution of excavation, backfill procedures, and compaction standards for structural stability.
  - 3. Section 329200 Turf and Grasses for turf (lawn) and hydroseeding.
  - 4. The American Standard for Nursery Stock ANSI Z60.1.

#### 1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. 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.
- C. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- D. Finish Grade: Elevation of finished surface of planting soil.

- E. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- F. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.
- G. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- H. 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.
- I. Planting Area: Areas to be planted.
- J. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 Soil Preparation for drawing designations for planting soils, City of Alexandria Landscape Guidelines (February 2019), or latest revision and Contract Drawings designations for planting soils.
- K. 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.
- L. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
- M. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

#### 1.4 COORDINATION

- A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
  - 1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
  - 2. Plant Photographs: Include color photographs clearly labeled with genus, species, and common name submitted in 8.5" x 11" document 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 three 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.

1.6 INFORMATIONAL SUBMITTALS

- A. 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.
- B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Submit a warranty letter for products.

1.8 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress. Supervisor must have 3 years of experience and successful installing jobs of commensurate scale and scope.
- B. Pesticide Applicator: City Approved, State licensed, commercial.
- C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
  - 1. Contractor to obtain representative soil samples and submit to soil laboratory for analysis.
  - 2. Report suitability of tested soil for plant growth.
    - a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    - b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.
    - c. Ph must be between 6.0 and 7.5.
- D. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- E. Pre-installation Conference: Conduct conference at Project site.

- F. Coordinate with the City for plant inspection prior to unloading plant material on site. The City reserves the right to inspect and reject unsatisfactory or defective material at any time during process of work.

1.9 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 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. Accompany each delivery of bulk materials 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. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
- E. Handle planting stock by root ball.
- F. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.
- G. Apply antidesiccant to trees and shrubs 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.
- H. 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.
- I. 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 less than moist condition in water for two hours. Reject plants with dry roots.
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.

#### 1.10 FIELD 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 periods stated in Part 3 - Execution. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
- 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.

#### 1.11 WARRANTY

- A. Contractor agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period as directed by the City.
  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 incidents that are beyond Contractor's control.
    - b. Structural failures including plantings falling or blowing over.
  2. Warranty Periods from Date of Planting Completion:
    - a. Trees, Shrubs, Vines, and Ornamental Grasses: 24 months, or completion of a single complete growing season, whichever is greater.
    - b. Ground Covers, Biennials, Perennials, and Other Plants: 24 months, or completion of a single complete growing season, whichever is greater.

#### 1.12 MAINTENANCE SERVICE

- A. Initial Maintenance Service: 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 for Trees and Shrubs: From date of installation to end of Warranty Period.
2. Maintenance Period for Ground Cover and Other Plants: From date of installation to end of Warranty Period.

## PART 2 - PRODUCTS

### 2.1 PLANT MATERIAL

- A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Contract 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 are unacceptable.
  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 COTR, 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 each 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.
- E. If formal arrangements or consecutive order of plants is indicated on Contract Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.
- F. Annuals and Biennials: 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 and that are in bud but not yet in bloom.

### 2.2 FERTILIZERS

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. 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: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  - 1. Composition: 10 percent nitrogen, 6 percent phosphorous, and 4 percent potassium, by weight, or as determined by soil analysis.
- E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets must break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots. Planting tables to be Agriform 21-gram 20-10-5 or approved equal.
  - 1. Size: 10-gram tablets.
  - 2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

## 2.3 MULCHES

- A. Organic Mulch: Shredded Pine Bark Mulch
- B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content less than or equal to 30 percent by weight; 98 percent passing through 1-inch sieve; soluble salt content of less than 5 deciSiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.
- C. Mineral Mulch: #1 Washed Stone
  - 1. Size Range: dust to 3/8"
  - 2. Color: White.

## 2.4 MISCELLANEOUS PRODUCTS

- A. Wood Pressure-Preservative Treatment: AWP A U1, Use Category UC4a; acceptable to authorities having jurisdiction, and containing no arsenic or chromium.
- B. Planter Filter Fabric: Woven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.

## 2.5 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.

## PART 3 - EXECUTION

### 3.1 PLANTING SEASONS

- A. As per City of Alexandria Landscape Guidelines (February 2019), or latest revision.
- B. September 1 to June 15, whenever soil is not frozen or excessively wet. Do not plant dogwoods, sweetgum, oaks or conifers between September 15 and March 15.

### 3.2 EXAMINATION

- A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
  - 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. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
  - 3. Suspend planting 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, or which is 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 COTR and replace with new planting soil.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 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.

### 3.4 PLANTING AREA ESTABLISHMENT

- A. Loosen subgrade of planting areas to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off the City's property.
  - 1. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
  - 2. Spread planting soil to a depth of 12 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
  - 3. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

### 3.5 EXCAVATION FOR TREES AND SHRUBS

- A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. 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.
  - 1. Excavate approximately three times as wide as ball diameter.
  - 2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
  - 3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
- B. Unamended subsoil and topsoil removed from excavations may not be used as planting soil.

### 3.6 TREE, SHRUB, AND VINE PLANTING

- A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.
- B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. Set stock plumb and in center of planting pit or trench with root flare 2 inches adjacent finish grades.
  - 1. Use amended planting soil for backfill.
  - 2. Balled and Burlapped: 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.

3. Container-Grown: Carefully remove root ball from container without damaging root ball or plant.
  4. Fabric Bag-Grown Stock: Carefully remove root ball from fabric bag without damaging root ball or plant. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  5. 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.
  6. Place planting tablets or granular fertilizer in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
  7. Continue backfilling process. Water again after placing and tamping final layer of soil.
- D. Bare-Root Stock: Set and support bare-root stock in center of planting pit or trench with root flare 1-inch adjacent finish grade.
1. Use amended planting soil for backfill.
  2. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling and maintain plumb while working backfill around roots and placing layers above roots.
  3. Place planting tablets in each planting pit or granular fertilizer when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside soil-covered roots about 1 inch from root tips; do not place tablets in bottom of the hole or touching the roots.
  4. Continue backfilling process. Water again after placing and tamping final layer of soil.
- E. 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.
- 3.7 TREE, SHRUB, AND VINE PRUNING
- A. Remove only dead, dying, or broken branches. Do not prune for shape.
  - B. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by the City, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
- 3.8 PLACING SOIL IN PLANTERS

- A. Place a layer of drainage gravel at least 4 inches thick in bottom of planter. Cover bottom with filter fabric and wrap filter fabric 4 inches up on all sides. Duct tape along the entire top edge of the filter fabric, to secure the filter fabric against the sides during the soil-filling process.
- B. Fill planter with planting soil. Place soil in lightly compacted layers to an elevation of 1-1/2 inches below top of planter, allowing natural settlement.

### 3.9 GROUND COVER AND PLANT PLANTING

- A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Contract Drawings in even rows with spacing as indicated.
- B. Use planting soil as per standard manual.
- C. 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.
- D. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- E. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

### 3.10 PLANTING AREA MULCHING

- A. Mulch backfilled surfaces of planting areas and other areas indicated.
  - 1. Trees and Tree-like Shrubs in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with 24-inch radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.
  - 2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

### 3.11 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with City's operations and others in proximity to the Work. Notify City before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

### 3.12 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 the City.
  - 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 the City.
- B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that the City determines are incapable of restoring to normal growth pattern or as otherwise directed by the City.
  - 1. Provide new trees of same size as those being replaced for each tree of 6 inches or smaller in caliper size.
  - 2. Provide two new tree(s) of caliper size for each tree being replaced those measures more than 6 inches in caliper size.
  - 3. Species of Replacement Trees: Depending on the circumstance an alternate species could be approved.

### 3.13 CLEANING AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off City's property.
- C. 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.
- D. 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.
- E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

### 3.14 MAINTENANCE SERVICE

- A. Contractor to provide maintenance service for two years from final completion.

### 3.15 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, resetting to proper grades or vertical position, and performing other operations



as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

- B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use practices to minimize the use of pesticides and reduce hazards.
- D. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with the City's operations and others in proximity to the Work. Notify the City before each application is performed.
- E. 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.

#### PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 605 – Planting and Section 607 – Herbicide Spraying, for Measurement and Payment.

END OF SECTION 329300

## SECTION 330500 – COMMON WORK RESULTS FOR UTILITIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.

#### 1.2 SUMMARY

- A. Section Includes:

1. A detection system must be provided with the construction of any new installation or reconfigured underground utility.
2. Any failed existing detection system must be restored as part of the scope of work for repairs to existing underground utilities.
3. The Contractor shall survey and record the actual horizontal alignment and vertical alignment of the utility at intervals not to exceed 20 feet during construction. At the request of the COTR, these records are to be formatted per their specification to include in their database.
4. The Contractor shall survey and record the actual horizontal alignment and vertical alignment of abandoned utilities at intervals not to exceed 100 feet during construction. At the request of the COTR, these records are to be formatted per their specification to include in their database.

- B. Related Requirements

1. Section 260500 Common Work Results for Electrical for furnishing and installing electrical equipment.
2. Section 260543 Underground Conduits for Electrical Systems for electrical conduit, junction boxes, and wiring.
3. Section 265613 Lighting Poles and Standards for permanent lighting along publicly owned and maintained roadways and parking lots.
4. Section 331000 Water Utilities for water main connections and related water works and piping.
5. Section 334200 Stormwater Conveyance for stormwater connections and related piping.

#### 1.3 ACTION SUBMITTALS

- A. Product Data:

1. Tracer detection system products.
- B. Shop drawings:
  1. Tracer detection system design.
- C. Closeout:
  1. Documentation providing detailed as-built records of utility material and horizontal and vertical data to recover the location of the underground utilities.
  2. Documentation providing detailed horizontal and vertical records of abandoned utility data to recover their underground locations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install tracer detection system per approved shop drawings.

3.2 FIELD QUALITY CONTROL

- A. Field Tests and Inspections:
  1. Test tracer detection system after installation and before backfill. Provide results of the test to the COTR.
- B. Non-Conforming Work:
  1. If tracer detection system does not perform as required, Contractor shall repair the system at no cost to the City.

PART 4 - MEASUREMENT AND PAYMENT

- A. Common Work Results for Utilities will not be measured separately.
- B. Common Work Results for Utilities will be considered incidental to the appropriate work items.

END OF SECTION 330500

SECTION 331000 – WATER UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
  - 1. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 203 – Coarse Aggregate and Section 520 – Water and Sanitary Sewer Facilities.
  - 2. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).
  - 3. City of Alexandria Design and Construction Standards, latest edition.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDRPR).
  - 2. ASTM D1784 Rigid Polyvinyl Chloride (PVC) compounds and chlorinated Polyvinyl Chloride (PVC) compounds.
  - 3. ASTM D2241 Polyvinyl Chloride (PVC) plastic pipe (SDR-PR).
  - 4. ASTM D2737 Specifications for Polyethylene (PE) plastic tubing.
  - 5. ASTM D3139 Joints for plastic pressure pipes using flexible elastomeric seals.
  - 6. ASTM D3350 Standard specifications for Polyethylene (PE) plastic pipe and fittings material.
- C. American Water Works Association (AWWA):
  - 1. AWWA C104 Cement-Mortar lining for ductile-iron and gray-iron pipe and fittings for water.
  - 2. AWWA C105 Polyethylene encasement for gray and ductile cast iron piping for water and other liquids.
  - 3. AWWA C110 Gray-Iron and ductile fittings, 3" through 48" for water and other liquids.
  - 4. AWWA C111 Rubber-Gasket joints for ductile-iron and gray-iron pressure pipe and fittings.
  - 5. AWWA C150 Thickness design of ductile iron pipe.
  - 6. AWWA C151 Ductile-iron Pipe, Centrifugally Cast in metal molds or Sand-lined molds, for water or other liquids.

7. AWWA C153 Ductile-Iron Compact Fittings, 3" through 12" (75MM through 300 MM) for water and other liquids.
8. AWWA C500 Gate valves, 3" through 48", NPS, for water and sewerage systems.
9. AWWA C509 Resilient Seated Gate Valves, 2" through 12", for water and sewerage systems.
10. AWWA C550 Protective interior coatings for valves and hydrants.
11. AWWA C600 Installation of gray and ductile cast iron water mains and appurtenances.
12. AWWA C605 Installation of Polyvinyl Chloride (PVC) pressure pipe and fittings for water.
13. AWWA C651 Disinfecting Water Mains
14. AWWA C900 Polyvinyl Chloride (PVC) pressure pipe, 4" through 12", for water.
15. AWWA C901 Polyethylene (PE) pressure pipe and tubing, 3/4" through 3", for water.
16. AWWA C905 Polyvinyl Chloride (PVC) water transmission pipe, nominal diameter 14" through 36".
17. AWWA C906 Polyethylene (PE) pressure pipe and fittings 4" through 36", for water distribution.

## 1.2 SUMMARY

- A. This section covers water main connections and related water works and piping, as indicated in the Contract Documents and specified herein.
- B. Related Requirements:
  1. Section 033000 Cast-In-Place Concrete for concrete materials, reinforcement mixture design and placement.
  2. Section 312000 Earth Moving for execution of excavation, backfill procedures and compaction standards for structural stability.
  3. Section 312333 Trenching and Backfilling for trench excavation, backfilling, and compaction.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  1. Include pipes, material, and size.
  2. Fittings and Flanges.
  3. Gaskets and joint material.

4. Casing Pipe.
5. Tapping sleeves, valves, and valve boxes.
6. Fire Hydrants.
7. Water Meters.
8. Caps and Plugs.
9. Polyethylene wrap.

#### 1.4 QUALITY ASSURANCE

- A. All pipe, valves, fittings, and accessories shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the material to be furnished.

#### 1.5 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied, unless permitted under the following conditions, and then only after arranging to provide temporary water service according to requirements indicated:
  1. Notify the COTR no fewer than two (2) days in advance of proposed interruption of water service.
  2. Do not proceed with interruption of water service without the COTR's written permission.

### PART 2 - PRODUCTS

#### 2.1 WATER PIPE AND FITTINGS

##### A. Plastic Water Pipe and Fittings (Push-On Joints)

1. Plastic Water Pipe (Push-On Joints):
  - a. Plastic water pipe shall be polyvinyl chloride (PVC) conforming to ASTM D1784 and ASTM D2241, latest revisions, with integral bell push-on gasket joint conforming to ASTM D3139. The requirements for the specific type of plastic pipe to be used shall be as given below unless otherwise noted on the Contract Drawings.

12" PVC - (AWWA C-900) DR 18 Class 150

10" PVC - (AWWA C-900) DR 18 Class 150

8" PVC - (AWWA C-900) DR 18 Class 150

6" PVC - (AWWA C-900) DR 18 Class 150

4" PVC - (AWWA C-900) DR 18 Class 150

- b. The pipe shall have an integral bell, rubber gasket joint and shall be capable of direct tapping.
  - c. The PVC pipe shall be approved by the National Sanitation Foundation (NSF) for potable water pipe and the NSF stamp shall be inclusive on the pipe furnished along with the normal size O.D., pressure class, dimensional ratio, and the manufacturer's name or trademark which may be Certain Teed Corporation, J.M. Corporation, North American, or COTR approved domestic equal.
- 2. Fittings for PVC Pipe:
  - a. Fittings that are 3" in diameter or larger may be either mechanical joint regular body or short body (S.S.B.) fittings, unless otherwise shown on the Contract Drawings.
  - b. Transition fittings for connection to Ductile Iron fittings shall be made of ductile cast iron with pressure rating of 350 PSI, cement lined, and asphalt coated.
  - c. All fittings shall also meet or exceed ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/A21.11 specifications and shall be manufactured by Tyler Pipe or Union Foundry or COTR approved domestic equal.
  - d. Fittings 2" and smaller, unless otherwise shown on the Contract Drawings, shall be PVC (Schedule 40) gasketed fittings manufactured by the Harrington Corporation of Lynchburg, Virginia or COTR approved equal. Ductile cast iron fittings shall be wrapped with an 8-mil thickness black polyethylene wrap.
- B. Polyethylene Plastic Pipe (PE) and Fittings:
  - 1. Polyethylene plastic pipe classification 3408 shall be manufactured to AWWA C901, AWWA C906, ASTM F714, and NSF standards as applicable.
    - a. Fittings for PE pipe shall be polyethylene, butt-fusion type manufactured by the same manufacturer as the pipe and of the same material specification.
    - b. Transition fittings for connection to Ductile Iron fittings shall be ductile iron pipe size adapter kit acceptable to the pipe manufacturer and approved by the COTR.
    - c. Polyethylene Plastic Pipe used for water systems shall be permanently marked with the identifying color blue or with blue stripes.
  - 2.  $\frac{3}{4}$ ", 1", 1- $\frac{1}{2}$ " Polyethylene Plastic Pipe (PE):
    - a. Shall be PE 3408, (CTS), SDR 9 conforming to ASTM D2737 and approved by the National Sanitation Foundation for potable water use and meet AWWA C901 specifications.
    - b. The PE tubing shall be rated for use with water at 73.4° F at a maximum working pressure of 200 psi.

