

**IFB Number: B34-115**

**Brookside Gardens Entry and Parking Renovation**

**ATTACHMENTS**

**TECHNICAL SPECIFICATIONS**

**BID**  
**TECHNICAL SPECIFICATIONS**  
**BROOKSIDE GARDENS ENTRANCE &**  
**PARKING RENOVATIONS**  
**October 2013**

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## **SECTION 101R – CLEARING AND GRUBBING**

### **101.01.1 DESCRIPTION**

This work shall consist of clearing and grubbing within the limits specified in the Contract Documents. Site clearing work includes protection of existing trees outside the disturbance limits, and trees within the disturbance limits that are identified on the site plan to be saved.

### **101.01.01 DEFINITIONS**

- A. Clearing. Clearing within the construction area includes removing and disposing of trees, brush, shrubs, vegetation, rotten wood, rubbish, fences and structures not specified in the Contract Documents for removal and disposal. Clearing outside the construction area is prohibited.
- B. Grubbing. Grubbing is removing from the ground and disposing of all stumps, roots and stubs, brush and debris.
- C. Limits. Limits of clearing and grubbing include the construction area are identified as the limit of disturbance (LOD or LOD/TP) shown on the sediment control plans.
- D. Disturbed Area. Any erodible material exposed by construction activities.
- E. Stabilization. Providing vegetation or structural measures (seed, temporary or permanent mulch, soil stabilization matting, riprap, stone aggregate, and paving by asphalt or concrete) that will prevent erosion. The placement of one or more of these temporary or permanent stabilization measures as directed by the M-NCPPC Construction Manager shall satisfy the requirements to proceed with the next grading unit or operation.
- F. Stabilized. An area covered with erosion resistant material such as grass cover, seed and mulch, soil stabilization matting, riprap, stone aggregate, or paving by asphalt or concrete.
- G. Site clearing work includes protection of existing trees outside the disturbance limits, and trees within the disturbance limits that are identified on the site plan to be saved. Please refer to section 721 Tree Preservation.

### **101.01.2 MATERIALS**

Provide barricades, coverings, and protective fence as necessary to prevent damage to existing trees or improvements indicated to remain in place.

### **101.03 CONSTRUCTION**

- A. It shall be the responsibility of the Contractor to walk the limits of disturbance/clearance

with the M-NCPPC Construction Manager before clearance operations have begun.

B. Protection of existing trees:

1. Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering (by stockpiling construction materials or excavated materials within the drip line), excess foot and/or vehicular traffic, and parking of vehicles within the drip line. Provide temporary fences, barricades or guards as required to protect the trees and vegetation to be left standing.
2. Water trees which are to remain within the limits of the contract work as required to maintain their health during the course of construction operations.
3. Root Pruning shall be performed wherever grades will be lowered within the critical root zone of a tree to be preserved. See Section 721 Tree Preservation.

C. Site clearing:

1. Clearing shall consist of removal and disposal at ground level of trees, brush, shrubs, grass, weeds, other vegetation, down timber, rotten wood, rubbish, fences, incidental structures, bituminous and concrete paving, and general debris within the limits of disturbance as shown on the plans.
2. Grubbing shall consist of removal of stumps, roots, stubs, foundations, and other buried items and debris which interfere with this work. Such removal shall be carried out to a depth of not less than two (2) feet below sub-grade or sub-base levels.
3. Trees, stumps, and roots that are to be removed as a result of site clearing shall be removed completely.

D. Recycle or reuse materials:

1. Recycle or reuse materials as directed in Section 017419 – Construction waste Management and Disposal.

E. Disposal of waste material:

1. Burning of combustible cleared and grubbed materials is not permitted.
2. All waste material must be removed from the site and legally disposed.

F. Replacement of damaged trees:

1. A concerted effort shall be made by the Contractor to protect the trees adjacent to the limits of clearance. If trees outside the limits or clearance are damaged, the following procedures shall be followed to repair the damage:
  - a) Repair or replace trees damaged by construction operations in a manner acceptable to the M-NCPPC-Arborist. Repair tree damage by an ISA Certified Arborist. Replace trees, which cannot be repaired and restored to full-growth status, as determined by the M-NCPPC Arborist.
  - b) If the M-NCPPC Arborist determines that the tree or shrub is damaged and not repairable, the contractor will be responsible to M-NCPPC for the following:
    - i. Removal and clean-up.
    - ii. Cost of Assessed value of tree as established through procedures of the Council of Tree and Landscape Appraisers or another agreeable method by the M-NCPPC Arborist.

G. Protection and restoration of existing improvements:

1. Restore any improvements damaged by this work to their original condition, as acceptable to M-NCPPC or other parties or authorities having jurisdiction.

**101.04      MEASUREMENT AND PAYMENT**

Payment shall be full compensation for clearing and grubbing including removal and disposal of fences, selective tree trimming and scar repair, when not covered as a specific pay item in the contract document, all material, labor, equipment, tools and incidental items necessary to complete this work. Payment shall be made on a unit rate or lump sum basis as indicated in the bid proposal.