- c. The PE water service tubing shall be Driscopipe 5100 - Ultra Line manufactured by Phillips Driscopipe, Inc., or Plexco Bluestripe as manufactured by Chevron Chemical Company or COTR approved domestic equal.
- 3. 2" thru 3" Polyethylene Plastic Pipe (PE).
  - a. Shall be PE 3408, (IPS), SDR 11 conforming to ASTM D2737 and approved by the National Sanitation Foundation for potable water use and meet AWWA C901 specifications.
- 4. 4" thru 36" Polyethylene Plastic Pipe (PE).
  - a. Shall be PE 3408, (DPS), SDR 11 conforming to ASTM D3350 and approved by the National Sanitation Foundation for potable water use and meet AWWA C906 specifications.
- C. Ductile Iron Pipe and Fittings
  - 1. Pipe:
    - a. Sizes 4" through 24" – Ductile iron pipe shall comply with AWWA C151 (ANSI A21.51), Thickness Class 51 unless otherwise specified.
    - b. Provide pipe interior with a cement mortar lining conforming to AWWA C104 (ANSI A21.4), and exterior of pipe with the manufacturer's standard bituminous coating applied by the airless spray method.
  - 2. Fittings:
    - a. Ductile iron fittings shall have a minimum pressure rating of 150 psi and comply with AWWA C110 or AWWA C153 (ANSI Standard A21.10) cement lined and outside coated as specified above for ductile iron pipe.
    - b. Use fittings with mechanical joints, or manufacturers restrained joints for underground use as indicated, and flanged joints for above ground use.
  - 3. Joints:
    - a. Mechanical Joints:
      - 1) Joints shall comply with AWWA C111 (ANSI A21.11), with bolts and nuts machined true and nuts trapped at right angles to a smooth bearing surface.
      - 2) Use bolts of high strength, annealed cast iron or high strength low alloy steel, T-head type having hexagonal nuts.
      - 3) Bolts and nuts for mechanical joints shall be Cor-Ten T Bolts as manufactured by NSS Industries of Plymouth, Michigan (1-800-221-5125) or COTR approved domestic equal.
    - b. Push on Joints:



- 1) Joints with single seal gasket shall comply with AWWA C111 (ANSI A21.11) and equal to Tyton, Fastite, Super Bell Tite, Altite or COTR approved domestic equal.

c. Restrained Joints:

- 1) The Contractor shall submit a detail, to the COTR, of the type of restrained joints used on a project if other than that specified on the Contract Drawings.
- 2) Restrained joints shall be provided for all water pipe at changes in direction of eleven and one-quarter degrees ( $11\frac{1}{4}^{\circ}$ ) or greater.

d. Gaskets

- 1) Vulcanized crude rubber or polyvinyl chloride plastisol with plain tips unless otherwise specified.

2.2 POLYETHYLENE WRAP

- A. All ductile iron water pipe, valves and fittings shall be installed with 8 mil thick black polyethylene sheeting wrap in accordance with AWWA C105, secured to the pipe by methods approved by the COTR.
- B. Film shall be Class “C” -Black, with a minimum nominal thickness of 0.008 (8 mils).
- C. Tape for securing the film shall be thermoplastic material with a pressure sensitive adhesive face capable of bonding to metal, bituminous coating, and polyethylene.
- D. Tape shall have a minimum thickness of 8 mils, and a minimum width of (1”) one inch.
- E. The polyethylene film envelope shall be free as is commercially possible of gels, streaks, pinholes, particles of foreign matter, and undispersed raw materials.
- F. There shall be no other visible defect such as holes, tears, blisters, or thinning out at folds.
- G. Manufacturers shall furnish a certification of conformance of the material to the requirement of AWWA C105 or ANSI A21.5.
- H. The polywrap shall be as manufactured by Dupont or COTR approved domestic equal.
- I. The tape shall be Scotch Wrap No. 50 or COTR approved domestic equal.

2.3 #10 GAUGE COPPER STRANDED WIRE

- A. #10 gauge stranded copper wire installed over polyethylene and PVC pipe for detection purposes shall be copper wire, Type TW, A.W.G. #10 gauge stranded.

2.4 WIRE SPLICE KITS

- A. Wire splices shall be Direct Bury Splice Kit, ID # 08-6105-9435-2, Part No. 500-54007-496965 as manufactured by 3M Electrical Products Division of Austin, Texas or COTR approved domestic equal.

2.5 VALVE AND VALVE BOXES (UNDERGROUND)

- A. Line valves 3" or larger shall be resilient seated wedge type, iron body, bronze mounted (IBBM), non-rising stem with "O" ring stem seals, open left with 2" square operating nut and with mechanical joint ends unless otherwise noted in the Contract Drawings.
- B. All gate valves shall comply with the latest revision of the AWWA Gate Valve Standard C-509 for double disc bronze mounted gate valves or with the latest revision of the AWWA C-550. Gate valves shall be rated as follows:

<b>Diameter</b>	<b>Working Pressure</b>	<b>Hydrostatic Test Pressure</b>
3" – 12"	200 psi	400 psi
14" – 42"	150 psi	300 psi

1. Testing shall conform to AWWA C-500. Resilient seated gate valves 3" through 12" shall be rated for zero leakage at the rate working pressure.
  2. Testing shall conform to AWWA C-509. Gate valves shall be as manufactured by Mueller, M & H or COTR approved domestic equal.
  3. The 2" valves shall be Model A-2360-2 manufactured by Mueller Company or Style 4067-07 manufactured by M & H Valve Company or COTR approved domestic equal.
  4. Line valves smaller than 2" shall be Model B103 manufactured by Stocham Company or COTR approved domestic equal.
- C. Valve boxes shall be three (3) piece adjustable, five and one-quarter inch (5-1/4") shaft diameter, high grade screw-tube cast iron valve boxes as manufactured by the Mueller, Model H-1301-1 or Tyler Series 6850 or COTR approved domestic equal.
1. The cast iron base shall be large enough to fit completely over the valve bonnet and the valve box cover shall have the word "Water" embossed on the topside of its cover.
- D. Iron bodied gate valves shall be wrapped with an 8 mil thickness black polyethylene wrap.

2.6 TAPPING SLEEVES AND VALVES AND VALVE BOXES

- A. Tapping sleeves for 12" and smaller water mains shall be of steel with epoxy coating and stainless steel bolts, style FTS, as manufactured by Ford or COTR approved domestic equal,

mechanical joint end connections, 200 psi maximum working pressure, designed to meet or exceed AWWA Standards.

1. Sleeve section shall be sized for the pipe on which it is to be mounted as verified by the Contractor.
  2. The outlet or branch shall be flanged for acceptance of the companion-tapping valve. Gaskets shall be plain ends for use on cast iron or PVC mains.
- B. Tapping sleeves for 14" and larger water mains shall be as listed above or may be constructed of Grade 18-8 Type 304 Stainless Steel and be of the split sleeve design style FTSS, as manufactured by Ford or COTR approved domestic equal.
1. Sleeves shall be provided with a gridded gasket, which totally surrounds the pipe to be tapped.
  2. The gasket shall be composed of virgin GPR conforming to ASTM D2000-80M 4AA607.
  3. The sleeves shall be manufactured to withstand a maximum working pressure of 150 psi.
  4. The outlet or branch shall be constructed of stainless steel and be flanged in accordance with AWWA 207 Class D, ANSI 150 psi drilling.
- C. Tapping valves shall conform to the manufacturer requirements above and shall have ANSI 150 psi flange or inlet and mechanical joint at outlet.
- D. Valve boxes for tapping valves shall be equal to valve boxes described in Section 2.5.

## 2.7 SERVICE ASSEMBLY

- A. Pay Item for Service Assembly, unless otherwise shown on the Drawings, shall include the main line field tap (direct tap or tapping saddle) with corporation stop on the newly installed and accepted water line, new meter box, and associated yoke bar, meter inlet valve, fittings and connection of the new assembly to the customer's existing service line.
- B. Corporation Stop
1. ¾", Catalog No. F1000-3, as manufactured by Ford Meter Box Company, Inc., with pack joint and with insert stiffener for PE or COTR approved domestic equal.
  2. 1", Catalog No. F1000-4, as manufactured by Ford Meter Box Company, Inc., with pack joint and with insert stiffener for PE or COTR approved domestic equal.
- C. Tapping Saddle
1. For AWWA C-900 mains (4" to 12") direct tap is acceptable or; use Catalog No. Hinged S90 manufactured by Ford Meter Box Company, Inc. or COTR approved domestic equal. Direct tapping of the new main is required for pipe over 12".

D. Meter Inlet Valve

1. On short side services, use Catalog No. AV94-323W or AV94-324W, as manufactured by Ford Meter Box Company, Inc. or COTR approved domestic equal.
2. On long side services, use Catalog No. B94-323W or B94-324W, as manufactured by Ford Meter Box Company, Inc. or COTR approved domestic equal.

E. Expansion Connection

1. Catalog No. EC-23 as manufactured by Ford Meter Box Company, Inc. or COTR approved domestic equal.

F. Yoke

1. Catalog No. Y202 as manufactured by Ford Meter Box Company, Inc. or COTR approved domestic equal.

G. Water Meter

1. New water meter(s) will be provided by the City of Alexandria Water Department. The Contractor shall install water meter(s) at no additional charge. Compensation for the installation of the service assembly shall include installing City furnished water meter(s).
2. For each water meter installation, the Contractor shall provide a document indicating the following information:
  - a. Serial # of the existing meter being replaced;
  - b. Numerical reading of the meter being replaced;
  - c. Street address of the affected relocation;
  - d. Serial # of the new meter being installed;
  - e. Numerical reading of the meter being installed; and,
  - f. Date of installation.
3. All existing water meters and boxes removed shall be delivered to the City of Alexandria Water Department, located at the City Consolidated Compound on Industrial Park Road.

H. Connection to Customer's Existing Service Line

1. Connection fitting(s) required to connect meter yoke to existing service line shall be a Ford C87-33 Pack joint coupling or COTR approved domestic equal.

I. Meter Box

1. Meter boxes shall be a #15-P Plastic Meter Box with a cast iron lid as manufactured by East Jordan Iron Works, Inc., or COTR approved domestic equal.

J. Aggregate

1. Aggregate installed under the meter shall conform to VDOT Specifications Section 203 – Coarse Aggregate, shall be No. 5 aggregate installed no less than six inches (6”) thick by the width and length of the meter box.

2.8 FIRE HYDRANT ASSEMBLY

- A. Fire hydrants shall be Model T-129 manufactured by M & H, or COTR approved domestic equal and conform to AWWA Standard C-502 and be equipped with two (2) nozzles, and one (1) pumper nozzle.
1. The two (2) – 2 ½" hose connection nozzles shall be 3 5/64" O.D. with eight (8) threads per inch. The one (1) – 4 ½" pumper nozzle shall be 5 31/64" O.D. with four (4) threads per inch.
  2. The fire hydrant shall be 5 1/4" main valve opening with 6" mechanical joint inlet, and shall have ductile iron upper and lower barrels and elbows.
  3. Hydrants shall be factory painted. The Contractor shall verify and be responsible for matching the hose connections and pumper nozzle threads to the thread standard used by the City of Alexandria Fire Department.
  4. All components, barrel, valve stem, etc., shall be designed to “break away” at a point above ground level in the event of traffic contact.
  5. The Contractor shall install fire hydrant so that the bury line on the fire hydrant is at the finished ground elevations.
- B. Fire Hydrant Assembly - Type I (parallel mount) shall include the main line mechanical joint tee, swivel by swivel 90° elbow, mechanical joint gate valve, cast iron valve box with concrete pad, swivel by solid adapter fire hydrant lead, and mechanical joint hydrant.
- C. Fire Hydrant Assembly - Type II (perpendicular mount) shall include the main line swivel tee, mechanical joint gate valve, cast iron valve box with concrete pad, swivel by solid adapter fire hydrant lead, and mechanical joint hydrant. The swivel by solid adapter fire hydrant leads shall be of the lengths required to suit field conditions.
- D. Fire Hydrant Assembly - Type III (tap on existing line) shall include steel with epoxy coating and stainless steel bolts manufactured by Ford tapping sleeve, mechanical joint tapping valve, cast iron valve box with concrete pad swivel by solid adapter fire hydrant lead, and mechanical joint hydrant.
- E. Swivel tees, swivel by solid adapter fire hydrant leads, and swivel by swivel 90° elbow shall be as manufactured by Tyler Pipe or COTR approved domestic equal.
- F. Aggregate installed around the fire hydrant weep holes shall conform to VDOT Specifications Section 203 – Coarse Aggregate.

2.9 COMPRESSION COUPLINGS

- A. Compression couplings for four inch (4") size pipe and up shall be ductile iron mechanical joint sleeves manufactured in accordance with ANSI/AWWA C110/A21.10 and ANSI/AWWA.
- B. Compression couplings for two inch (2") and smaller pipe shall be steel compression couplings manufactured by Rockwell or approved equal.

#### 2.10 CAPS AND PLUGS

- A. Where existing lines are to be abandoned, the ends shall be cut and fitted with an appropriately sized cap or plug. The cap or plug shall be cast iron mechanical joint fitting. The capped end shall be back-filled with compacted native material in such a manner as to ensure the integrity of the cap.
- B. Where lines are to remain in service, the ends shall be cut and fitted with a ductile iron mechanical joint plug or cap with retainer glands. This assembly shall be blocked with concrete thrust blocking.

#### 2.11 FILL MATERIAL

- A. Material for backfill of valves and valve boxes shall be Class A-2-4 material with a minimum PI of three (3), this material is commonly known as "Red Dirt".

#### 2.12 CONCRETE FOR VALVE BOX PADS

- A. Concrete required for the valve box pads shall conform with Section 033000 Cast-in-place Concrete herein.

#### 2.13 JOINT RESTRAINTS FOR PVC PIPE

- A. Restraint devices to be installed on PVC C900 pipe for all mechanical joint ductile iron fittings and valves shall be Ford Uni-Flanged Series 1300-C or COTR approved domestic equal. Restraint devices to be installed on PVC C900 pipe bells shall be Ford Uni-Flanged Series 1390-C or COTR approved domestic equal.

#### 2.14 TRANSITIONS FOR SMALL DIAMETER POLYETHYLENE WATER PIPE

- A. Transitions for joining polyethylene (PE) water pipe to other types of pipe (3" and smaller) shall be made with a properly sized steel insert (Stiffener) inserted into the polyethylene pipe and using a compression coupling to connect the pipes together.

#### 2.15 TRANSITIONS FOR 6" THRU 12" DIAMETER POLYETHYLENE WATER PIPE

- A. Transitions for joining 6" thru 12" polyethylene (PE) water pipe to other types of pipes shall be made with a Ductile Iron Mechanical Joint Anchoring Kit as manufactured by Independent Pipe Products, or COTR approved domestic equal, to a mechanical joint fitting or valve.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. All pipe, valves, appurtenances and accessories shall be installed as indicated on the Contract Drawings. Any deviations must be approved by the COTR before installation.

### 3.2 PIPE BEDDING CONDITIONS

- A. All pipes and other related items laid in open trench excavations shall be haunched and bedded and uniformly supported over their full length on beddings of the types specified, if any, as shown on the Contract Drawings.
- B. Flat-bottomed trenches shall be excavated and dewatered prior to preparing the specified foundations.
- C. All WORK shall be performed in a dry trench.
- D. Where pipe bedding conditions of a higher type than those shown on the Contract Drawings or than those called for in the Specifications are ordered, as a result of the Contractor's method of operation, the Contractor shall be due no additional compensation.
- E. Where special bedding is directed by the COTR as a result of unsuitable soil conditions, the Contractor shall be paid for special bedding under appropriate bid items, or if not included as a bid item, then as negotiated.

### 3.3 INSPECTION OF PIPE BEFORE INSTALLATION

- A. All pipe, fittings and related items shall be carefully inspected in the field before lowering in the trench.
- B. Cracked, broken, warped, out of round or otherwise defective pipe, fittings, or other related items, as determined by the Contractor or the COTR, shall be pulled and not installed. Such rejected pipe shall be clearly tagged in such manner as not to deface or damage it, and the pipe shall then be removed from the job site by the Contractor at his expense.

### 3.4 INSTALLATION OF WATER PIPE AND FITTINGS

- A. All pipe and fittings shall be installed in strict accordance with the manufacturer's recommendations with excavation and backfill in accordance with Sections 312000 Earth Moving and Section 312333 Trenching and Backfilling.
- B. Water main installation shall conform to ANSI/AWWA C600 pipe specifications.
- C. Bedding material shall be placed in accordance with the plans and VDOT Specification Section 203 – Coarse Aggregate, unless otherwise directed by the COTR.
- D. Trench widths should provide a minimum space of four inches (4") on each side of the pipe to avoid excess earth loads on pipe and to allow proper compacting of backfill to provide sidewall support. Where excavation is in soil of a select material type, normal trench depth will be used.
- E. Installing P.E. Pipe
  - 1. All P.E. water mains shall be installed in strict accordance with the manufacturer's recommendation.

2. The manufacturer of the type of pipe furnished shall furnish a qualified factor representative for a minimum of three full working days to train, observe and qualify the Contractor's personnel on the proper method of joining and installing every size of pipe and the associated fittings to be used on the job in accordance with applicable Department of Transportation (DOT) regulations.
3. The Contractor and the factory representative shall coordinate these days in order to assure that the representative is on the job at the start of the laying of each different size pipe by the Contractor.
4. On P.E. service lines and mains, each valve will be supported by a 80-pound bag of "Sackrete" concrete mix.
5. Heat fused P.E. pipe shall not be snaked in the trench. Backfill shall not be placed on any plastic pipe while it is in a heated condition. Cooling of the pipe by an approved method will be required by the Engineer, if necessary.
6. Set time for newly assembled heat fused joints shall be as follows:
  - a. 10 Minutes minimum @ 60°F to 90°F
  - b. 11 Minutes minimum @ 40°F to 60°F
  - c. 12 Minutes minimum @ 25°F to 40°F

F. Field Cutting of Pipe

1. Field cutting of all pipes shall be accomplished by a method approved by the COTR. Any section of pipe, which is damaged during the cutting cooperation, will be rejected.