## SECTION 103R- CONSTRUCTION WASTE MANAGEMENT

### PART 1 - GENERAL RELATED DOCUMENTS

- A. Drawings and Specifications of the Contract, including General and Special Conditions, apply to this Section.

#### 1.1 SUMMARY

- A. This section specifies diversion of Construction and Demolition (C&D) waste from the landfill.
  1. Waste Management Goals: a minimum of 75% of the total project waste should be diverted from landfill, in order of preference 1) weight, 2) volume, whichever is most feasible to measure. Recycle, re-use, and or salvage a minimum of 75% of structural materials and 95% of road/infrastructure materials. Re-use or recycle 100% of vegetation (does not include non-native invasive), non-contaminated soils, and mineral/rock waste generated during construction for use within 50 miles of the site.
  2. Submit contract documents, including a waste management plan, to show evidence of recycling, and reuse of recovered materials.
  3. Inform M-NCPPC Construction Manager where Construction and Demolition (C&D) Waste Management requirements could detrimentally impact C&D schedule.
  4. Effect optimum management of solid wastes via a materials management hierarchy.
  5. The materials management hierarchy shall be: reduce, reuse, and recycle.
  6. Prevent environmental pollution and damage.

#### 1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations, including vegetation, soils, and mineral/rock waster.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another

facility.

- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

### 1.3 WASTE MANAGEMENT GOALS

- A. The recycling goal to be achieved at substantial completion of the project shall be at least 75 percent of C & D waste materials of the total non-hazardous solid waste generated by the Work, which includes reuse, and 100% of the land-clearing materials such as on-site soils, mineral/rock waste and plant material. Use all reasonable means to divert construction and demolition waste from landfills and incinerators.
  - 1. Reduce: The Project shall generate the least amount of waste and methods shall be used that minimize waste due to error, poor planning, breakage, mishandling, contamination, or similar factors. Promote the resourceful use of materials to the greatest extent possible.
  - 2. Reuse: The Contractor and Subcontractors shall reuse materials to the greatest extent possible. Salvage reusable materials for resale, for reuse on this Project, or for storage for use on future projects. Return reusable items (e.g., pallets or unused products) to the material suppliers.
  - 3. Recycle: As many of the waste materials not able to be eliminated in the first place or salvaged for reuse shall be recycled. Waste disposal in landfills shall be minimized to greatest extent possible.
- B. Divert from disposal vegetation, soils and mineral/rock waster generated during construction to achieve a net zero-waste site. Recycle excess vegetation to develop compost, mulch, erosion protection stream stabilization measures, retaining walls, site furniture, etc. Balance cut and fill. Contaminated soils and diseased and/or invasive plant materials need not be included in calculations of land-clearing materials totals. Provide an estimate of the waste to be generated, the location of the receiving agent, documentation (Such as receipts and photographs) to verify that materials are retained according to requirements.
- C. Facilitate recycling and salvage of materials, including, but not limited to the following:
  - 1. Demolition Waste:
    - a. Asphalt paving.
    - b. Concrete.
    - c. Concrete reinforcing steel.
    - e. Concrete masonry units.
    - i. Structural and miscellaneous steel.
    - j. Rough hardware.
    - u. Piping.
    - v. Electrical conduit.
    - w. Copper wiring.
    - x. Lighting fixtures
    - y. Vegetation (not including diseased and non-native invasives).

- z. Soils and mineral/rock wastes.
2. Construction Waste:
- a. Masonry and CMU.
  - b. Lumber.
  - c. Wood sheet materials.
  - d. Wood trim.
  - e. Metals.
  - f. Roofing.
  - g. Insulation.
  - h. Gypsum board.
  - i. Piping.
  - j. Electrical conduit.
  - k. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
    - 1) Paper. 2) Cardboard. 3) Boxes. 4) Plastic sheet and film. 5) Polystyrene packaging.
    - 6) Wood crates. 7) Plastic pails.

#### 1.4 WASTE MANAGEMENT PLAN

A. Within 15 calendar days of date established for the Notice to Proceed, the Contractor, with input from all subcontractors, shall submit a written Waste Management Plan to the Construction Manager. The plan should provide the following:

1. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include points of waste generation and total quantity of each type of waste. Include estimated quantities and assumptions for estimates. The quantities can be measured by weight or volume, but use same units of measure throughout waste management plan.
2. Waste Reduction Work Plan: The plan shall identify strategies to reuse existing materials on site, recycle for on-site use when possible, recycle for off- site use, salvage of materials, and otherwise strategies to divert materials from disposal. State whether materials will be sorted on site or comingled, and shall include a general description of each type/category of Demolition and Construction waste generated and the location of receiving agent. Receiving agent should be located as near to the project site as possible. List each type of waste and per the following categories:
  - a. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work, including testing and amending materials to ensure they are suitable for reuse.
  - b. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - c. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - d. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.