G. Setting of valves and fittings

1. Settings of valves and fittings shall be in accordance with USAS B31.8, except as modified for P.E. pipe in Section 3.4.E.

H. Installing service assemblies

1. All essential details of construction of the service assemblies to be installed are indicated on the Contract Drawings. The Contract Drawings shall be followed carefully. The labor, materials and equipment required to be furnished by the Contractor for each service assembly shall depend on the installation size, type, and meter setting.
2. The Contractor shall set each service assembly where shown on the Contract Drawings or as directed by the COTR. The Contract Drawings will indicate whether the existing meters in the proposed service assembly are to be refitted and used at the relocation point.
3. Existing meters and regulators, not to be refitted, used again or relocated, shall be delivered to the City of Alexandria Water Department, accompanied by a "Water Service Ticket", furnished by the Contractor, detailing the location from which it was removed, old meter number, new meter number, etc.



- a. All existing water service lines, which are not to be re-used, shall be cut and capped below natural ground surface.
4. The Contractor shall not set the service assemblies until all the mains have been cleaned, tested, purged and approved by the COTR.

### 3.5 PIPE LAYING

- A. Every precaution shall be taken to prevent foreign material from entering water pipe while it is being placed in the trench. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a water tight plug or other means approved by the COTR.
- B. If water is in the trench, the seal shall remain in place until the trench is pumped enough to resume laying operations.
- C. No pipe shall be laid in water or when, in the opinion of the COTR, trench conditions are unsuitable.

### 3.6 DEPTH OF COVER

- A. The water mains shall be laid so as to have a minimum of thirty inches (30") of earth cover. If the carrier pipe is in a casing, the minimum cover in the road shall be five feet (5') and at the street ditch shall be a minimum of three feet (3').
- B. Where required by site conditions or noted on the Contract Drawings, the Contractor shall provide for extra depth burial.
- C. The Contractor shall install all water lines as to maintain a minimum horizontal distance of six feet (6') from all sewer lines and minimum vertical distance of eighteen inches (18") above all sewer lines unless otherwise instructed by the COTR in writing. All distance shall be measured from the outside diameter of each pipe.

### 3.7 INSTALLATION OF POLYETHYLENE WRAP

- A. All underground ductile iron pipe, fittings, valves and tapping sleeves and valves shall be encased with the specified eight (8) mil black polyethylene wrap.
- B. The wrap shall be installed in accordance with the manufacturer's recommendations and AWWA C-600.
- C. The wrap shall be secured to the pipe, fittings, etc. with polyethylene compatible adhesive tape.
- D. All rips, tears or other damage shall be repaired with the adhesive tape.

### 3.8 INSTALLATION OF #10 GAUGE STRANDED COPPER WIRE

- A. The Contractor shall install #10 gauge stranded copper tracer wire directly over and on the center of all PVC water mains and PE service lines.
- B. The wire shall be continuous on all mains and service lines and shall be connected to all fixtures and appurtenances.

C. Wire Spice Kits.

1. Wire splices shall be Direct Bury Splice Kit, ID # 08-6105-9435-2, Part No. 500-54007-496965 as manufactured by 3M Electrical Products Division of Austin, Texas or COTR approved domestic equal.

D. The #10 gauge stranded copper tracer wire shall be attached to C.I. valve box, seven inches (7") below top of valve box, with a Thomas & Betts Type H Split Bolt Connector or COTR approved domestic equal.

E. The Contractor shall drill hole in valve box to accommodate split bolt connector.

3.9 INSTALLATION OF UNDERGROUND VALVES AND VALVE BOXES

- A. All valves and valve boxes shall be backfilled with one-half (½) cubic yard of Class A-2-4 material with a minimum PI of three (3), this material is commonly known as "Red Dirt".
- B. The valve boxes shall have a concrete pad poured at the top of the box as shown on the Standard Details for Water Line Installation and painted with one coat of silicone alkyd paint "Medium Blue."

3.10 TAPPING LINES

- A. Tapping city water lines 12" and smaller shall be performed by the City of Alexandria Water Department. The City of Alexandria Water Department, (318) 441-6214, shall be notified 48 hours in advance of any water line tap.
- B. The Contractor shall verify the outer dimension and type of existing lines, which are to be tapped for connecting the new line to the existing lines prior to ordering connection equipment and fittings.
  1. The Contractor's attention is directed to the fact that cast iron lines to be tapped are old and the outside diameters may be to a different standard than current standards.
  2. Any deviation from the data shown on the Contract Drawings shall be brought to the attention of the COTR for resolution.
  3. The Contractor shall set up the tapping sleeve and valve for inspection by the City of Alexandria Water Department Personnel, prior to the City performing the tapping operation.
  4. Any adjustments or modification to tapping sleeve and/or valve shall be made by the Contractor under the direction of the City of Alexandria Water Department Personnel.

3.11 CUTTING AND CAPPING LINES

- A. Existing water lines shall be cut, capped and blocked where designated on the Contract Drawings. Existing water pipe is to be cut in a straight and true face after arranging with the City of Alexandria Water Department Personnel on a time and sequence of valving-off the section of water mains to remain in service.

1. As part of the operation, the Contractor shall physically remove a minimum five foot (5') length of pipe. The cut ends shall be cleaned for attachment of appropriate fittings.
  2. Unless otherwise specified, fittings shall include a ductile iron mechanical joint plug or cap with retainer glands as required.
  3. Concrete blocking shall be installed as shown on the Standard Details for Water Line Installation.
- B. The sequence of water cut-off operations will determine the type of capping and blocking to be required for the end of pipe to be eventually abandoned. The existing line to be abandoned must have the ends sealed.

### 3.12 INSTALLATION OF FIRE HYDRANT ASSEMBLY

- A. All fire hydrants will be installed at the location specified on the Contract Drawings unless otherwise directed by the COTR.
1. The fire hydrant shall be installed with the pumper nozzle facing the street and in a manner that allows a minimum of eighteen inches (18") from the face of the pumper nozzle to the back of the curb.
  2. If field condition does not allow the above requirement or the fire hydrant location creates obstruction as to maintain the above requirement, the COTR shall be notified and a suitable resolution shall be directed by the COTR.
  3. Installation shall be as shown on the Contract Drawings.
- B. The hydrant shall be installed so that the pumper nozzle faces the principle street. The fire hydrant lead piping shall have a minimum of thirty inches (30") of cover.
1. The Contractor shall install fire hydrant so that the bury line on the fire hydrant is at the finished ground elevation.
- C. The fire hydrant together with ductile iron piping, fittings, valves, etc. shall be wrapped with the specified eight (8) mil black polyethylene wrap. Special care shall be taken so that the fire hydrant drain hole is not blocked.
- D. A 16" x 8" x 4" thick pre-cast concrete pad shall be installed to support the fire hydrant as shown on the City Standard Details.
- E. Four (4) cubic feet of washed gravel shall be installed around the fire hydrant as shown on the City Standard Details.
- F. All fire hydrants shall be installed with a factory applied paint.

### 3.13 REMOVE AND SALVAGE EXISTING FIRE HYDRANTS

- A. Existing fire hydrants shall be removed as designated on the Contract Drawings or where directed by the COTR. Existing fire hydrants shall be removed by cutting the fire hydrant lead with a straight true cut. The cut end shall be capped with the appropriate ductile iron mechanical

joint cap with retainer gland. The removed fire hydrant shall be delivered to the City of Alexandria's Water Department.

3.14 INSTALLATION OF CONCRETE THRUST BLOCKING

- A. Concrete thrust blocking on water mains 14" or larger shall be provided at all tees, bends, dead ends and other such appurtenances as indicated on the City Standard Details for Water Line Installation. Concrete shall conform to Section 033000, Cast-In-Place Concrete, and shall be a 5½ cement sack mix with a 28-day compressive strength of 3,000 psi.

3.15 CONNECTION TO EXISTING LINE

- A. Connection to existing lines shall be performed under the direction of the City of Alexandria Water Department. The City of Alexandria Water Department (318) 441-6214, shall be notified, forty eight (48) hours in advance of any water line tap.
- B. The Contractor shall verify the out dimensions and type of existing lines, which are to be connect for tying the new lines to the existing lines prior to ordering connection equipment and fittings. Any deviation from the data shown on the Contract Drawings shall be brought to the attention of the COTR for resolution.
- C. Connection of new pipe or main to existing pipe or main shall be accomplished by using appropriately sized nipples and couplings or sleeves, specifically designed for the connection work as specified. A search for existing locator wire shall be made.
  - 1. New wire, installed with the new pipe work, shall be attached around the sleeve or coupling and then connected to the existing locator wire as specified elsewhere herein with splice kits.

3.16 FIELD HYDROSTATIC AND LEAKAGE TESTS

- A. The hydrostatic testing of all lines shall conform to the requirements of AWWA C600, Section 13, except as modified below.
  - 1. The test pressure shall be 150 psi and shall be maintained for a minimum of four (4) hours with no leakage.
  - 2. The test shall be applied to the whole individual valved-off sections of the mains either before or after the trench is backfilled, as directed by the COTR.
  - 3. At the Contractor's option, services may or may not be included in the hydrostatic and leakage test. If the Contractor elects not to test the services, then all services will have a visual inspection after installation with full line pressure and the Contractor shall satisfy himself that there are no leaks. All services shall be flushed for a full 15 minutes.
- B. The COTR may require to be present at any or all of these tests.
  - 1. The Contractor shall furnish gauges, meters, water, tools, labor, equipment, and all other materials necessary to conduct the tests. The COTR will be notified at least 48 hours in advance of the hydrostatic test.

2. The test pressure will be based upon the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge. Gauges shall have an operating range of twice the testing pressure and be severe service liquid dampened, and liquid lubricated type. Unless otherwise specified, gauges shall be Catalog No. 625 by John C. Ernst Co. or COTR approved domestic equal.
3. Should leakage be encountered, the Contractor shall, at his expense, locate and repair the defective joint(s) or fitting(s), until there is no leakage within the specified test area.
4. Results of the field hydrostatic test shall be submitted to the City of Alexandria Water Department for approval prior to acceptance of water improvements by the City of Alexandria.

### 3.17 INSTALLING PIPE-BORING AND JACKING METHOD

- A. When shown on the Contract Drawings, lines installed under this contract which require crossing under public highways, paved roads, streets, or driveways shall be installed by the jacking and boring method. The installation of utility pipe and the boring and jacking method shall be in accordance with A.R.E.A. Specifications, pages 1-4-18 thru 1-4-24.
- B. The excavation of all approach pits and trenches within the right-of-way of the highway or railroad shall be of sufficient length from the street or railroad tracks to permit traffic to pass without interference. All backfill on the approach pits and trenches within the right-of way shall be tamped in layers a maximum of six (6) inches thick for the entire length and depth of the trench or pit.
- C. The backfill shall be compacted to 90% of maximum density obtained at optimum moisture as determined by AASHTO T 180-57, Method A. Mechanical tampers may be used after a cover of six inches (6") has been obtained over the top of the barrel of the pipe.
- D. The boring operation shall be accomplished using a commercial type boring rig and the hole made by the installation shall be of the same diameter (within two (2) inches) as the largest outside joint diameter of the pipe installed.
- E. In the event sub-surface operations result in injury or damage to the pavement, repairs to this pavement shall be made by the Contractor, at no additional cost to the City. In the event paving cracks or either side of the pipeline, or is otherwise disturbed or broken due to the Contractor's operations, he shall repair or replace same at his own expense without further compensation.

### 3.18 INSTALLING CASING PIPE

- A. When shown on the Contract Drawings, the Contractor shall furnish and install all utility mains perpendicular to and under railroad tracks and roadways in a casing pipe. This casing shall be completed and with end seals, vent pipe, and other specials required to install the main in the casing. All installations shall be in accordance with these Specifications and the requirements of the railroad or roadway, as applicable.
- B. Unless otherwise specified the casing pipe shall be installed by the boring and jacking method in conformance with Section 3.17 of these Specifications.

### 3.19 FIELD CLEANING, TESTING AND PURGING

- A. The field cleaning, testing and purging operations shall be applied to the whole or individual valved-off sections of the high pressure distribution mains (feeder mains), distribution mains and service lines either before or after the trench is backfilled, as directed by the COTR.

3.20 SET-UP FOR DISINFECTING OF WATER MAINS BY CITY OF ALEXANDRIA

- A. The Contractor shall assist the City of Alexandria Water Department in the collection of samples required for State Department of Health and Hospitals approval of the completed system by providing acceptable injection taps, sampling taps, temporary blow-off and line flushing as required, and suitable for satisfactory disinfection of the new lines.
- B. The Contractor shall install a ¾" brass corporation stop at each point of injection of chlorine solution and a ¾" corporation stop in the existing main for chlorination water supply. All corporation stops shall be left in the main after completion of chlorination.
  - 1. A temporary blow-off(s) shall be installed as shown on the Drawings, the minimal size of the blow-off(s) shall be no less than ½ the diameter of the line being tested.
- C. The Contractor shall make the excavation for each corporation stop and have same open and pumped free of water, earth, and debris for use by the City of Alexandria Water Department.
  - 1. The Contractor shall notify the City of Alexandria Water Department, 48 hours prior to the work of each chlorination operation as scheduled by the Contractor, and shall have men and equipment attending the needs of the City for any excavation, shoring, bailing, pumping, flushing, valve operation or other incidental assistance required for the City to have adequate help in access to the work, and in the injection, blow-off, location and operation of valves, hydrants, and in general to assist the City to do its Work.
- D. The Contractor shall flush the lines to be chlorinated prior to calling on the City for chlorination.
- E. The Contractor shall be responsible for scheduling the chlorination and testing to demonstrate that the lines in each section tested are free of contamination. After a section is disinfected and reported clear of contamination, the Contractor shall conduct his operations so that no further contamination of that section is caused by his operations.
- F. The scheduling may be done in any reasonable sectioning or phasing, and the approval of the COTR will be obtained for each proposed section to be disinfected to make sure the operation is practical.
- G. The Contractor shall ensure that the water in the new line cannot be used by consumers until water samples collected and analyzed by the City of Alexandria Laboratory show the water to be free of coliform bacterial.

3.21 DISINFECTION OF WATER MAINS BY CITY OF ALEXANDRIA

- A. The City of Alexandria Water Department will perform all actual injection, sampling, testing, and reporting.
- B. The City's disinfection procedure is to inject gaseous chlorine solution into the new lines immediately adjacent to the valve separating the new line from the existing system and to

continue to inject sufficient chlorine solution until a 50 ppm reading is attained at all extremities and within all reaches of the new piping.

1. Reversed flow is to be prevented.
  2. Solution shall remain in the new lines for at least twenty-four (24) hours and a sample is checked to ascertain a 5 ppm chlorine residual.
  3. All valves, hydrants, taps and other appurtenances are to be operated while the lines are filled with the highly concentrated chlorine solution.
  4. If the residual has fallen below 5 ppm, the lines are re-chlorinated. If the residual is more than 5 ppm, the lines are flushed with potable water and a sample taken for bacteriological testing by the City of Alexandria's Laboratory.
  5. The new lines shall not be placed into service until the sample is proved to be coliform free.
- C. In the event the chlorine residual, after 24 hours, is below 5 ppm or if the sample fails, the flushing, chlorination and purging procedure is repeated until the new lines are proved sterile. The cost for additional injection, sampling, testing, and reporting shall be paid for by the Contractor to the City of Alexandria Water Department. The fee shall be as set forth in the schedule below:
1. \$100.00 for each set up
  2. \$50.00 for each blow-off

PLUS

CHLORINIZATION	CHLORINE
2" to 10" 0.10 per ft. 1st 1000' 0.05 per ft. all over 1000'	\$50.00 1 <sup>st</sup> 1000' \$25.00 each additional 1000'
12" .12 per ft. 1st 1000' .06 per ft. all over 1000'	\$55.00 1st 1000' \$30.00 each additional 1000'
14" .14 per ft. 1st 1000' .07 per ft. all over 1000'	\$60.00 1st 1000' \$35.00 each additional 1000'
16" .16 per ft. 1st 1000' .08 per ft. all over 1000'	\$65.00 1st 1000' \$40.00 each additional 1000'
18" .19 per ft. 1st 1000' .09 per ft. all over 1000'	\$70.00 1st 1000' \$45.00 each additional 1000'
20" .20 per ft. 1st 1000' .10 per ft. all over 1000'	\$75.00 1st 1000' \$50.00 each additional 1000'
24" 0.24 per ft. 1st 1000' .12 per ft. all over 1000'	\$80.00 1st 1000' \$55.00 each additional 1000'

### 3.22 DISINFECTION OF FITTINGS AND PIPE AT RELOCATIONS

- A. At all tie-ins, short relocations or other points where disinfection by chlorination is not possible, pipe, fittings, valves and other items shall be thoroughly cleaned and disinfected by mopping with a 50 ppm chlorine solution.