- e. **Disposed Materials:** Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
- 3. **Location/Access:** Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed. If the materials are to be sorted, each bin will be clearly labeled with the name of the material in both English and Spanish.
- 4. **Cost/Revenue Analysis:** Indicate estimated total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include:
  - a. Total quantity of waste.
  - b. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
  - c. Total cost of disposal (with no waste management).
  - d. Revenue from salvaged materials.
  - e. Revenue from recycled materials.
  - f. Savings in hauling and tipping fees by donating materials.
  - g. Savings in hauling and tipping fees that are avoided.
  - h. Handling and transportation costs. Include cost of collection containers for each type of waste.
  - i. Net additional cost or net savings from waste management plan.

## 1.5 PRECONSTRUCTION AND PREBID MEETINGS

- A. Prior to Bid Due Date there will be a pre-bid conference which will include discussion of construction waste management requirements. After Award of Contract but prior to the commencement of the Work, schedule and conduct a meeting with Construction Manager to discuss the proposed Construction Waste Management Plan and to develop a mutual understanding regarding details of construction waste management implementation.

## 1.6 WASTE REDUCTION PROGRESS REPORTS

- A. Concurrent with each Application for Payment, the Contractor shall submit to the Construction Manager a report which outlines the current progress in meeting the Performance Requirements as listed in Section 1.3 above. The Contractor is ultimately responsible for implementation of the C&D Waste Management Plan and achieving the diversion goals. The reports shall include the following information:
  - 1. Material category
  - 2. Generation point of waste.
  - 3. Total quantity of waste in tons.
  - 4. Quantity of waste salvaged, both estimated and actual in tons.
  - 5. Quantity of waste recycled, both estimated and actual in tons.
  - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
  - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations.
- D. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- E. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

## PART 2 - EXECUTION

### 2.1 PLAN IMPLEMENTATION

- A. General: The Contractor shall be responsible for coordinating the separation, handling, recycling, salvage, reuse, and return methods to be used by all construction personnel. The Contractor shall be responsible for reporting the results of the Construction Waste Management Plan. The Contractor shall designate a party (or parties) who shall be responsible for instructing construction personnel and overseeing and documenting results of the Construction Waste Management Plan.
- B. Waste Management Coordinator: Designate a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
  - 1. Distribute waste management plan, that is acceptable to Construction Manager, to everyone concerned within three days of submittal return.
  - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. The project design includes a number of items that can may be used to implement the Waste Management plan as shown in the construction document plan to include:
  - 1. Excising Chain Link Fence Fabric
    - a. Reinstalled as the Deer Fencing
  - 2. Existing Light Poles
    - a. Installed as the Chain Link Fence Posts
    - b. Remainder to be recycled

3. Pedestrian Bridge
    - a. Salvaged and placed as directed by M-NCPPC Construction Manager
  4. Irrigation
    - a. Reuse or return to the M-NCPPC Construction Manager the heads, valves, backflow preventer, decoders, irrigation boxes, backflow preventer, backflow preventer cage
  5. Concrete site flat work curbs & gutters, Stone, Stone Veneer/Simulated Stone Veneer
    - a. Used in rockery walls and in gabion Walls
  6. Woody vegetation
    - a. Well chipped material to be used as mulch mats
    - b. Well chipped material may be left on the Brookside Gardens site as directed by the M-NCPPC Construction Manager
- E. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

## **SECTION 105 - PROJECT IDENTIFICATION SIGN**

### **105.01 DESCRIPTION**

Within ten (10) calendar days after the start of construction, the Contractor shall furnish and erect a Project Identification Sign at the project site, at a location selected by the Construction Manager. The sign shall be neatly painted, weather resistant and lettered, to identify the project, with pertinent information on the project as stipulated by the Construction Manager. Contractor shall submit 8 ½" X 11" graphic representation of sign for approval prior to fabrication.

### **105.02 MATERIALS**

The sign shall be 4' x 6' constructed of 3/4" plywood and shall have a smooth finish white background. Lettering shall be black latex paint or adhesive vinyl firmly affixed to the plywood surface, and each letter shall be a minimum of 3" in height. Letters shall be legible graphic type, as approved by the Construction Manager. The sign shall be mounted on two 4" x 4" timber posts with adequate bolts and fittings to ensure proper stability.

### **105.03 CONSTRUCTION**

After installation of the sign is completed, it will be inspected and approved by the M-NCPPC Construction Manager. If reflection is apparent on the sign, it's positioning shall be adjusted by the Contractor, as directed by the Construction Manager. The sign shall be erected at a height where the bottom of the sign is a minimum of 5' from the ground it is erected on. The Contractor shall maintain the sign for the duration of the project. If peeling or damage occurs due to weather, construction activity or vandalism, it shall be the Contractor's responsibility to restore the sign to its original condition at no cost to the Commission. At the completion of the project, the Contractor shall remove the sign from the project site.

### **105.04 MEASUREMENT AND PAYMENT**

Project ID sign may be considered incidental work, or bid as a separate item in this contract. If it is not listed in the Bid Items it shall be considered incidental to the overall contract. Please refer to the bid items in the Bidding Documents for method of payment.





## **SECTION 107 - CONSTRUCTION STAKEOUT**

### **107.01 DESCRIPTION**

This work shall consist of furnishing, placing and maintaining construction layout stakes as specified in the Contract Documents or as directed by the M-NCPPC Construction Manager. Horizontal and vertical control on site will be established by the Commission prior to the commencement of construction. All construction stakeout as and when necessary for the satisfactory completion of this project shall be provided by the Contractor.

### **107.02 MATERIALS**

The material for flagging the clearing limits shall be a 3” international orange vinyl material with LOD printed on it with 2” letters. The Contractor shall, as part of the construction stakeout operation, before any clearing operation commences and prior to pre-construction meeting with MCDPS, demarcate limit of disturbance throughout the entire project as shown in the Contract Documents and labeled as Limit of disturbance to the satisfaction of the Construction Manager.

### **107.03 CONSTRUCTION**

- A. The Contractor shall use the horizontal and vertical controls as provided by the Commission and shown on the plans; to accurately stakeout all proposed facilities, LOD, and grading. The Contractor is responsible for all layout work and stakeout work as necessary (including re-staking as needed) to insure proper locations and grading as shown on the plans.
- B. Prior to construction, all stakeouts must be reviewed by the Construction Manager or Inspector. Construction manager review shall not be construed as approval.
- C. Commission crews shall in no way be responsible for providing further assistance to the Contractor above and beyond providing the initial horizontal and vertical controls. It is the responsibility of the Contractor to protect and maintain all control lines and benchmarks. Reestablishing damaged controls or benchmarks will be done by the Contractor at the Contractor's expense.
- D. The Contractor shall use competent personnel and state of the art equipment for all engineering work required to set and maintain the elevations and dimensions as specified in the Contract Documents.

#### **107.03.02 GRADE CONTROLS**

The Contractor shall provide approved equipment to check the grades as directed by the Construction Manager.

### **107.03.03      FLAGGING**

The flagging shall be placed continuously around work areas. In areas where trees are not to be disturbed, the Contractor shall individually flag those trees in a line along the clearing limits that are not to be moved or destroyed and provide tree protection measures as required in the contract documents. If the clearing or LOD flagging has been disturbed or damaged, the Contractor shall reflag the areas within 48 hours after notification by the Engineer that replacement flagging is needed.

### **107.03.04      UTILITIES**

The contractor must contact Miss Utility to locate all existing off site utilities. The contractor is responsible for the location of the on-site underground utilities that are not located by Miss Utility. It is the contractor's responsibility to furnish written proof to the Construction Manager that all utilities have been cleared for both off site and on site utilities. This proof may be a copy of the Miss Utility fax-back or a copy of the Miss utility on line record for off site and written confirmation from the contractor for the location of on site utilities. Excavation may proceed only when both Miss Utility and the Construction Manager agree that all utilities have been located. Test pitting of utilities will be the responsibility of contractor and will be incidental to the work.

### **107.04            MEASUREMENT AND PAYMENT**

Construction stakeout will not be measured but will be paid for at the Contract - lump sum price. The payment will be full compensation for furnishing, placing and maintaining construction layout stakes, flagging of clearing limits and wetlands, and for all material, labor, equipment, tools, and incidentals necessary to complete the work. Payment of the Contract lump sum price will be prorated and paid in equal amounts on each monthly estimate. The number of months used for prorating will be the number estimated to complete the work. If construction stakeout is not listed in the bid items, it shall be considered incidental to the overall contract.

## **SECTION 111R - AS-BUILT DRAWINGS (RECORD DRAWINGS) AND SUPPORT DOCUMENTATION**

### **111.01      DESCRIPTION**

Throughout construction, the Contractor shall maintain all pertinent records of construction materials, testing, and inspections required to document that the actual construction is in conformance with the Contract Documents and regulatory permits. At the completion of the project, the contractor shall develop certified final redlined as-built drawings of the project and obtain approval and closeout of all permits, including those from the Montgomery County Department of Permitting Services (MCDPS). The Contractor shall also provide the Commission with two (2) bound copies of all submittals, shop drawings, correspondence, material certifications, operating manuals, inspections, and testing results related to completed project. Preparation of As-Built plans includes, but is not limited to:

1. Confirming the horizontal locations and vertical elevations of all new facilities built throughout the park (relative to original controls provided by the Commission)
2. Storm drain and storm water management facilities shall be surveyed during installation. This includes invert elevations and dimensions for base of core trench, infiltration trench, filters, underground structures, and geotechnical information as required by MCDPS, etc.
3. Underground utilities, irrigation systems, septic tanks, etc. including profiles, inverts and top of facility elevations
4. Foot print of structures and top of curb elevations
5. Any considerable change or shift in the size or location of any ballfield or other facilities from approved drawings
6. Any considerable change or shift in the size. Location and substitution of all landscape planting, including landscape planting associated with stormwater management facilities
7. Any utility certification as required for as-built certification of the underground utilities such as WSSC
8. All the survey work required for As-Built plans is the sole responsibility of the contractor
9. Any significant deviations from the approved drawings
10. A digital file in AutoCADD format and a set of mylars of the approved As-Built plans and all supporting documents must be submitted to the Commission