3.23 CLEARING UP, REMOVING SURPLUS EARTH, ETC.

- A. As soon as the backfilling of any excavation is completed, the Contractor must at once begin the removal of all surplus dirt. Except dirt that is necessary to correct settlement of the initial backfilling operations.
- B. The Contractor shall remove all pipe and other material placed or left on the street or right of way by him except material needed for the replacement of the paving. The street shall be opened and made passable for traffic.
  - 1. Following the above Work, the repairing and complete restoration of the street surfaces, bridges, crossings and all places affected by the Work shall be done as promptly as possible.
- C. Any surplus earth which may be left on the street or right of way after the excavations have been completely refilled shall be regarded as the property of the Contractor and must be removed as soon as possible at his own expense except that in un-graded streets, it shall be optional with the Engineer whether surplus material shall be removed or deposited on the surface and graded for the convenience of traffic.

3.24 INSTALLATION OF PE PIPE BY DIRECTIONAL BORE

- A. At least 7 days prior to mobilizing equipment the Contractor shall submit his detailed installation plan to the COTR. The plan shall include a detailed plan and profile of the bores and be plotted at a scale no smaller than 1" = 20' horizontal and vertical. The plan shall also include a list of major equipment and supervisory personnel and a description of the methods to be used.
- B. Directional drilling and pipe installation shall be done only by an experienced contractor specializing in directional drilling and whose key personnel have at least five (5) years experience in this work.
- C. Joining shall be performed by thermal butt-fusion in accordance with the manufacture's recommendations.
- D. All polyethylene pipes shall be cut, fabricated and installed in strict conformance with the pipe manufacturer's recommendations. Joining, laying and pulling of polyethylene pipe shall be accomplished by personnel experienced in working polyethylene pipe.
- E. Pipe shall be joined to one another by means of thermal but fusion. Polyethylene Pipe lengths to be joined by thermal butt-fusion shall be of the same type, grade and class of polyethylene compound and supplied from the same raw material supplier.
- F. The Contractor shall install the pipelines by means of horizontal directional drilling. The Contractor shall assemble, support and protect the pipeline prior to installation in the directional drill tunnel.



1. Horizontal directional drilling shall consist of drilling a small diameter pilot hole from one end of the alignment to the other, followed by enlarging the hole diameter for the pipeline insertion.
  2. The exact method and techniques for completing the directional drilled installation will be determined by the Contractor, subject to the requirements of these Specifications.
- G. Reaming operations shall be conducted to enlarge the pilot after acceptance of the pilot bore. The number and size of such reaming operations shall be conducted at the discretion of the Contractor. The maximum allowable pull exerted on the HDPE pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacture so that the pipe or joints are not over stressed.
1. A swivel shall be used to connect the pipeline to the drill pipe to prevent torsional stresses from occurring in the pipe. The lead end of the pipe shall be closed during the pullback operation
- H. During the drilling, reaming or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids or cuttings at the entry and exit pits. The drilling fluids and cuttings shall be removed from the site and disposed of legally. After completion of the directional drilling work, the entry and exit pits shall be restored to original conditions.
- I. After the pipe is in place, cleaning pigs shall be used to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check for anomalies in the form of buckles, dents, excessive out-of-round, and any other deformations.
1. The sizing pig run shall be considered acceptable if the test results indicate that there are no sharp anomalies greater than 2 percent of the nominal pipe diameter or excessive out-of-round greater than 5 percent of the nominal pipe diameter.

#### PART 4 - MEASUREMENT AND PAYMENT

- A. VDOT Specification Section 510 – Relocating or Modifying Existing Miscellaneous Items and Section 520 – Water and Sanitary Sewer Facilities, for Measurement and Payment.
- B. For the following items, payment shall include full compensation for all labor, materials, equipment, and incidentals necessary for providing fully functional water systems.
  1. Jacking and Boring shall be measured and paid for at the contract unit price per linear foot for the size of pipe specified, and shall be full compensation for installing complete, for all boring, backfilling, and bedding and for all equipment, tools, labor, and incidentals to perform all the Work necessary to complete the item in accordance with the Contract Documents.
  2. Directional Bore shall be measured and paid for at the contract unit price per linear foot for the size of pipe specified, and shall be full compensation for installing complete, for all boring, backfilling, and bedding, and for all equipment, tools labor and incidentals to perform all the Work necessary to complete the item in accordance with the Contract Documents.

3. Special Crossing (Per Plan Detail) shall be measured and paid for as a lump sum price for crossings, in place and accepted, and shall constitute full compensation for furnishing, hauling and installing all material, and for furnishing all equipment, tools, labor, material and incidentals necessary to perform all the Work necessary to complete the item in accordance with the Contract Documents. The limits of pay will be shown on the detail.
4. Additional Bedding Material (As Directed by the COTR) shall be measured and paid for at the contract unit price per cubic yard of bedding material, and shall be full compensation for furnishing, hauling, and installing all bedding and for all equipment, tools, and labor incidental to perform all of the Work necessary to complete the item in accordance with the Contract Documents.
5. “Red Dirt” Backfill Material will not be measured and paid for separately. “Red Dirt” backfill will be incidental and included in the Contract Unit Cost of the work being performed.

END OF SECTION 331000

SECTION 333100 – SANITARY SEWERAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
  - 1. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 302 – Drainage Structures, Section 520 – Water and Sanitary Sewer Facilities.
  - 2. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).
  - 3. City of Alexandria Design and Construction Standards, latest edition.
  - 4. ACPA Concrete Pipe Installation Manual, latest edition.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM 1417 Standard Practice for Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air
  - 2. ASTM D1784 Rigid Polyvinyl Chloride (PVC) compounds and chlorinated Polyvinyl Chloride (PVC) compounds.
  - 3. ASTM D2241 Polyvinyl Chloride (PVC) plastic pipe (SDR-PR).
  - 4. ASTM D3139 Joints for plastic pressure pipes using flexible elastomeric seals.
- C. American Water Works Association (AWWA):
  - 1. AWWA C600 Installation of gray and ductile cast iron water mains and appurtenances.
  - 2. AWWA C900 Polyvinyl Chloride (PVC) pressure pipe, 4” through 12”, for sanitary sewers.

1.2 SUMMARY

- A. This section covers furnishing and installing necessary materials for sanitary systems in accordance with VDOT Road and Bridge Specifications and in conformity with the dimensions, lines and grades shown on the plans or as established by the COTR.

1.3 RELATED REQUIREMENTS

- A. Section 033000 Cast in Place Concrete for concrete materials, reinforcement, mixture design, and placement.

- B. Section 311000 Site Clearing for site clearing and removal of above- and below-grade site improvements not part of pavement removal.
- C. Section 312000 Earth Moving for execution of excavation, backfill procedures and compaction standards for structural stability.

#### 1.4 ACTION SUBMITTAL

- A. The contractor shall submit a listing of suppliers for all manufactured products to be used for sewer appurtenances. These shall include but are not limited to:
  - 1. Include pipes, material and size.
  - 2. Fittings and flanges.
  - 3. Gaskets and joint material.
  - 4. Manholes, frames and covers.
  - 5. Sewer brick.
  - 6. Concrete blocks
  - 7. Hydraulic cement mortar
  - 8. Reinforcing steel
  - 9. Curing material for concrete
  - 10. Nonshrink waterproof grout
  - 11. Aggregate
  - 12. Flowable backfill

Inferior performance on prior projects of a similar nature shall be grounds for rejecting a supplier's product. Any manhole covers located within an accessible route shall be stable, firm, and slip resistant. Manhole covers located within the detectable warning surface of curb ramps shall contain an ADA compliant detectable warning surface.

- B. Submit approved shop drawings and technical data on manholes, frames, covers, pipe and fittings prior to ordering and receiving these materials.

#### 1.5 INFORMATIONAL SUBMITTAL

- A. Certificates of compliance with specified standards and tests will be required from the manufacturer through the Contractor to the COTR.

#### 1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Inspection of material

1. When delivered to the site, and prior to unloading, the Contractor shall inspect all pipe, fittings, manholes, frames, covers and accessories for loss, damage or lack of specified identifications and markings.
2. Any defective or improper material shall be immediately marked and shall not be unloaded.

B. Handling

1. In shipping, storing and installing pipe, fittings, manholes and accessories shall be kept in a sound, undamaged condition. They shall, at all times, be handled with care and shall not be dropped, dumped or bumped against any other object. Any material(s) damaged shall be marked and immediately removed from the job site.
2. All precast manhole sections shall be lifted and moved by use of suitable lifting slings, plus and holes so as not to damage the manhole lip or edges.

C. Storing

1. Pipe shall be stored off the ground on sticking or pallets. Pipe shall be stacked with spigot ends projecting from the stack in opposite directions for alternate rows.
2. Sewer brick shall be kept clean and dry.
3. Manhole joints shall be kept protected from damage and shall be kept clean and free of mud, dirt, concrete or other materials that would affect the making of a watertight seal.

D. Defective Materials

1. All materials found at any time during the progress of the work to have cracks, flaw or other defects shall be rejected and marked and the Contractor shall promptly remove such defective materials from the work site.
2. All damage to precast sections that is not cause for rejection shall be repaired. Repair and patching of minor breaks shall be done by chipping and scarifying the defective area before application of a non-shrink grout. Sufficient time shall be allowed for curing before precast sections are installed.

1.7 QUALITY ASSURANCE

- A. Pipes shall be laid true to the lines and grades shown on the plans or as directed by the COTR. The grade shown on the plans is the invert grade to which the work shall conform. Work rejected shall be corrected by the contractor at his own expense in a manner acceptable to the COTR.
- B. The contractor shall demonstrate his proposed methods of maintaining the grade and alignment of the pipe during construction with the COTR before the start of construction.
- C. The contractor shall furnish all labor, materials, and tools to establish and maintain all lines and grades. The COTR shall approve such tools and materials as are required for the work and

furnished by the contractor. Benchmarks and reference points as required for control of the work shall be the responsibility of the COTR. Transferring line and grade from these references shall be the responsibility of the contractor.

1.8 FIELD CONDITIONS

- A. Interruption of Sanitary Sewer Service: Do not interrupt sanitary sewer service to facilities occupied, unless permitted under the following conditions:
  - 1. Notify the COTR no fewer than two (2) days in advance of proposed interruption of sewer service.
  - 2. Do not proceed with interruption of sewer service without the COTR's written permission.
  - 3. Contractor to provide a temporary pump around that is to be approved by the COTR prior to installation and being put in service.

PART 2 - PRODUCTS

2.1 Pipes, fittings and flanges

- A. Shall conform with VDOT Road and Bridge Specifications Section 232.

2.2 Gasket and Joint Materials

- A. Shall conform with VDOT Road and Bridge Specifications Section 212

2.3 Concrete blocks and Bricks

- A. Shall conform with VDOT Road and Bridge Specifications Section 222.

2.4 Hydraulic Cement Mortar

- A. Shall conform with VDOT Road and Bridge Specifications Section 218.

2.5 Concrete

- A. Shall conform with Section 033000 Cast in Place Concrete and shall be A3 concrete.

2.6 Reinforcing Steel

- A. Shall conform with VDOT Road and Bridge Specifications Section 223.

2.7 Curing material for concrete

- A. Shall conform with VDOT Road and Bridge Specifications Section 220.

2.8 Nonshrink waterproof grout

- A. Shall conform with VDOT Road and Bridge Specifications Section 218.

2.9 Aggregate

- A. Shall conform with VDOT Road and Bridge Specifications Section 203.

2.10 Flowable backfill

- A. Shall conform with VDOT Road and Bridge Specifications Section 249.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall be responsible for anticipating and locating underground utilities and obstructions in accordance with VDOT Road and Bridge Specifications Section 105. When construction appears to be in close proximity to existing utilities, the Contractor shall unearth trench(es) a sufficient distance ahead of the work or shall excavate test pits to verify the exact locations and inverts of the utility to allow for changes in line or grade as may be necessary.
- B. Connections to existing lines shall be made only after the proposed line is completed and approved by the COTR. Connections shall be made in the minimum time possible with minimum interruption of service. Work and interruptions in existing service shall be scheduled with the utility owner.
- C. The Contractor shall abandon existing sewer lines and appurtenances and manholes not required in the completed system as directed by the COTR. Abandoned materials shall become the property of the Contractor, unless otherwise noted on the plans, upon satisfactory replacement with the new installation. The Contractor shall clean abandoned pipe that is not removed of debris and plug it with Class A3 concrete at open ends if the utility is less than 8 inches inside diameter. If the abandoned pipe is 8 inches inside diameter or greater, the Contractor shall clean the pipe of debris and fill it entirely with Class A3 concrete or flowable backfill conforming to VDOT Road and Bridge Specifications Section 509.
- D. The Contractor shall remove existing manholes that are not required in the completed system to at least 2 feet below the proposed subgrade or natural ground line and fill the rest of the manhole with approved backfill in accordance with VDOT Road and Bridge Specifications Section 302.03 (a)2.g.
- E. The Contractor shall restore disturbed property prior to final acceptance. Restoration shall include, but not be limited to, replacing shrubbery, sod, or topsoil, including lime, fertilizer, seed, and mulch; replacing paved or finished surfaces with similar materials; and performing other work in accordance with VDOT Road and Bridge Specifications Section 107.08.
- F. Sidewalks and streets shall be kept open for passage. The Contractor shall provide and maintain adequate and safe passage over excavations to accommodate pedestrians or vehicles as directed by the Engineer until no longer required.

3.2 Protecting Water Supplies:

- A. During the course of construction, the Contractor shall protect water supply facilities within the construction limits from contamination by sewage. The Contractor shall use the following criteria to govern the installation of water and sewer facilities in proximity of each other:

1. Parallel Separation:

- a. Except as specified hereinafter, sanitary sewer lines shall be placed at least 10 feet horizontally from existing and proposed water lines. This distance shall be measured from edge to edge. If local conditions prevent a lateral separation of 10 feet, a sewer line may be placed closer than 10 feet to a water line if the top of the sewer pipe is at least 18 inches below the bottom of the water line. Where the vertical separation cannot be obtained, the sewer shall be constructed of mechanical joint water pipe. Gravity sewers shall be pressure tested, in place, to 50 pounds per square inch without leakage prior to backfilling. Force main sanitary sewer shall be pressure tested in accordance with VDOT Road and Bridge Specifications Section 520.04(c).

2. Crossings:

- a. Water and sewer lines that cross shall be placed to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer line. Where this vertical separation cannot be obtained, the sewer shall be constructed of mechanical joint or other approved water pipe for at least 10 feet on each side of the crossing. Sanitary sewers and combined sewers crossing over a water line shall have a vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line. The support shall be adequate to prevent excessive deflection of joints and the settling on and breaking of the water line. The water or sewer line shall be centered at the point of the crossing so that joints will be equidistant and as far from each other as practicable. Water lines shall not pass through or come in contact with any part of a sanitary sewer, combined sewer, or sanitary sewer manhole. The Contractor shall immediately notify the COTR if he becomes aware that the work will result in the violation of these criteria. Upon such notification, the COTR will issue instructions concerning remedial measures to allow the work to proceed.

B. Excavation:

1. The Contractor shall perform excavation, backfill, and compaction in accordance with these Section 312000 of these Contract Documents, except that stone larger than 1 inch in diameter shall not be used in backfill until the pipe has a cover of at least 1 foot. The remainder of backfill to the original ground or to within 12 inches of the finished subgrade shall not include stone larger than 10 inches in its greatest dimension. Pipelines installed outside the roadway shall be backfilled in 8-inch layers and compacted to approximately 85 percent of the theoretical maximum density.
2. The Contractor shall generally excavate trenches for pipelines along straight lines with the bottoms uniformly graded as required. Bedding material shall be placed in accordance with the plans. Where the trench bottom is in rock, it shall be excavated to at least 8 inches below the bottom of the pipe and backfilled with COTR approved local or commercial bedding material. The Contractor shall ensure installed pipe shall have a



uniform bearing on a solid foundation for its entire length. Where pipe foundations are yielding, pipe shall be bedded on at least 8 inches of approved local or commercial bedding material. Bell holes, where applicable, shall be of sufficient size to provide proper joints.

3. Trenches below the grade line of the pipe shall be dewatered during installation of pipelines.
4. When work is not in progress for any reason, lines shall be securely closed with a water-tight cap or plug to prevent water and debris from entering the lines.
5. Where adjacent pavements are to be retained, pavement removed for pipeline trenches shall be replaced in kind with equal or better material or as otherwise specified or directed by the COTR. The Contractor shall maintain a smooth riding surface until pavement repairs are completed after backfilling.

C. Inspecting Pipe and Fittings:

1. The Contractor shall inspect pipe and fittings for cracks and defects before they are lowered into the trench. Faulty pipe and fittings shall be removed from the site.

D. Placing Pipe:

1. Pipes, fittings and accessories shall be carefully lowered into the trench to prevent damage to materials, protective coatings, and linings. The Contractor shall not drop or dump materials into the trench.
2. If pipe, fittings, or accessories are damaged during handling, the Contractor shall immediately bring such damage to the COTR's attention. The Contractor shall then submit a method for repairing the damaged item, if the item is repairable, to the COTR for approval or replace the item at the Contractor's expense if it is not repairable. Damaged items shall be repaired as approved by the COTR or shall be removed from the project.
3. The Contractor shall remove lumps, blisters, and excess coating from ends of pipes that are to be joined. The inside of the bell and the outside of the spigot shall be wire brushed, wiped clean, dry, and free from oil and grease before installing the pipe. Foreign material shall be kept from entering pipe during placement.
4. The spigot end shall be centered in the bell and the pipe forced home and brought to the correct line and grade as each length of pipe is placed in the trench. Pipe shall be secured in place with approved backfill material tamped under it except at bells. The Contractor shall take precautions to prevent dirt from entering the joint space. If it becomes necessary to deflect water main pipe during construction, the amount of deflection shall not exceed the manufacturer's recommendation.

E. Cutting Pipe:

1. The Contractor shall cut pipe for fittings or closure pieces in a neat and orderly manner without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. The lining of the pipe shall not be damaged.
- F. Joining of Pipe:
1. Gasket end joint lubricant for sewer facilities shall be as recommended by the manufacturer or as approved by the Engineer. Pipe that is not furnished with a depth mark shall be marked before assembly to ensure that the spigot end is inserted to the full depth of the joint. Field-cut pipe lengths shall be filed or ground to resemble the spigot end of such pipe as manufactured.
  2. PVC Pipe:
    - a. shall be joined by gasketed bell and socket joints in accordance with AWWA C-900.
- G. Plugs, Caps, Tees and Bends:
1. The Contractor shall anchor plugs, caps, tees, and bends with reaction backing if indicated in the Plans. Backing shall be concrete reaction blocks, metal reaction harnesses, or a combination thereof. Concrete shall be placed in accordance with VDOT Road and Bridge Specifications Section 404 and cured in accordance with Section 316.04(j). Metal harness tie rods and clamps shall be of adequate strength to prevent movement and shall be galvanized or rustproofed by a means approved by the COTR.
- H. Sanitary Service Lateral Connection:
1. Connection shall be performed by approved methods prior to installation using wyes, bends, adapters, cleanouts, and necessary pipe. Existing service laterals shall mate with the new fitting, adapter, or pipe to produce a watertight joint.
- I. Sanitary Manholes and Manhole Frames and Covers:
1. These items shall be constructed in accordance with these Contract Documents Section 334200. A secure bond between the pipe and manhole wall shall be obtained. Flexible insert gaskets shall be used to obtain a watertight joint. The gasket style and composition shall be subject to the approval of the Engineer. Precast wall sections shall be seated with flexible joint sealant for their full circumference. Lift holes, defects, joints between sections, and frames and covers shall be sealed with nonshrink waterproof grout.
- J. Sanitary Drop Connections:
1. Connections shall be constructed in accordance with Sections 033000, 312000, and 334200 and VDOT Road and Bridge Standards Section 406.
- K. Sewer Cleanouts:
1. Cleanouts shall be constructed in accordance with Sections 033000, 312000, and 334200 and VDOT Road and Bridge Standards Section 406.

L. Conveying Sewage:

1. When it is necessary to contain or pump sewage during the adjustment of or connection to existing sewers, sewage shall be carried by a watertight conveyor to sewers or manholes approved by the COTR or shall be disposed of in accordance with local and state health codes and regulations. The Contractor shall not permit sewage to flow onto or over any open surface.

M. Manhole Frame and Covers and Other Castings located within the Paved Roadway, Shoulder or Sidewalk:

1. These items shall be constructed within a tolerance of +/-0.05 foot of the finished grade.

N. Reconstruct Existing Sanitary Manhole:

1. Reconstruction shall consist of removing the existing manhole to the point indicated on the plans or directed by the COTR. The Contractor shall reconstruct by using existing units and pavement rings or new units and adjustment rings to attain the proposed finished grade.

3.3 Testing

A. The Contractor shall test sewer mains, appurtenances, and materials for leakage after installation. Testing shall be performed in the presence of the COTR. The Contractor shall provide water, plugs, equipment, tools, labor, materials, and incidentals necessary to perform the testing. If any section of a main or manhole under test shows leakage in excess of that specified, the Contractor shall make necessary repairs or replacements at his own expense. Testing shall be repeated until satisfactory results are obtained. Visible leaks shall be repaired regardless of the amount of allowable leakage.

1. Force Main Sanitary Sewers and Appurtenances:

- a. New force main sanitary sewers appurtenances shall be tested for leakage using the hydrostatic pressure test method in accordance with Section 4 of AWWA C600 and the following.
  - 1) The duration of each test shall be at least 2 hours. Sections of main with concrete reaction backing shall not be tested until at least 5 days after the backing is placed. If the backing is constructed with high-early-strength concrete, the test may be performed 2 days after backing is placed.
  - 2) Testing of tie-ins with existing mains shall be performed under the normal working pressure of the main involved. The COTR will not allow visible leakage at these points during a period of at least 2 hours.
  - 3) The hydrostatic test pressure shall be 150 pounds per square inch or 1.5 times the working pressure, whichever is greater, based on the elevation of the lowest point in the line or section under test and shall be corrected to the elevation of the test gage. The Contractor shall ascertain the specific working pressure of the force main sanitary sewer from the utility owner.

Leakage loss shall not exceed the allowable leakage (L) as determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148,000}$$

Where:

L = the allowable leakage in gallons per hour

S = the length of pipe tested in feet

D = the nominal inside diameter of the pipe in inches

P = the average test pressure during the leakage test in pounds per square inc

2. Gravity Sanitary Sewers

- a. Leakage shall be not more than 200 gallons per inch of pipe diameter per mile per day (24 hours) for pipe up to and including 24 inches in diameter and not more than 4,800 gallons per mile per day for pipe more than 24 inches in diameter for any section of the system, including manholes, when subjected to at least 4 feet of head above the line crown at the upstream manhole of the section being tested.

1) Infiltration Test:

- a) When, in the opinion of the COTR, the trench or excavation is sufficiently saturated as a result of natural ground water, tests may be made on the basis of infiltration. The Contractor shall measure the flow of water at the nearest downgrade manhole. Three series of measurements shall be made at not less than 1-hour intervals, and the results shall be reduced to an average. The average for a 24-hour period shall then be computed. If the pipeline or manholes fail to meet the test requirements, the Contractor shall repair leaks and defective pipe and replace manholes at the Contractor's expense. The Contractor shall then repeat the test until satisfactory results are obtained.

2) Exfiltration Test:

- a) The Contractor shall perform an exfiltration test when the trench or excavation is dry and infiltration will not occur. The test shall be conducted as follows: The pipe shall be plugged at the lower manhole. The line and manhole shall be filled with water to a 4-foot level or to the top of the straight section if the manhole is less than 4 feet in height. The water shall stand until the pipe has reached maximum absorption and until trapped air has escaped (at least 4 hours). After maximum absorption has been reached, the manhole shall be filled to the original level. After 1 hour has elapsed, the Contractor shall record the difference in the level in terms of gallons.

The 24-hour loss shall then be computed. If the pipe line system and manholes fail to meet test requirements, the Contractor shall repair leaks at the Contractor's expense. The test shall then be repeated until satisfactory results are obtained.

3) Air Test:

- a) In lieu of the infiltration or exfiltration test for leakage, the Contractor may test the sewers by using low air pressures in accordance with ASTM F1417. The Contractor shall perform the low air pressure test in accordance with the following:
  - (1) The Contractor shall eliminate discernable water leaks and remove debris after backfilling and prior to air testing. Tests shall be conducted from manhole to manhole or from manhole to terminus. No personnel shall be allowed in manholes once testing has begun.
  - (2) The Contractor shall provide securely braced test plugs at each manhole and a suitable means of determining the depth of the ground water level above the inverts immediately before testing.
  - (3) The Contractor shall slowly add air to the portion of the pipe being tested until the internal air pressure is at a test pressure of 4 pounds per square inch above the invert or ground water table, whichever is greater, or until the pressure is equal to the hydraulic gradient, whichever is greater. If the test plug shows leakage, as determined by the COTR, the Contractor shall relieve the pressure for at least 2 minutes. The Contractor shall then disconnect the hose and compressor. If the pressure decreases to 3.5 pounds per square inch, the Contractor shall record the amount of time required for the pressure to drop from 3.5 to 2.5 pounds per square inch. The minimum allowable holding times will be as specified herein. The COTR will not accept pipes that fail to maintain minimum holding times required by ASTM F1417. Any repairs, replacement, and retesting as specified by the COTR shall be performed at the Contractor's expense. If low air pressure tests are used, the manholes shall be tested by exfiltration. Inflatable stoppers shall be used to plug all lines into and out of the manhole being tested. The stoppers shall be positioned in the lines far enough from the manhole to ensure testing of those portions of the lines not air tested. The manhole shall then be filled with water to the top and a 12-hour soaking period shall be allowed prior to test measurement. The manhole shall be refilled to a mark, and at the end of 1 hour, the amount of leakage shall be measured. Leakage shall not exceed 1/2 gallon per hour. If the manhole fails to comply with the test requirements, the Contractor shall repair leaks at the Contractor's expense. The

test shall then be repeated until satisfactory results are obtained.

- 4) Existing Pipe Offsets will not be subjected to hydrostatic pressure testing unless specified on the plans. After installation and connection to the existing mains, the offset shall be placed in service and left uncovered for visual inspection by the COTR for at least 2 hours. Visible leaks shall be repaired to the satisfaction of the COTR prior to acceptance of the offset. The Contractor shall disinfect offset of existing pipe for water mains in accordance with AWWA C-651, Section 9.

#### PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specifications Section 520 Water and Sanitary Sewer Facilities for measurement and payment of the following items, including VDOT Standard and non-standard items:
  1. Sanitary Sewer Pipe
  2. Sanitary Sewer Force Mains
  3. Sanitary Sewer Lateral Connections
  4. Sanitary Drop Connections
  5. Sanitary Sewer Manholes, frames and covers and watertight frames and covers
  6. Sewer cleanouts
  7. Offsetting existing pipe
  8. Leak detectors
  9. Concrete
  10. Flowable Backfill
  11. Excavation and replacement of pavement
- B. Testing and inspection of sanitary sewers and pipe rehabilitation is considered incidental to construction and no additional payment will be made.

END OF SECTION 333100

## SECTION 334200 - STORMWATER CONVEYANCE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

A. Contract Drawings and general provisions of the Contract.

1. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 302 – Drainage Structures, Section 501 – Underdrains, Crossdrains, and Edgedrains and Section 510 – Relocating or Modifying Existing Miscellaneous Items.
2. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).
3. City of Alexandria Design and Construction Standards, latest edition.
4. ACPA Concrete Pipe Installation Manual, latest edition.
5. All inlets and outlet protection to be in compliance with VDOT drainage manual and VESCH.

B. American Society for Testing and Materials (ASTM):

1. ASTM A74 Standard Specification for Cast Iron Soil Pipe and Fittings
2. ASTM A536 Standard Specification for Ductile Iron Castings
3. ASTM C76 Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
4. ASTM C443 Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
5. ASTM C478 Specification for Precast Reinforced Concrete Manhole Sections
6. ASTM C890 Standard Specification for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
7. ASTM C891 Standard Practice for Installation of Underground Precast Concrete Utility Structures
8. ASTM C923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
9. ASTM C913 Standard Specification for Precast Concrete Water and Wastewater Structures

10. ASTM C990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
11. ASTM C1173 Standard Specification for Flexible Transition Couplings for Underground Piping Systems
12. ASTM C1479 Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
13. ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
14. ASTM D3034 Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
15. ASTM D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
16. ASTM D5926 Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems
17. ASTM F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
18. ASTM F679 Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
19. ASTM F1417 Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air
20. ASTM F1668 Standard Guide for Construction Procedures for Buried Plastic Pipe
21. ASTM F1760 Standard Specification for Coextruded Poly Vinyl Chloride (PVC) Non-Pressure Pipe Having Reprocessed-Recycled Content

C. American Society of Mechanical Engineers (ASME):

1. ASME A112.36.2M

D. American Water Works Association (AWWA)

1. AWWA C 110 Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and Other Liquids

1.2 SUMMARY

- A. This section covers stormwater connections and related piping, as indicated in the Contract Documents and specified herein.
- B. Section Includes:



1. Storm drainage piping and fittings.
2. Underdrains.
3. Manholes.
4. Frame & Covers.
5. Inlets.
6. Headwalls/End Treatments.
7. Catch basins.
8. Removal of existing pipes.

C. Related Requirements:

1. Section 033000 Cast-in-Place Concrete for concrete materials, reinforcement, mixture design, and placement.
2. Section 311000 Site Clearing for site clearing and removal of above- and below-grade site improvements not part of pavement removal.
3. Section 312000 Earth Moving for execution of excavation, backfill procedures and compaction standards for structural stability.

1.3 DEFINITIONS

- A. ACPA: American Concrete Pipe Association
- B. PVC: Polyvinyl Chloride Plastic
- C. RCP: Reinforced Concrete Pipe
- D. HDPE: High Density Polyethylene
- E. BMPs: Best Management Practices

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Before commencing work, the Contractor must provide data sheet from the material manufactures confirming the specification requirements and submitted for the approval by the COTR.
- B. Leakage Testing Plan
- C. Test results of tests required by this Section.
- D. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.
3. Stormwater BMPs: Include plans, elevations, sections, details, design calculations, installation, and maintenance.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1-inch equals 20 feet and vertical scale of not less than 1-inch equals 4 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
- C. Product Certificates: For each type of pipe and fitting, from manufacturer.
- D. Field quality-control reports.

#### 1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

#### 1.7 FIELD CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by City or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:
  1. Notify the COTR no fewer than two weeks in advance of proposed interruption of service.
  2. Do not proceed with interruption of service without the COTR's written permission.
  3. Storm pipe shall ensure positive slope and maintain a minimum velocity of 3 feet per second during a 2-year frequency storm or a minimum of 0.5% slope, whichever is greater slope. A minimum drop across the structure of 0.1' shall be provided in all drainage structures.
  4. Minimum size of pipe to be used outside of the VDOT right-of-way must be 12 inches diameter where the distance between access openings is 50 feet or less and 15 inches diameter where access openings exceed 50 feet. The minimum size of pipe permitted within the VDOT right-of-way is 15 inches unless it is the initial pipe in the system or as a lateral line when necessary. The initial pipe or lateral line in the VDOT right-of-way may be 12 inches if there is 50 feet or less between access points.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Handle manholes, catch basins, and stormwater inlets according to manufacturer's written rigging instructions.

## PART 2 - PRODUCTS

### 2.1 CONCRETE PIPE AND FITTINGS

- A. Source Limitations: Obtain concrete pipe and fittings from single manufacturer.
- B. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C76, Class III, with gasketed joints
  - 1. Gaskets: ASTM C443, rubber.

### 2.2 PVC PIPE AND FITTINGS

- A. Source Limitations: Obtain PVC pipe and fittings from single manufacturer.
- B. PVC Sewer Pipe and Fittings:
  - 1. PVC Sewer Pipe and Fittings, 15" and Smaller: ASTM D3034, SDR 26, gasketed joints.
  - 2. PVC Sewer Pipe and Fittings, 18" to 60" ASTM F679, wall thickness, bell and spigot for gasketed joints.
  - 3. Gaskets: ASTM F477, elastomeric seals.

### 2.3 PIPE REMOVAL

- A. Backfill: shall be approved material and compacted as specified in Section 312333 Trenching and Backfilling.

### 2.4 TRANSITION COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
  - 1. For Concrete Pipes: ASTM C443, rubber.
  - 2. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
  - 3. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.
- C. Ring-Type, Flexible Couplings:
  - 1. Source Limitations: Obtain ring-type, flexible couplings from single manufacturer.

2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

## 2.5 MANHOLES

### A. Standard Precast Concrete Manholes:

1. In accordance with the City of Alexandria Design and Construction Standards, latest revision or as indicated on the Contract Drawings.

### B. Designed Precast Concrete Manholes:

1. Description: ASTM C913; designed in accordance with ASTM C890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C990, bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C923, cast or fitted into manhole walls, for each pipe connection.
5. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
6. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

- ### C. Manhole Frames and Covers:
- In accordance with the City of Alexandria Design and Construction Standards, latest revision or as indicated on the Contract Drawings. Manhole cover in area where pedestrian will walk shall be provided with slip resistant cover.

## 2.6 STORMWATER INLETS

- ### A. Curb Drop Inlets:
- In accordance with the City of Alexandria Design and Construction Standards, latest revision or as indicated on the Contract Drawings.
- ### B. Standard Drop Inlets:
- In accordance with the City of Alexandria Design and Construction Standards, latest revision or as indicated on the Contract Drawings.
- ### C. Modified Drop Inlets:
- In accordance with the City of Alexandria Design and Construction Standards, latest revision or as indicated on the Contract Drawings.
- ### D. Yard Inlets:
- In accordance with the City of Alexandria Design and Construction Standards, latest revision or as indicated on the Contract Drawings.

- E. Frames and Cover: In accordance with the City of Alexandria Design and Construction Standards, latest revision or as indicated on the Contract Drawings. Inlets cover in area where pedestrian will walk shall be provided with slip resistant cover.

## 2.7 HEADWALLS/END TREATMENTS

- A. Headwalls: In accordance with the VDOT Road and Bridge Standards and Specifications.
- B. Endwalls: In accordance with the VDOT Road and Bridge Standards and Specifications.
- C. Flared End-Sections: In accordance with the VDOT Road and Bridge Standards and Specifications.