In addition to the standard requirements of the owner, the Contractor shall also be responsible for completing all As-Built requirements related to any permits issued for the project. The Contractor shall prepare As-Built plans in accordance with the standards, procedures, and requirements of the permit agency at the time of construction. This includes any required survey, inspection, and certification by an independent firm familiar with the work performed. For example, the completed As-Built package for Stormwater Managements facilities shall include all supporting documents and

information as required on the latest MCDPS “As-Built/Record Drawing Plan Review Checklist” (sample attached). Furthermore, the Contractor shall make any and all repairs and/or modifications required to obtain As-Built approval and final release of permit at no additional cost to the owner. The Contractor shall submit certified As-Built plans and support documents directly to the permitting agency, with two (2) copies to the Construction Manager. Once DPS approves the As-Built plans and Construction Manager concurs, the Contractor shall submit to the Commission a digital file including scans of all approved Mylars including permit drawings. The Contractor shall coordinate with the permitting agency and inspectors as required to obtain final approval and permit release. The Contractor shall consider the As-Built preparation, review, and approval as part of the overall construction schedule and shall complete this work within the Contract Period established for the project. The design documents in electronic file format (AutoCAD 2012) including base survey information will be provided to the contractor.

**111.02        MATERIAL**

Not Applicable

**111.03        CONSTRUCTION**

Not Applicable

**111.04        MEASUREMENT AND PAYMENT**

Payment will be full compensation for all material, labor, equipment, tools and incidental items necessary to complete the work. Payment shall be made on a unit rate or lump sum basis as shown in the bid proposal. Up to 20% of the full payment for storm water management related bid items may be withheld at the discretion of the Commission pending MCDPS approval of As-Built plans.

## **SECTION 200R - EXCAVATION, FILLING & GRADING**

### **200.01      DESCRIPTION**

- A.      Work consists of all labor, materials, equipment and services necessary for and incidental to the execution and completion of earthwork as indicated on the drawings and specified herein.
- B.      The extent of excavation, filling and grading is shown on the drawings.
- C.      Preparation of subgrade for slabs and pavements is part of this work.
- D.      Backfilling around facilities such as structures, curbs, pavements, etc., is included as part of this work.

### **200.01.01      DEFINITIONS**

- A.      The determination of rock excavation, which will be measured in the field by the Commission and paid for at Unit Price per cubic yard or method acceptable to the M-NCPPC's Construction Manager, shall be that mineral material which will require blasting, use of pneumatic equipment for breaking and which is not removable by use of a Caterpillar model D-8 Bulldozer or equivalent with a single-tooth ripper. The removal of disintegrated rock shall be classified as earth Excavation. The rock excavation as measured in the field shall be deducted from the volume of Excavation item provided it is within the grading limits of the area. Rock Excavation outside of these limits shall be carried out only at the discretion and direction of the M-NCPPC's Construction Manager.
- B.      Minimum Effort: If rock is not removed during the process of normal digging and ripping, then extend the excavation to expose the rock surface within the limit of original excavation. Contact the M-NCPPC Construction Manager or his representative for further direction.
- C.      Earth Excavation: Anything not classified as rock.
- D.      Unsuitable Materials: Debris, man made or fabricated materials, concrete spoil, decayable material, and soft, expansive or unstable matter which cannot be field compacted to densities specified.

## **200.01.02     RELATED SECTIONS**

- A.     See Section 321443 Porous Unit Paving for specialized excavation filling and grading for the subgrade under the porous pavement.
- B.     See Section 321243 Flexible Porous Paving for specialized filling and grading for the subgrade under the flexible porous pavement
- C.     See Section 329400 Planting Soils for preparation of planting soils and their subgrades

## **200.02         MATERIALS**

- A.     Fill and backfill (Refer to section 916 - MSHA, 2008 Standard Specifications)
  - 1.     Minimum requirements:
    - a.     Cohesionless materials shall be classified in accordance with AASHTO guidelines as either A-3 (sand) or A-2 (sand and fines), and the minimum dry unit weight shall not be less than 110 PCF maximum dry density as determined by A.S.T.M. D-698.
    - b.     Cohesive materials shall be classified in accordance with AASHTO guidelines as either A-4 (silt), A-5 (silt), A-6 (clay) or A-7 (clay) with a minimum dry unit weight not less than 105 PCF maximum dry density as determined by ASTM D-698.
    - c.     Backfill and Fill Materials: Satisfactory soil materials approved by the Construction Manager and free of rock or gravel larger than 2" (top 12" of subgrade) in any dimension, debris, waste, frozen materials, organic and other deleterious matter.
- B.     Sheeting, shoring and bracing: Sheeting, shoring and bracing materials shall be timber, steel or aluminum, or a combination thereof, designed as required by a Professional Engineer registered in the State of Maryland, to retain the earth around structures, prevent cave-in and settlements, and to fulfill all safety requirements.
  - 1.     Timber shall be structural grade with minimum working stress of 1,100 psi.
  - 2.     Steel sheet piling shall conform to requirements of ASTM A328, continuous interlocking type. Struts, bracing and all other accessories required for the sheet piling system shall meet requirements of ASTM A36.