## 2.8 CLEANOUTS

- A. Cast-Iron Cleanouts:
  - 1. Source Limitations: Obtain cast-iron cleanouts from single manufacturer.
  - 2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top loading classifications according to the following applications,
    - a. Light Duty: In earth or grass foot-traffic areas.
    - b. Medium Duty: In paved foot-traffic areas.
    - c. Heavy Duty: In vehicle-traffic service areas.
    - d. Extra-Heavy Duty: In roads.
- B. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings. PVC Cleanouts:
  - 1. Source Limitations: Obtain PVC cleanouts from single manufacturer.
  - 2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to clean out of same material as sewer piping.
    - a. Light Duty: In earth or grass foot-traffic areas.
    - b. Medium Duty: In paved foot-traffic areas.
    - c. Heavy Duty: In vehicle-traffic service areas.
    - d. Extra-Heavy Duty: In roads.

## 2.9 CATCH BASINS

- A. Standard Precast Concrete Catch Basins: In accordance with the VDOT Road and Bridge Standards and Specifications.
- B. Frames and Grates:
  - 1. In vehicle-traffic areas: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include flat grate with small, square or short-slotted drainage openings.
  - 2. Non-vehicle-traffic areas: In accordance with the VDOT Road and Bridge Standards and Specifications.
  - 3. In foot-traffic areas: In compliance with ADA Standards and Guidelines.

### PART 3 - EXECUTION

#### 3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 312000 Earth Moving.

#### 3.2 UTILITY LOCATION

- A. Prior to any utility installation work commencing, Contractor shall call Miss Utility of Virginia to locate all utilities.

#### 3.3 PIPING INSTALLATION

- A. General Locations and Arrangements: Contract Drawings indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation or pipe cutting is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, non-pressure drainage piping in accordance with the following:
  - 1. Install piping pitched down in direction of flow.

2. Install PVC sewer piping in accordance with ASTM D2321 and ASTM F1668.
3. Install reinforced-concrete sewer piping in accordance with ASTM C1479 and ACPA's Concrete Pipe Installation Manual.
4. Refer to VDOT Specification Section 501 for installation of underdrains, crossdrains, and edgedrains.

#### 3.4 PIPE REMOVAL

- A. When specified, remove and dispose of existing pipes as indicated on the Contract Drawings.
- B. Place backfill in voids with approved material on subgrade that is free of mud, frost, snow, or ice.
- C. Place and compact initial and final backfill as specified in Section 312333 Trenching and Backfilling.

#### 3.5 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants in accordance with ASTM C891.
- C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements, sidewalks, and paths. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.
- E. Adjust existing frames and covers, as indicated. Refer to VDOT Specification Section 510.

#### 3.6 STORMWATER INLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Adjust existing inlets to grade, indicated. Refer to VDOT Specification Section 510

#### 3.7 ABANDONED MANHOLES AND PIPING

- A. Manholes and Piping: In accordance with the City of Alexandria Design and Construction Standards, latest revision or as indicated on the Contract Drawings.
- B. Comply with all OSHA confined space requirements while working within existing manholes and structures.
- C. When the limit of the abandonment terminates in an existing manhole to remain, the flow line in the bench of the manhole to the abandoned line shall be filled with concrete and shaped to maintain the flowline of the lines to remain.

### 3.8 FIELD QUALITY CONTROL

#### A. Internal CCTV Inspection of Storm Sewers:

1. Inspect interior of piping using a color closed-circuit television (CCTV) camera to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
2. Inspect storm sewers.
3. Provide the COTR with videos, DVD format or on Flash Drive, and written logs to document the internal CCTV inspection:
  - a. Written logs must note the location of sewer laterals and pipe deficiencies by distance from the upstream manhole.
  - b. The video shall include audio commentary regarding the sewer condition.
4. The COTR will review the videos and written logs to verify that the storm sewers were constructed in accordance with the Contract Documents.
5. The videos must verify that the storm sewers are clean and free of sediment and debris to the satisfaction of the COTR. Storm sewers not satisfactorily cleaned shall be promptly cleaned and reinspected by color closed-circuit television (CCTV) camera.
6. CCTV inspection shall be completed, documentation of inspection shall be provided, and COTR shall determine that the sewers were constructed in accordance with the Contract Documents before payment for completed sections of storm sewer will be recommended.

#### B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:
  - a. Exception: Piping with soil tight joints unless required by authorities having jurisdiction.
  - b. Option: Test plastic piping in accordance with ASTM F1417.



6. Leaks and loss in test pressure constitute defects that must be repaired.
7. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

### 3.9 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

## PART 4 - MEASUREMENT AND PAYMENT

- A. See VDOT Specification Section 302 – Drainage Structures, for Measurement and Payment for of the following items, including VDOT Standard and non-standard items:
  1. Pipe
  2. Manhole
  3. Frames and Cover
  4. Standard drop inlet
  5. Endwall
  6. Catch basins
- B. See VDOT Section 501 – Underdrains, Crossdrains, and Edgedrains, for Measurement and Payment for the following items, including VDOT Standard and non-standard items:
  1. Underdains
  2. Outlet pipe
- C. See VDOT Section 510 – Relocating or Modifying Existing Miscellaneous Items, for Measurement and Payment for the following items, including VDOT Standard and non-standard items:
  1. Removal of existing pipe
    - a. Removal of existing pipe shall be measured and paid for at the contract unit price per linear foot.
- D. Modified inlets will be measured and paid for at the contract unit price per each installed and shall be full compensation for complete installation in accordance with the Contract Documents. The price shall include all labor, materials, equipment, tools and incidentals necessary to complete work.
- E. Testing and inspection of storm sewers and pipe rehabilitation is considered incidental to construction and no additional payment will be made.

END OF SECTION 334200

## SECTION 337116 – ELECTRICAL POLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
  - 1. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 700 – General and Section 703 – Traffic Signals.
  - 2. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Furnishing and installing guy wires for overhead wooden utility poles to obtain clearance to sidewalks, accessible pedestrian routes, and/or shared use paths.

#### 1.3 PREINSTALLATION MEETING

- A. Project Stakeout
  - 1. Unless otherwise indicated, conduct stakeout at Project site.
  - 2. This meeting shall occur after the notice to proceed, prior to commencing any work. No work shall proceed before the stakeout is approved by the COTR.
  - 3. The Contractor shall have the utilities marked by MISS UTILITY prior to the meeting.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Data Sheet
  - 1. Including preparation instructions and recommendations, installation procedures, and recommended environmental conditions for approval.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Store guy wire, anchors, extension poles, and incidentals according to the manufacturer's written recommendations.

### PART 2 - PRODUCTS

#### 2.1 ANCHORS, GUY WIRES AND EXTENSION POLE

- A. Source Limitations: Obtain guy wire anchors, wires, and extension poles from a single manufacturer.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install guy wires, anchors, and guy wire extension poles at locations per the Contract Drawings.
  - 1. Refer to VDOT Specification Section 703 – Traffic Signals for guy wire vertical and lateral clearances.
- B. Install guy wires, anchors and guy wire extension poles per the Manufacturer's Recommendations.

### PART 4 - MEASUREMENT AND PAYMENT

- A. For the following items, payment shall include full compensation for all labor, materials, equipment, tools, and incidentals necessary for providing fully functional system.
  - 1. Guy Wire shall be measured and paid for at the contract unit price per linear foot installed and shall be full compensation for complete installation in accordance with the Contract Documents.
  - 2. Guy Wire Anchors shall be measured and paid for at the contract unit price per each installed and shall be full compensation for complete installation in accordance with the Contract Documents.
  - 3. Guy Wire Extension Poles shall be measured and paid for at the contract unit price per each installed and shall be full compensation for complete installation in accordance with the Contract Documents.
  - 4. Removal of existing guy wires, anchors, and extension poles, as specified in the Contract Documents, shall not be measured and paid for but are incidental to work performed.

END OF SECTION 337116

## SECTION 338000 – COMMUNICATIONS UTILITIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
  - 1. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 700 – General and Section 703 – Traffic Signals.
  - 2. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Offsetting flexible communications and telecommunications conduit per the Contract Drawings a maximum of 3-ft horizontal or 3-ft vertically.
  - 2. This section does not include total relocations of communications and telecommunications lines. Fully relocations will be performed by the respective utility owners.

#### 1.3 PREINSTALLATION MEETING

- A. Project Stakeout
  - 1. Unless otherwise indicated, conduct stakeout at Project site.
  - 2. This meeting shall occur after the notice to proceed, prior to commencing any work. No work shall proceed before the stakeout is approved by the COTR.
  - 3. The Contractor shall have the utilities marked by MISS UTILITY prior to the meeting.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Data Sheet
  - 1. Including preparation instructions and recommendations, installation procedures, and recommended environmental conditions for approval.

### PART 2 - PRODUCTS

N/A

### PART 3 - EXECUTION

3.1 OFFSETTING FLEXIBLE COMMUNICATIONS AND TELECOMMUNICATIONS CONDUIT

- A. Prior to unearthing conduit to offset, contact the respective utility owner to inform them of the proposed offset. Ensure that a representative of the utility company is onsite prior to any offsetting, if required by the utility company. Contact adjacent utility owners that are in the direct vicinity of conduit that is to be offset.
  - 1. No service interruptions shall be made without the written permission of the respective utility owner.
- B. The Contractor shall have the utilities marked by MISS UTILITY prior to any earth disturbing activity.
- C. Stakeout the conduit that is to be offset per the Contract Drawings.
- D. Locate the nearest manholes, handholes and/or junction boxes both upstream and downstream of the proposed offset conduit to confirm enough slack is provided in the communications and telecommunications wiring.
- E. Carefully excavate around the existing conduit that is to be offset and conduit's new location, ensure not to impact any existing utilities with the vicinity. Support and protect all adjacent utilities as necessary. Damage to any adjacent utility shall be repaired by the Contractor immediately at the Contractor's expense.
- F. During excavation, if any unmarked utility is unearthed, stop immediately and contact the COTR.
- G. Once the existing conduit is uncovered, inspect the conduit for existing damage or defects. Repair the any existing damage per the recommendations of the utility owner.
- H. Offset the existing communications and telecommunications conduit per the Contract Drawings, in the presence of the utility owner, ensuring not to damage the existing conduit. Confirm all clearance requirements for the conduit are met prior to backfilling.
- I. Completely backfill and cover the offset conduit, compacting carefully and restore the area to its existing conditions, as indicated by the COTR.

PART 4 - MEASUREMENT AND PAYMENT

- A. Offsetting communications and telecommunications conduit shall be measured and paid for at the contract unit price per linear foot, as indicated in the Contract Drawings, and shall be full compensation for all labor, materials, equipment, tools and incidentals necessary complete the work.
- B. Excavation and area restoration will not be paid separately and is considered incidental to the work required for offset conduit.

END SECTION 338000

## SECTION 344113 - TRAFFIC SIGNALS

### PART 5 - GENERAL

#### 5.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Manual on Uniform Traffic Control Devices, 2009 or latest edition with Revisions when adopted by the City of Alexandria.
- C. Virginia Work Area Protection Manual, Standards and Guidelines, 2011 with latest Revisions.
- D. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications), Section 700 – General, Section 703 – Traffic Signals, and Section 803 – CCTV Video Equipment.
- E. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).
- F. National Transportation Communications for Intelligent Transportation Systems Protocol (NTCIP).

#### 5.2 SUMMARY

- A. Section includes:
  - 1. Furnishing and installing traffic control devices and traffic signal equipment in accordance with VDOT Road and Bridge Specifications and Standards.
- B. Related Requirements:
  - 1. Section 033000 Cast-in-place concrete for signal pole concrete foundations.
  - 2. Section 101453 Traffic Signage for sign panels included on traffic signal equipment.
  - 3. Section 260500 Common work results for furnishing and installing electrical equipment.
  - 4. Section 260519 Low-voltage electrical power conductors and cables for furnishing, installing, and testing low voltage (600 volt) wire and cable.
  - 5. Section 260543 Underground conduits for electrical systems for furnishing and installing underground conduit and junction boxes.
  - 6. Section 312000 Earth Moving for execution of excavation, backfill procedures, and compaction standards for structural stability.

#### 5.3 PREINSTALLATION MEETINGS



A. Project Stakeout:

1. Unless otherwise indicated, conduct stakeout at Project site.
2. This meeting shall occur after the notice to proceed, prior to any work. No work shall proceed before the stakeout is approved by the COTR.
3. The Contractor shall have the utilities marked by MISS UTILITY prior to the meeting.

5.4 SUBMITTALS

A. Product Data Sheets:

1. Including: preparation instructions and recommendations, finishes, installation procedures, and recommended environmental conditions for approval.
2. Submit certification that products furnished comply with requirements and are recommended by manufacturer for uses indicated for approval.

PART 6 - PRODUCTS

6.1 MATERIALS

A. The following traffic signals and traffic control devices materials shall conform to the VDOT Road and Bridge Specifications:

1. Concrete foundations
2. Electrical service
3. Electrical service grounding electrodes
4. Electrical service work pads
5. Mast arm signal poles
6. Mast arms
7. Pedestal poles
8. Conductor cables and equipment grounding conductor (EGC)
9. Conduit
10. Junction boxes
11. Test bores
12. Remove existing sign panel
13. Relocate existing sign panel

14. Remove existing pole
15. Remove existing foundation
16. Remove existing signal head
17. Remove existing controller
18. Remove existing junction box
19. Relocate existing signal head
20. Traffic control cabinets
21. Local controller
22. Traffic signal head section
23. Pedestrian signal head
24. Hanger assembly
25. Video detection system
26. Video detection camera
27. Video detection cable
28. Emergency vehicle preemption detection system
29. Emergency vehicle preemption detector cable
30. Pedestrian actuation
31. CCTV video equipment

## 6.2 CITY SPECIFIC EQUIPMENT

### A. ATC Controller Cabinet

1. The City of Alexandria currently uses Mobotrex ATC Cabinet (P44).
2. Cabinet shall include a shelf-mount configuration.

### B. Signal Controller

1. The City of Alexandria currently uses Yunex M60 Controller.

### C. Switches

1. See Section 272100 Data Communications Network Equipment.

D. Transit Signal Heads

1. Transit signals shall comply with the VDOT Road and Bridge Specifications for traffic signal heads.
2. Transit signal heads shall include light emitting diode (LED) displays.
3. Transit signal heads shall consist of a vertical “go” aspect, a triangular “yield” display, and a horizontal “stop” aspect.

PART 7 - EXECUTION

7.1 INSTALLATION

- A. All components integral to the installation of traffic signals and traffic control devices shall be installed per VDOT Specifications Section 700 – General, 703 – Traffic Signals, Section 803 – CCTV Video Equipment and these City of Alexandria Specifications.

PART 8 - MEASUREMENT AND PAYMENT

- A. See VDOT Specifications Section 700 – General, Section 703 – Traffic Signals, and Section 803 – CCTV Video Equipment for measurement and payment.
- B. Transit signal heads shall be measured and paid according to the traffic signal head pay item in VDOT Specifications Section 703.

END OF SECTION 344113

## SECTION 344114 - TRANSIT SIGNAL PRIORITY (TSP) SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Contract Drawings and general provisions of the Contract.
- B. Manual on Uniform Traffic Control Devices, 2009 or latest edition with Revisions when adopted by the City of Alexandria.
- C. Virginia Work Area Protection Manual, Standards and Guidelines, 2011 with latest Revisions.
- D. Virginia Department of Transportation, Road and Bridge Specifications, 2020 with latest Revisions (VDOT Specifications).
- E. Virginia Department of Transportation, Road and Bridge Standards, 2016 with latest Revisions (VDOT Standards).
- F. National Transportation Communications for Intelligent Transportation Systems Protocol (NTCIP).
- G. Americans with Disabilities Act (ADA).

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Furnishing, installing, programming, integrating, and performing acceptance testing for a full turnkey distributed Transit Signal Priority (TSP) system and TSP equipment upgrades at seventeen (17) intersections. TSP will enable the Alexandria Transit Company's (DASH) buses and Washington Metropolitan Area Transit Authority (WMATA) buses an early green light or extended green light through the use of a multimode phase selector. DASH buses will utilize 2.4 GHz radio and GPS communication to transmit priority messages between the transit vehicle and the traffic signal. WMATA buses will utilize cellular antennae and modems to transmit priority messages between the transit vehicle and the traffic signal over a dedicated cellular network. This project's primary components include installation of TSP equipment at the following seventeen (17) intersections.