## **200.03      CONSTRUCTION**

- A.      Submittals: Test Reports-Excavating, Filling, and Grading:
1.      The Contractor shall be responsible for hiring a geotechnical company to carry out soil testing for all structural fills and as required. Submit 2 copies of the following reports directly to the Construction Manager from the testing service, with copy to the Contractor.
    - a.      Verification of each footing subgrade.
    - b.      One optimum moisture-maximum density curve for each type of soil encountered.
    - c.      Report of actual unconfined compressive strength and/or results of bearing tests of each 8" stratum tested.
    - d.      Summary of all testing and certification (sealed by PE) that construction was completed in accordance with contract drawings and specifications.
- B.      Site Information:
1.      Data on indicated subsurface conditions are not intended as representations or warrants of continuity of such conditions between soil borings. It is expressly understood that M-NCPPC will not be responsible for interpretations or conclusions drawn by Contractor. Data are made available for the convenience of the Contractor.
  2.      Additional test borings and other exploratory operations may be made by Contractor at no cost to M-NCPPC.
- C.      Existing Utilities: Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
1.      Should piping or other utilities be encountered during excavation, consult the Construction Manager immediately for directions as to procedures. Cooperate with M-NCPPC and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility M-NCPPC.
  2.      Do not interrupt existing utilities serving facilities occupied and used by the Commission or others, except when permitted in writing by the Construction Manager and then only after acceptable temporary utility services have been provided.
- D.      Use of Explosives: Use of explosives is prohibited. If use of explosives is required it shall be with prior written permission from the Commission and authorities having jurisdiction. In that case the Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

E. Protection

1. Safety: Provide protective measures necessary for the safety of workmen, the public and adjacent property. Prevent cave-ins, collapse of walls, structures and slopes, both on and adjacent to the site.
2. Standards: Comply with regulations of local authorities having jurisdiction, including all applicable OSHA requirements.
3. Repair: Include the removal of damaged materials and replacement with new materials (as required by original Contract Documents) where such materials are affected by settlement or other damage.

F. Site Preparation

1. Excavation consists of cutting, removing, filling, compacting and grading of material encountered when establishing required grade elevations in accordance with plans and specifications, that are not classified rock excavation or unauthorized excavation.
  - a. Topsoil- all topsoil must be removed from all areas prior to grading. Topsoil shall be stripped, and sent off-site to a soil supplier, blender, recycler, or landowner who can use the topsoil. Any proceeds may be
2. Rock excavation consists of removal and disposal of materials encountered that cannot be excavated without the use of explosives or pneumatic equipment. Typical materials classified as rock are, solid rock, rock in ledges, and rock hard aggregate deposits (refer to section 200.01.1). Intermittent drilling performed to increase production but not necessary to permit excavation of material encountered will be classified as earth excavation.
3. Unauthorized excavation consists of removal of materials in excavation under footings, foundation bases, retaining walls, slabs, slopes, site grading by extending indicated bottom elevations of footings or indicated subgrade elevations or indicated line grades or dimensions without specific direction of the M-NCPPC Construction Manager. All unauthorized excavation including remedial work such as backfilling and compacting with earth or gravel, lean concrete fill or any other material to bring elevations to grades as specified and to the satisfaction of the M-NCPPC Construction Manager, shall be carried out at the Contractor's expense.
4. Additional excavation: When excavation has reached the required grades, subgrade elevations and lines, notify the M-NCPPC Construction Manager, who will make an inspection of the site. If unsuitable bearing materials are encountered at required elevations, the M-NCPPC Construction Manager and/or Geotech Engineer may require further (deeper) excavation and replacement of unsuitable (excavated) material.



- a. All areas to be paved will be proof rolled at subgrade in the presence of the M-NCPPC Construction Manager or Park Inspector. If deemed necessary, bad soils below subgrade will be undercut and replaced as described below. At the end of each day undercutting is performed, the Contractor shall certify, in writing, the quantity, in cubic yards, of undercutting performed in agreement with the Park Inspector. Both parties shall sign the certification, which shall be submitted to the Construction Manager at the end of the day.
  - b. Type 1 undercutting: If possible unsuitable soils will be removed and distributed on-site in locations designated by the M-NCPPC Construction Manager; otherwise materials will be hauled off-site at no additional cost to M-NCPPC. Suitable soils will be placed in the undercut area from on-site sources; as directed by the M-NCPPC Construction Manager. Refer to appropriate compaction section.
  - c. Type 2 undercutting: If possible unsuitable soils will be removed and distributed on-site in locations designated by the Construction Manager; otherwise materials will be hauled off-site at no additional cost to M-NCPPC. Crusher run stone or other select borrow material will be hauled in and used as replacement material as directed by the Construction Manager. Refer to appropriate compaction section.
5. Stability of Excavations: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible space restrictions or stability of materials excavated.
- a. Maintain sides of slopes of excavations in safe conditions until completion of backfilling.
6. Dewatering:
- a. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.
  - b. Do not allow water to accumulate in excavations. Remove water to prevent softening of subgrades, foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water from excavations.
  - c. Convey water removed from excavations to collecting or run-off areas with approval of MCDPS Inspector. Provide and temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.
  - d. Contractors shall be aware of low areas that are likely to experience