- a. South Van Dorn Street and Eisenhower Avenue
  - b. South Van Dorn Street and Metro Road (new intersection)
  - c. South Van Dorn Street and Courtney Avenue
  - d. South Van Dorn Street and Pickett Street
  - e. South Van Dorn Street and Van Dorn Plaza
  - f. South Van Dorn Street and Stevenson Avenue
  - g. North Van Dorn Street and Holmes Run Parkway
  - h. North Van Dorn Street and Taney Avenue<sup>2</sup>
  - i. North Van Dorn Street and Richenbacher Avenue<sup>2</sup>
  - j. North Beauregard Street and Reading Avenue
  - k. North Beauregard Street and North Highview Lane
  - l. North Beauregard Street and Mark Center Drive
  - m. North Beauregard Street and Seminary Road<sup>1</sup>
  - n. North Beauregard Street and West Braddock Road<sup>2</sup>
  - o. North Beauregard Street and Rayburn Avenue<sup>2</sup>
  - p. Seminary Road and Mark Center Avenue<sup>2</sup>
  - q. North Beauregard Street and Fillmore Avenue<sup>2</sup>
2. For this project, Transit Signal Priority will require hardware (phase selector and harness, 2.4 GHz radio/GPS and receiver, cellular modem, cellular antenna, and auxiliary interface panel, as indicated) modifications to the traffic signal controller cabinet to allow TSP operation to operate effectively with the existing signal timing and phasing.
  3. There shall be no hardware or software modifications made to the DASH or WMATA buses under this contract.
- B. Related Requirements:
1. Section 344113 Traffic Signals for traffic signal equipment.
- 1.3 TSP OPERATION
- A. The TSP system shall utilize vehicle equipment and intersection equipment to communicate low priority requests for DASH and WMATA buses.
  - B. The TSP system shall provide automated signal priority requests and servicing without requiring operator activation. The traffic signal controller shall be solely responsible for the priority routine granted.
  - C. For DASH TSP operation, the priority vehicle equipment shall acquire positioning data via GPS satellite. With the positioning data and calculated heading and speed, the priority vehicle shall

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<sup>1</sup> Existing phase selector proposed to be upgraded to multimode model; maintain existing WMATA cellular antenna and modem and install DASH TSP components.

<sup>2</sup> Intersection features existing WMATA TSP equipment; remove existing WMATA TSP hardware, upgrade WMATA TSP components in accordance with these specifications, and install DASH TSP components.

broadcast a message via 2.4 GHz transceiver to the intersection equipment upon approach to the intersection. The message shall contain, at minimum, position (location), heading, speed, vehicle ID, and the priority request.

- D. For WMATA TSP operation, the bus priority request generator shall send a priority request via dedicated and secure 4G/FirstNet-capable cellular network. The message shall contain, at minimum, position (location), heading, speed, vehicle ID, and the priority request.
- E. For DASH TSP, a pole-mounted, intersection radio/GPS unit at the intersection shall receive the radio transmission from DASH vehicle equipment and transmit those messages to the multimode Phase Selector housed in the traffic controller cabinet. The Phase Selector shall compare the information received from the vehicle to the parameters stored in its memory and activate a priority request output with vehicle messages that correspond to the programmed parameters. The active Phase Selector priority request shall be input to the traffic signal controller as a low priority input.
- F. For WMATA TSP, a cabinet-mounted, intersection cellular antenna at the intersection shall be wired to an in-cabinet 4G/FirstNet-capable cellular modem. The intersection cellular equipment shall receive TSP messages from WMATA vehicle equipment and transmit those messages to the multimode Phase Selector housed in the traffic controller cabinet. The Phase Selector shall compare the information received from the vehicle to the parameters stored in its memory and activate a priority request output with vehicle messages that correspond to the programmed parameters. The active Phase Selector priority request shall be input to the traffic signal controller as a low priority input.
- G. TSP hardware, firmware, and ancillary equipment procured under this scope of work shall be compatible with existing TSP equipment owned and/or operated by the City of Alexandria, DASH, and WMATA.

#### 1.4 REFERENCES

- A. Within these Project Technical Specifications, the Department refers to the Virginia Department of Transportation, and the City refers to the City of Alexandria.
- B. The Contractor shall conform to these Project Technical Specifications and the Virginia Department of Transportation (VDOT) Road and Bridge Specifications, dated 2020, hereinafter referred to as the “Road and Bridge Specifications” and all applicable revisions, the VDOT Road and Bridge Standards, dated 2016, revised 2022, and all revisions and supplements listed in these Project Technical Specifications. The Contractor shall conform to the Virginia Work Area Protection Manual (VWAPM), dated 2011, revised 2020, conform to the 2009 edition of the FHWA Manual of Uniform Traffic Control Devices (MUTCD).

Additionally, the Contractor shall comply with the following documentation as applicable:

- 1. National Transportation Communications for Intelligent Transportation Systems Protocol (NTCIP) (where indicated in these Special Provisions), and
- 2. Americans with Disabilities Act (ADA).

- C. The Contractor shall furnish materials and workmanship conforming to the National Electric Code (NEC), National Electric Safety Code (NESC), Underwriters Laboratories (UL), or other listing agencies approved by the Virginia Department of Insurance, and all local safety codes in effect on the date of advertisement. The Contractor shall comply with Code of Virginia regarding the licensing of electrical contractors. The Contractor shall comply with the Contract Drawings, all previously referenced specifications, and all applicable local ordinances and regulations before and during all stages of the work.
- D. When required by the local ordinances and governmental agencies, upon completion of the work, the Contractor shall have all systems inspected and approved in writing by the authorized governmental electrical inspector for the area. The Contractor shall furnish written certification of the authorized inspector's approval to the COTR. Inspection by the authorized governmental electrical inspector shall neither eliminate nor take the place of the inspections by the COTR. Upon the COTR's receipt of written certification and the Contractor's written request for a final inspection of the installations, the COTR shall perform a final inspection.
- E. Where required, all work shall conform to ITE, AASHTO, and ASTM standards in effect on the date of advertisement. The Contractor shall notify the COTR and affected local utility companies seven (7) business days before operational shutdowns to coordinate connection or disconnection to an existing utility or system, unless otherwise instructed herein.

#### 1.5 COORDINATION WITH OTHERS

- A. The Contractor shall coordinate with DASH and with WMATA through the completion of implementation, testing, and evaluation as specified in the Summary of Work. It is the Contractor's responsibility to schedule activities involving DASH and WMATA with sufficient lead time to adjust the schedule as necessary for timely completion of work.
- B. The Contractor is advised to take into consideration the fact that other contracts have been, will be, or may be let to work in the vicinity of the project area. The Contractor shall coordinate and cooperate fully with all others to eliminate or curtail delays and interference to City of Alexandria TSP implementation, including design of TSP intersection parameters (on-board bus configuration done by others), configuration of the traffic controller for TSP operation, and configuration of the TSP Central Management Software (TSP Central Management Software configuration done by others). The Contractor shall perform the Work so as not to cause interference with others or to conflict with performance of traffic maintenance by others. The City assumes no liability for contract delays or costs resulting from performance or non-performance of others. The City will not consider any claims for compensation due to the delay, other than written authorized time extension.

#### 1.6 QUALITY ASSURANCE

- A. The Contractor shall develop a quality control program specific to TSP implementation outlining responsibilities of the Contractor and submit it to the City Engineer for review and approval within ten (10) working days after issuance of a Notice to Proceed (NTP). The quality control program shall refer to resources that identify QA/QC responsibilities of the City of Alexandria to monitor the contractor's progress and compliance with City requirements. The quality control program shall also include QA/QC procedures for reviewing contractor submittals, shop drawings/plan revisions, coordination with DASH, WMATA, and the City

methodology, and City staff participation and responsibilities during the testing and inspection stage

- B. The Contractor shall be required to resubmit a quality control program that has not been approved by the City Engineer within seven (7) calendar days for approval, unless otherwise noted. The Contractor shall follow the approved quality control program for the duration of the contract. The Contractor shall not order equipment and/or materials without an approved quality control program.
- C. Any deviations from the contract plans shall be submitted for approval by the COTR. At a minimum the quality control program shall include:
  - 1. Key staff for the project and assigned responsibilities.
  - 2. Quality control review milestones.
  - 3. Delivery time based on project schedule.

#### 1.7 WARRANTIES

- A. Warranty shall include technical on-site support for products during project construction through a period of at least one (1) year from date of final acceptance for the system. Technical support includes, but is not limited to:
  - 1. On-site diagnosis for all parts and labor necessary or incidental to repair defective equipment or workmanship and malfunctions that arise during the warranty period.
  - 2. Assist and aid in troubleshooting from related issues.
  - 3. Provide ongoing no-cost firmware upgrades (to meet/adhere the most recent published SAE, IEEE, and USDOT standards/specifications).
  - 4. Provide installation how-to/documentation.
  - 5. Configuration how-to/documentation.
  - 6. Firmware Release Notes.
- B. In the event of defects or failures in said equipment, or other items, or workmanship or any part thereof, then upon receipt of notice thereof from the City, the Contractor's warranty obligations for all hardware and software required for operation shall be to repair or replace and make operational all System components within 72 hours of being notified of the condition.
- C. Additional obligations of Contractor to remedy defects shall extend through the manufacturer's warranty period to a date up to five (5) years after the completion of the contract and approval of testing for all equipment including, but not limited to hardware, software, firmware, materials, systems, subsystems, cabling, and wiring furnished and installed under this Contract.



- D. During the five (5) year manufacturer's warranty period, the Contractor shall bare all costs of replacement of any equipment damaged inside the cabinet as a result of any leaking related to antenna mounting, as applicable to cabinet-mounted antennas only. Additionally, any damage to the traffic signal controller, and/or traffic signal cabinet components as a result of system installation, shall be fully replaced, installed, and made operational at the full cost of the Contractor during the warranty period. Any malfunctions and damages within the traffic signal cabinet will be subject to COTR investigation.
- E. The provisions of this section shall not operate to deprive the City of other rights the City may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor as provided by law or under the requirements of the Contract Documents.
- F. Contractor warrants and represents that all equipment and the other items including the hardware, software, firmware and other items supplied to the City hereunder and all workmanship shall be in accordance with this Contract, shall be fully fit for performance and shall operate in accordance with the requirements of the Contract Documents. The Contractor guarantees that all equipment and other items to be supplied meet original manufacturer's specifications. The Contractor guarantees all equipment and other items to be supplied and workmanship against defects or failures in workmanship and materials, excepting to the extent of defects or failures which the Contractor demonstrates to the satisfaction of the COTR have arisen by reason of accident, abuse or negligence or fault of the City, its agents, employees, Licensees, or invitees, and not due to fault on the Contractor's part.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. The Contractor shall furnish new equipment, materials, and hardware unless otherwise required. The Contractor, at the guidance of the City of Alexandria, shall inscribe the manufacturer's name, model number, serial number, and any additional information needed for proper identification on each piece of equipment housed in a case or housing.
- B. The VDOT Pre-Approved Traffic Control Device Listing (PATCDL) is available on the Virginia Department of Transportation's website. Certain signal and communications equipment, material, and hardware shall be pre-approved on the PATCDL by the date of installation. Equipment, material, and hardware not pre-approved when required shall not be allowed for use on the project. Consult the PATCDL website, to obtain pre-approval procedures.

### 2.2 MATERIALS

- A. The Phase Selector and Harness shall meet the following requirements:
  - 1. The phase selector shall process the signal from the radio/GPS unit and activate outputs, which are connected to the preemption/priority inputs on the traffic controller.
  - 2. The phase selector shall be accompanied by a harness, or card rack, that interfaces between the phase selector card and cabinet input panel.

3. The phase selector shall be installable in the harness, or, alternatively, in an input file rack within the traffic signal controller cabinet.
  4. The phase selector shall be compatible with existing TSP emitter equipment aboard DASH buses and WMATA buses.
  5. The phase selector shall provide the following features:
    - a. Multimode functionality, receiving communication via 2.4 GHz radio, cellular, and infrared emitters.
    - b. Four channels of detection.
    - c. User-adjustable range setting up to 2,500 feet of operation.
    - d. Compatibility with ATC controllers.
    - e. 10/100Mb ethernet communication on the front panel.
    - f. RS232 communications front port.
    - g. User-selected communications baud rate of 1,200 to 230,400 bits per second.
    - h. Display LED Indicators, including high- and low-priority test calls, reset to default parameters, and range setting.
  6. The phase selector shall be operable on either 120VAC 60Hz or 24 VDC.
  7. The phase selector shall be operable between -34.6°F and +165.2°F (-37°C to +74°C).
  8. The phase selector shall be tested to NEMA environmental and electrical test specifications and be FCC compliant.
- B. The Radio/GPS Unit shall meet the following requirements:
1. The radio/GPS cable shall be compatible with the phase selectors installed as part of this scope of work.
  2. The radio/GPS unit shall:
    - a. Be capable of receiving communication from existing TSP emitter equipment aboard DASH buses.
    - b. Contain a GPS receiver antenna and a 2.4 GHz transceiver with antenna.
    - c. Connect to the phase selector through radio/GPS cabling.
    - d. Detect communication signals out to a distance of up to 2,500 feet.
    - e. Be pole mountable and weather resistant.

- C. The Radio/GPS Cable shall meet the following requirements:
1. The radio/GPS cable shall connect the radio/GPS unit to the phase selector per manufacturer specifications.
  2. The radio/GPS cable shall be compatible with the phase selectors and radio/GPS antennas installed as part of this scope of work.
  3. At each end, the cable shall connect to the 11-pin terminal blocks provided on the radio/GPS antenna and the phase selector
- D. The Cellular Modem shall meet the following requirements:
1. The cellular modem shall connect to the phase selector via ethernet cable.
  2. The cellular modem shall:
    - a. Support AT&T as a carrier
    - b. Be 4G/FirstNet capable
      - 1) Support download and upload speeds of up to 600 Mbps and 150 Mbps, respectively.
      - 2) Be certified by NIST.
      - 3) Feature a 10/100/1000 Ethernet (RJ45) port and three SMA antenna connectors (primary, diversity, GNSS).
      - 4) Feature a 30-channel GPS and GLONASS receiver (Tracking Sensitivity: -160dBm).
      - 5) Not exceed 4.69" x 3.35" x 1.34" in dimension.
      - 6) Operate in temperatures ranging from -40 to +158 degrees Fahrenheit (-40 to +70 degrees Celsius).
    - c. Be compatible with existing TSP emitter equipment aboard WMATA buses.
- E. The Cellular Antenna shall meet the following requirements:
1. The cellular antenna shall be cabinet mounted and connect to the cellular modem housed inside the cabinet via two LTE cables and one GNSS cable.
  2. The cellular antenna shall:
    - 1) Be 4G capable and 5G-ready, covering 617-960 and 1710-6000 MHz. Cellular coverage shall include CBRS (Citizen Band Radio Service) at 3.55-3.7 GHz and Band 71 at 617-698 MHz.

- 2) Be configured for GPS.
- 3) Feature three connector cords - two LTE cables and one GNSS cable – 60” each in length.
- 4) Not exceed a diameter of 5.5” or a height of 2.38”.
- 5) Mount via 7/8” diameter feed through, with a 3/4” long thread for up 1/2” thick surface.
- 6) Operate in temperatures ranging from -40 to +176 degrees Fahrenheit (-40 to +80 degrees Celsius).

F. The Auxiliary Interface Panel (AIP) shall meet the following requirements:

1. The AIP shall provide a connection between the phase selector and traffic signal cabinet wiring.
2. The AIP shall be compatible with the phase selectors installed as part of this scope of work.
3. The auxiliary interface panel (AIP) shall provide the following features:
  - a. Monitor status of green indications for active signal outputs.
  - b. Allow for installations requiring more than four outputs.
  - c. Connect to the face of the phase selector per manufacturer specifications.
4. Wire gauges from 22 to 16 AWG may be used to connect from the AI to the traffic control cabinet wiring. Confirm preferences with City staff prior to installation.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. The Contractor shall call Traffic Computer Specialist Mark Skinger (703) 746-4148 at least 48 hours before beginning any construction work. Ensure that an experienced, IMSA certified, Level II signal technician is standing by to provide emergency maintenance services whenever work is being performed in the proximity of traffic signal controller cabinets and traffic signal controller cabinet foundations. Standby status is defined as being able to arrive, fully equipped, at the work site within 30 minutes ready to provide maintenance services.
- B. The Contractor shall immediately cease work and notify the COTR and affected owners if damage to existing utilities, cables, or equipment occurs. The Contractor shall make all required repairs and replacements at no additional cost to the City. The Contractor shall avoid trimming (i.e., pruning) trees. Removal of trees is strictly prohibited. The Contractor shall maintain access to sidewalks, pushbuttons, ADA ramps, benches, bus stops, etc. during construction unless unavoidable. The Contractor shall conduct any required sidewalk closures in accordance with

the MUCTD and the VWAPM. The Contractor shall deliver “Furnish Only” equipment to the City Signal Shop located at 3200 Colvin Street in Alexandria. The Contractor shall provide the Engineer one (1) full working days’ notice before delivering such equipment.

### 3.2 INSTALLATION

- A. The contractor shall furnish all labor, materials, equipment, tools, services, supervision, and incidentals required to complete the work as shown on the Contract Drawings and as specified herein.
- B. Work under this contract consists of wayside equipment installation, configuration, and evaluation for Transit Signal Priority (TSP) and traffic controller upgrades at 15 signalized intersections operated by the City of Alexandria.
- C. Technical definitions regarding TSP included in this Contract are provided below.
  - 1. Auxiliary Interface Panel – detects green indications from the traffic signal controller and provides additional outputs for the phase selector card to interconnect with the traffic signal cabinet.
  - 2. Phase Selector – Prioritizes the received priority calls and communicates the calls with the traffic signal controller to provide priority.
  - 3. Phase Selector Harness (Dedicated Card Rack) – a stand-alone input file that houses the Phase Selector; serves as connection between the Phase Selector and the traffic controller input wiring
  - 4. Radio/GPS Unit – a pole-mounted, weather-resistant antenna containing a GPS receiver with antenna and 2.4 GHz transceiver with antenna; the antenna receives radio transmission from the vehicle equipment
  - 5. Cellular Modem - provides cellular communication connectivity to the phase selector card to communicate with the TSP central management software and transit vehicles. Model shall be consistent with that used for WMATA’s existing TSP system.
  - 6. Cellular Antenna - detects electronic signals over a wireless cellular network, and facilitates data transmission and reception for the modem over a wireless cellular network. Cellular antenna and modem allow TSP-related information such as signal priority requests, TSP parameters and logs from the phase selector card to be wirelessly transmitted to and from transit vehicles and the central management software. Model shall be consistent with that used for WMATA’s existing TSP system.
  - 7. Fleet Management Software - refers to the Clever Devices bus firmware and/or software that permits configuration of global, intersection-specific, and route-specific Transit Signal Priority (TSP)-related parameters to enable TSP operation.
  - 8. TSP-Enabled Bus – a DASH or WMATA bus equipped with hardware and software installations and configurations necessary to transmit a TSP priority request compatible with corresponding intersection equipment installed under this Scope of Work.

- D. The Contractor shall verify that the installation meets all requirements for a fully operational TSP system, including: recognition in phase selector of a low-priority call transmitted through 2.4 GHz radio/GPS communication for DASH buses and through a 4G/FirstNet capable cellular network for WMATA buses; transmission of the low-priority call from the phase selector card to the ATC Traffic Signal controller; service of the low priority call within the programmed parameters specified in the phase selector and in the traffic controller; and accurate data reporting. TSP operation must also be verified to meet the data quality requirements during System Testing.
- E. The wayside TSP equipment shall operate as a system. That is, compatibility shall be guaranteed between all TSP components and sub-components for the purposes of transmitting TSP messages from a TSP-enabled bus to the traffic signal controller. TSP equipment under this scope of work – phase selector, phase selector harness, AIP, radio/GPS unit, cellular modem, cellular antenna and all necessary and accompanying cabling, wiring, software, firmware, and assemblies – shall be compatible for these purposes.
- F. Under this scope of work, the Contractor shall be required to perform the following tasks:
  - 1. Attend coordination meeting with the City's Project Manager to develop project schedule, including verification testing.
  - 2. Design TSP parameters, including, but not limited to, priority detection zones, conditional priority parameters, Phase Selector channels, headings (as applicable), bus route assignment, and traffic signal controller priority settings, for City of Alexandria. The Contractor shall coordinate with DASH, WMATA, and the City for the establishment of these priority zones and configuration. No TSP parameters shall be configured without prior approval from the City of Alexandria.
  - 3. Program ATC Traffic Controller timings and traffic controller TSP parameters (i.e., priority settings) and bench test ATC Traffic Controllers. The City of Alexandria shall provide existing controller timings for programming.
  - 4. Furnish and install radio/GPS unit; mount and configure on traffic signal pole.
  - 5. Furnish and install radio/GPS cable; route cable from radio/GPS unit to the traffic controller cabinet through existing conduit. Conduit location and capacity is to be field verified prior to installation.
  - 6. Furnish and install cellular antenna; mount on cabinet with all associated data cables.
  - 7. Furnish and install in-cabinet TSP equipment at each intersection in accordance with Contract Plan set and Vendor design standards:
    - a. Radio/GPS unit, mounting equipment, and data cables
    - b. Phase Selector Card, Harness, and associated cables and wiring
    - c. Cellular Modem and associated cables.

- 1) All cellular modem SIM cards shall be provided by WMATA
- d. Auxiliary Interface Panel
  - 1) An Auxiliary Interface Panel shall be installed and configured at all intersections detailed in the Contract drawings in accordance with these Specifications. The Auxiliary Interface Panel shall monitor green indication outputs for all active phases, including non-TSP enabled phases. The Contractor shall coordinate with the product vendor to furnish all Auxiliary Interface Panels required for installation. The City shall not be responsible for the handling, transport, or storage of any Auxiliary Interface Panels prior to installation.
8. Retrofit cabinet to accommodate proposed TSP equipment.
9. Configure Phase Selector and Auxiliary Interface Panel in Traffic Controller Cabinet. Verify equipment functionality in accordance with these Special Provisions and approved testing plans.
10. Configure Central Traffic Signal Management Software on existing City-provided server.
11. Conduct in-field system testing and integration to verify TSP system and signal firmware requirements.
12. Provide for mobilization, demobilization, and field layout.
13. Implement, monitor, and maintain both vehicular and pedestrian traffic for the duration of the construction period. Install and maintain temporary traffic control signs, temporary signalization, pavement markings, barriers, barricades, arrows, and other transition devices as required. Reconfigure devices in conjunction with changes in work area and provide for their removal and disposal upon project completion.
14. Prepare As-Built drawings in conformance with City requirements.
- G. In addition to the above items, any incidental items of work necessary for a complete and finished product are included as part of this contract.
- H. Prior to final acceptance, all Contractor-furnished equipment and software shall successfully complete a 30-day testing Observation Period. The 30-day Observation Period is part of the work included in the total contract time and shall be completed prior to final acceptance of the project. Final acceptance will occur following the successful completion of the 30-day Observation Period and after all documentation requirements have been fully satisfied. Refer to the "System Verification" section of these Project Technical Specifications for additional requirements.
- I. The Contractor shall be fully responsible for protection against damages for the duration of the contract of all utilities, utility structures, private property fencing, walls, and vegetation, and existing sidewalk coping within the contract limits and adjacent thereto. The utilities included but are not limited to public and/or private water, sewer, electricity, gas, communication lines.

Cost of this protective work shall be distributed among the contract pay items. No separate measurement or payment will be made.

### 3.3 TSP PARAMETER DESIGN AND SYSTEM VERIFICATION

#### A. TSP Parameter Design

1. The Contractor shall design all TSP-related parameters for the full functionality of the TSP System. This includes the design of parameters in the following components and their relation to one another in interconnects, as present:
  - a. Traffic Signal Controller Firmware TSP Parameters
    - 1) Priority Phases
    - 2) Lock Out Time
    - 3) Priority Output Delay
    - 4) TSP Check In
    - 5) Early Green
    - 6) Extend Green
    - 7) TSP Reporting Configuration
  - b. Phase Selector Parameters
    - 1) TSP Channels
    - 2) Latitude
    - 3) Longitude
    - 4) Low Priority Outputs
    - 5) Max Call Times
    - 6) Lost Signal Hold Time
    - 7) Off Approach Hold Time
    - 8) Limit Time between Calls
    - 9) Directional Priority
    - 10) Profile Schedule (Time of Day operation)
    - 11) Relative Priority



12) Detection zones

2. Detection Zone Requirements

- a. TSP detection zones shall be located no further in advance than the nearest traffic signal or bus zone. Within this limitation, the detection zones should be located as far in advance as possible to give the signal time to maneuver towards a priority green. DASH TSP operations will utilize GPS systems, which will provide flexibility to move the detection zone under certain conditions. WMATA TSP operations shall utilize latitude/longitude, heading, and TSP start and stop distances to define TSP communication zones. The Contractor shall submit predefined DASH and WMATA TSP detection zones for COTR concurrence.
3. The Contractor shall submit all parameters to the COTR for review. The Contractor shall coordinate with DASH, WMATA, and/or designated representatives during the design of the on-board bus software parameters, as needed. The Contractor shall not be responsible for the programming of parameters on on-board bus equipment.
4. Activities under this Pay Item are for design and coordination only. The Contractor is responsible for programming and configuration of Phase Selector parameters.

3.4 SYSTEM VERIFICATION

A. General

1. The Contractor shall test each item of equipment and software provided or modified under this contract to assure that it is compliant with the technical requirements in this specification and is free of manufacturing and material defects. Commercial-off-the-shelf-equipment and software will not require individual testing, but shall be tested at the subsystem/system level. For each test, the contractor shall submit to the COTR evidence in the form of test reports that the equipment/system has been tested to operate in the stated environment and electrical conditions. The Contractor shall perform additional testing and pre-testing so that these formal tests can be executed smoothly, with minimal failures.

B. System Verification Plan Overview

1. The Contractor shall develop and deliver a system test plan that covers system integration, Factory Acceptance Test (FAT), Operational Readiness Test (ORT), and System Acceptance Test (SAT) testing for the TSP technology and signal hardware, firmware, and software upgrades. The system test plan shall provide an overview of the contractors intended test process and shall include examples of test reports and test failure reports. The system test plan shall identify resources required of the City of Alexandria. It shall also provide a high-level functional summary of the methods used for verifying each function and feature of the hardware, software, and firmware being tested. The system test plan shall be delivered for COTR review and approval 15 days prior to the System Design Review.

2. Within 30 calendar days of the Notice-to-Proceed, the Contractor shall furnish for approval all configuration manuals, user manuals, installation manuals, troubleshooting manuals, system configuration manuals, and maintenance manuals for all equipment installed, integrated and configured under this project. Contractor shall furnish for approval all configuration manuals, user manuals, installation manuals, troubleshooting manuals, system configuration manuals, and maintenance manuals for all equipment installed, integrated, and configured under this project.
3. No testing shall commence until the COTR has reviewed and approved the testing procedure to be conducted. If any of the tests below fail to conform to the outlined requirements, the Contractor shall identify the point of failure. If failure is the result of defective and/or damaged hardware, the Contractor shall replace and reinstall the equipment at no additional cost to prior to retesting.

C. Data Quality Assurance

1. The Contractor is responsible for the provision of accurate reporting of performance data. As part of System Testing, described below, the Contractor shall validate that data is being collected at the maximum efficiency of the technology being utilized, as documented by the manufacturer. The Contractor shall not be paid for installing equipment until the required testing requirements as described below are met or exceeded.
2. All TSP data shall be reviewed and analyzed by the Contractor for valid operation, and documentation, including: generation of appropriate TSP requests by priority vehicles, accurate location of detection zones at each approach, and appropriate traffic controller responses at each approach. TSP data that do not pass review and approval may be subject to further investigation.
3. The Contractor shall provide a time-stamped event summaries, by intersection, that validate operation. One weekday summary and corresponding logs should be provided at the beginning of the ORT and a once a week (weekday) summary every week until the ORT is completed.
4. In addition to data log validation of operation described in the previous paragraph, configuration accuracy and other operational parameters are to be separately verified as required. Examples of data instances in which operation may not be approved include, but are not limited to, the following:
  - a. TSP request sent by the transit vehicle outside of the approved parameters.
  - b. TSP request not sent by the transit vehicle within the approved parameters when a TSP request is the expected outcome.
  - c. TSP request not received by the phase selector when recognition of TSP request on the corresponding phase selector channel is the expected outcome.

- d. TSP request not received by the Traffic Controller from the phase selector when recognition of TSP request on the corresponding Low Priority channel is the expected outcome.
  - e. Data latency from transit vehicle request to recognition by the traffic controller exceeds one (1) second.
  - f. Time stamp indications of detection latency or clock drift.
  - g. Detection zone locations outside of the GPS degree of accuracy.
  - h. TSP phase extension/early green varies from manual observation collected during City inspection by more than 10%.
5. If Quality Assurance review indicates invalid operation, reporting or performance data, the Contractor shall be directed to investigate the problem for up to one (1) year. The COTR shall review and consider any Contractor explanation of suspected invalid data. The COTR alone shall make the final determination on the validity of operational performance and reporting as to which data are or are not valid for use. Any TSP system that generates invalid operational data shall be considered incomplete and shall not be paid until Contractor's investigation results are accepted by the City.

D. System Test Procedure

- 1. Overview
  - a. The Contractor shall develop and deliver FAT, ORT, and SAT Test Procedures. Test procedures shall be based on test plans approved during the System Design phase. Test procedures shall ensure that each factory and field test is comprehensive and verifies all the features of the subsystems and functions being tested. Test procedures shall be modular to allow individual test segments to be repeated as needed. Test procedures shall include step-by-step procedures associated with each City of Alexandria Transit Signal Priority test. Test procedures shall be delivered for City of Alexandria review and approval 30 days prior to the Factory Acceptance Test.
- 2. Factory Acceptance Test (FAT)
  - a. The Contractor shall conduct a Factory Acceptance Test (FAT) to demonstrate correct operation of all functions of the fully integrated TSP system, including TSP servers and consoles and related equipment, depot subsystem functions, and multiple sets of on-board TSP vehicle equipment for fixed-route vehicles. The Factory Test shall be conducted in accordance with the approved Factory Test Procedure. The interfaces between equipment and subsystems are viewed as crucial aspects of system design. To verify these interfaces, subsystem tests shall include as many subsystem interfaces as possible. All tests shall be performed, "over-the-air", using mobile antennas and mobile data radios. Microwave and common carrier interconnections between the system network controller and the fixed sites may be simulated. The FAT shall fully test TSP functionality using

simulated data methods. The simulation test of these functions shall exercise vehicle subsystems as well as the fixed-end components by simulating the GPS, odometer, and other navigation data feeds to the vehicle subsystems that are being staged at the FAT.

- b. All testing hardware, software, and special test and calibration equipment required to demonstrate the acceptable operation of the system shall be provided by the contractor, and the Contractor shall not substitute equipment or software during factory tests without prior COTR authorization.

3. Operational Readiness Test (ORT)

- a. The contractor shall conduct a comprehensive ORT following the successful completion of the FAT and correction of all variances. The ORT Test shall be conducted in accordance with the approved ORT Procedure. City of Alexandria will make available required resources, as identified in the approved System Test Plan to facilitate this testing.
- b. The ORT shall include a complete set of TSP intersection equipment including the priority request server and intersection controller. Testing shall verify the complete functionality of the TSP, intersection equipment interfaces and functions and interface to the TSP data system. As a minimum, all functions identified in the Technical Requirements in this specification shall be exercised or identified as being tested at the ORT.
- c. The Contractor shall incorporate time into the ORT process to allow City of Alexandria representatives an opportunity to conduct an unstructured test. City representatives shall be able to conduct unstructured testing of any system function or requirement providing:
- d. The function or requirement can be adequately and sufficiently tested and verified using the ORT test configuration.
- e. Testing of the function or requirement does not require additional Contractor provided test equipment.
- f. Testing of the function or requirement does not require additional Contractor provided or developed test scripts or simulation data.
- g. The Contractor shall work with the City to develop and refine the TSP parameters for each intersection before and during the systems acceptance period. This period is expected to last up to fifteen (15) business days after the completion of the ORT. During this period, City of Alexandria staff will collect and evaluate TSP data and determine if TSP settings require adjustments. Should issues, questions, concerns regarding the installation, maintenance, or operations arise, the Contractor shall work with the City to resolve the issue.

4. System Acceptance Test (SAT)

- a. The System Acceptance Test shall not commence until all equipment and materials under this contract have been delivered installed, and “debugging” has been completed. The Contractor shall be required to complete all training prior to initiation of the System Acceptance Test. Following complete delivery and installation of the integrated system, a 30-day System Acceptance Test shall commence, during which the Contractor and the City of Alexandria shall conduct the testing of all system functions and features according to the System Acceptance Test Procedure. The City shall also conduct ad-hoc testing. Defects found by the City during the System Acceptance Test in performance or software failure or newly installed hardware failure will be promptly reported to the Contractor for repair/correction. Each repair/correction shall be documented to the City. A thorough functional test shall be made on each item of installed equipment (fixed-end equipment, depot equipment, on-bus subsystem, and other City systems equipment, etc.) to confirm performance equal to technical requirements in this specification before releasing the item to service.

5. Cut-Over to Revenue Operations

- a. Following successful completion of the ORT and correction of all variances, the remainder of the TSP intersections shall be installed and cut-over to live operations on the new system. During the cut-over to live operations, The City will monitor the performance of the system and notify the contractor of any failure or degradation of the system or its components. Failures or degradation shall be promptly corrected by the Contractor at no cost to the City.
- b. Cut-over to the new TSP system shall have minimal impact to on-going DASH revenue operations, WMATA revenue operations, or local traffic operations.

3.5 CITY OF ALEXANDRIA IT STAFF COORDINATION

- A. No work shall be conducted in the City LAN room, or modifications made to City LAN equipment, without City IT (ITS) staff being present. Notify City IT staff at least seven (7) days prior to such work being scheduled.

PART 4 - MEASUREMENT AND PAYMENT

- A. The Work of this section will be measured as the actual number of pieces of equipment procured. Equipment procured on a per each basis shall include all hardware, cabling, mounting hardware, and all necessary labor, materials, equipment, tools, and supplies as may be required. Equipment measured and paid for on a per each basis under this section shall include, but not be limited to:
  1. Phase selector and harness
  2. Radio/GPS unit
  3. Radio/GPS cable (measured and paid for in linear feet)
  4. Auxiliary Interface Panel

- 5. Cellular Modem
- 6. Cellular Antenna
- B. Additional Work shall be measured and paid for on a lump sum basis, including:
- C. Configuration of traffic signal controllers for TSP operation
- D. TSP parameter design and system verification.
- E. All detection zone design, supplemental testing integration, training, and other work required for a fully operational TSP system shall be considered incidental to TSP parameter design and system verification.
- F. Removal of existing TSP equipment as specified in the plan set and specifications shall be measured and paid for on a per intersection basis.
- G. Any spare parts requested by the City shall be measured and paid for as the actual number furnished and accepted.
- H. All modem SIM cards shall be provided by WMATA.
- I. WMATA shall be responsible for configuration of Fleet Management software parameters for WMATA buses.

END OF SECTION 344114