groundwater seeps and take appropriate measures to properly dewater excavations in those areas.

- e. Dewatering will be the responsibility of the contractor and shall be done in conformance with best management practices and shall be incidental to the contract. The Commission shall not pay for areas requiring undercutting due to insufficient dewatering practices.

7. Material Storage:

- a. Stockpile and protect satisfactory excavated materials, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
- b. Locate and retain soil materials away from edge of excavations.
- c. Dispose of excess and or unsatisfactory and waste materials as specified hereinafter.

8. Excavation for Structures:

- a. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction and for inspection.
- b. In excavating for footings and foundations, do not disturb bottom of excavation. Excavate by hand to final grade just before concrete is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.
- c. Concrete footings, foundations and like structures shall be placed at the elevations shown on the drawings or as specified. Buried walls of former structures, which may exist where footings, foundations, etc., are to be placed, are to be removed to one foot below the elevations of bottoms of such footings, foundations, etc. When this has been accomplished, the M-NCPPC Construction Manager shall inspect such walls and if he finds them to be structurally sound, removal shall cease. However, if the M-NCPPC Construction Manager considers further removal necessary, the Contractor shall proceed until suitable conditions are reached. The Contractor shall accomplish such removal to the elevations of bottoms of footings, foundations, etc., as part of the contract; however, he shall be paid for required removal one foot below these elevations. Also, if due to the character of the soil or to encountering utilities or obstacles not known to exist, the M-NCPPC Construction Manager orders other additional excavation performed, the Contractor shall be paid for such work, as well as for further removal of walls, in accordance with applicable unit prices listed

in the Bid or Proposal. However, the Contractor will not be paid for excessive excavation as a result of an error on his part.

- c. All topsoil shall be removed from areas where footings, foundations, pavement or structures have to be built. If the topsoil extends deeper than proposed elevations, then procedure given in paragraph F.4 above shall be followed.

9. Excavation for Stone, Concrete, and Bituminous Pavements:

Cut surface under pavements to comply with cross-section, elevations and grades as shown. All excavated areas, which are to be paved, shall be compacted in accordance with paragraph 12, of this Section.

- a. Where rock is encountered, carry excavation 1'0" below subgrade and backfill with suitable material approved by the Geotechnical Engineer.
- b. All topsoil from under areas to be paved with stone, asphalt or concrete, shall be removed to the subgrade elevations. If unsuitable material is encountered, with the direction of M-NCPPC's Construction Manager, all unsuitable material shall be removed until suitable soil is encountered. At that point the M-NCPPC Construction Manager shall inspect the soil and if that is deeper than the required elevations for sub-base, sub-grade etc., the M-NCPPC's Construction Manager shall direct the use of replacement material to bring grades up to required elevations. Such backfill materials shall be compacted in accordance with specifications for compaction until required density is achieved before proceeding with the next step. Procedure as laid out in paragraph F.4 above shall be followed in such cases for additional excavation.

10. Excavation for Ditches:

Cut ditches to cross-sections and grades as shown. Deposit excavated materials to prevent cave-ins or material falling or sliding into ditch. Keep ditches free of debris until final acceptance of the work.

11. Cold Weather Protection:

Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

12. Fills and Backfills:

- a. Improved unpaved areas: Areas on which fill is to be placed shall be stripped of all topsoil and then scarified prior to placement of fill. Fill material shall

be placed in 8-inch (maximum thickness before compaction) layers to be continuous and horizontal over the entire length of fill. Each layer of fill shall be compacted by an approved power roller. Compaction shall be carried out at optimum moisture content to a dry density of 85% for non-structural areas. For slopes over 3:1 please see plans for specifications or follow instructions given by M-NCPPC Construction Manager. The dry density of the compacted fill shall be determined by ASTM D1556. The moisture content of the compacted embankment layers shall be as mentioned elsewhere. The remaining embankment shall be suitable earth fill, free from stones that will be retained on a sieve with 3-inch square openings or as directed by the M-NCPPC's Construction Manager, and compacted as specified above. Soft spots identified by the M-NCPPC's Construction Manager during proof rolling will be undercut and backfilled. Proof rolling and compaction equipment shall meet the requirements as mentioned elsewhere. Payment for undercutting and backfilling to eliminate soft spots shall be made in accordance with the Contract provisions affecting the work.

- b. Paved surfaces and slab backfill: Compact after proof rolling and each layer of backfill or fill materials to 95% maximum dry density.
- c. Footings and Foundations: When permitted by M-NCPPC Construction Manager sub-foundation concrete can be used or CR6 can be placed under footings and foundations and shall be compacted to not less than 95% maximum density.
- d. Moisture Control: The soils used in fill and backfill shall be moistened or aerated to within 2% of the optimum at no additional cost to the M-NCPPC.
  - 2. Where the soil layer is too wet, the Contractor shall dry the soils by plowing or discing to aerate the soil and reduce the moisture content to within 2% of the optimum.
- e. Tests including classification, fill placement and soil compaction shall be made under the supervision of the M-NCPPC's Construction Manager or Inspector. Compaction Equipment shall be subject to approval by the Construction Manager and shall meet the following criteria based on soil type as follows:
  - 1. Cohesionless Soils: Vibratory drum compactors weighing in excess of 5 tons and capable of providing minimum impact force 30,000 lbs. at minimum frequency of 100 v.p.m with smooth drum. The maximum speed shall not exceed 5 M.P.H. and a minimum of 3 passes is required for all areas.

2. Cohesive Soils: Sheepsfoot or tamping rollers shall consist of metal drums or shells, not less than four feet in diameter, equipped with self-cleaning tamping feet. Tamping rollers shall make at least 4 complete coverages of the material being compacted and rolling shall continue until the tamping feet "build-up" or "walkout" of the surface. Operating speeds of tamping roller shall not exceed 5 m.p.h.

### 13. Fine Grading

#### a. Quality Assurance

Contractor must supply evidence of having performed similar fine grading work on a least three other sites especially in regards to maintaining the degree of accuracy outlined in the grading specifications.

The equipment, which is used on the site, shall be capable of producing work within the grading tolerance as specified within this specification for area to be graded.

#### b. Procedure

1. General: Uniformly grade areas within limits of disturbance under this section including adjacent transition areas. Smooth finish surface within specified tolerances; compact in accordance with paragraph F.12 of this Section with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
2. Ditches: Finish ditches to ensure proper flow and drainage.
3. Grassed Areas: Finish areas to receive planting soils to within not more than 0.10' above or below the required subgrade elevations.
4. Pavements: Shape subgrade under pavement to line, grade and cross-section, with finish surface not more than 1/2" above or below the required subgrade elevation, duly compacted.
5. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2" when tested with a 10' straightedge.

### 14. Maintenance

a. Protection of Graded Areas: Protect newly graded areas from traffic and erosion, and keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

b. Reconditioning Compacted Areas: Where completed compacted areas are disturbed

by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

15. Disposal of Excess and Waste Materials

- a. Removal from M-NCPPC Property: Remove waste materials, including unacceptable excavated material, trash, and debris from the M-NCPPC property and legally dispose of it. Off-site disposal shall be considered incidental to contract.

**200.04      MEASUREMENTS AND PAYMENT**

Payment will be full compensation for all material, labor, equipment, tools and incidental items necessary to complete the work. Payment shall be made on a unit rate or lump sum basis as indicated in the bid items.

## **SECTION 212R - STONE BASE**

### **212.01      DESCRIPTION**

Work consists of all labor, materials, equipment and services necessary for and incidental to the execution and completion of preparation of stone base, as called for in the plans and specifications herein.

### **212.02      MATERIALS**

- A.      Graded Aggregate Sub-base (ASTM D2940): This material shall be in accordance with MSHA (2008) Specifications Section 901.
- B.      #2 / #3 Stone: This material shall be in accordance with M43, No.2
- C.      # 57 (AASHTO M43): This material shall be in accordance with MSHA (2008) Specifications, Section 901, (No. 57) stone.
- D.      # 8 (AASHTO M43): This material shall be in accordance M43, No.8
- E.      Crusher Run Aggregate (CR-6): This material shall be in accordance with MSHA Specifications, Section 910.

### **212.03      CONSTRUCTION:**

- A.      After completion of excavation, filling and grading, it shall be ensured that the line, grade, shape, elevations are in accordance with and shall meet the final grades as shown in the plans. It shall also be ensured that the sub-base has been properly compacted during the excavation/grading operation to 95% of maximum dry density. The area where the stone base is to be provided shall be free of topsoil or any other unsuitable material. The earth sub-base shall not be frozen. The tolerance of the earth sub-base shall be  $\pm 1/2$  inch from the designed grade.
- B.      The M-NCPPC Construction Manager shall approve the earth sub-base before stone is deposited.
- C.      The stone material as specified in the plans and "materials" above, shall then be deposited and spread in the area (roads, parking lots, gate house etc.) as required to the depth of fully compacted stone as shown in the plans, details, list of items, contract, etc. The material shall be spread on earth sub-base, foundations, or preceding layer (previously compacted to required density), in a manner that will prevent segregation of coarse and fine particles. Proper equipment shall be used to indicate the required depth for the spreading of stone layers. An approved machine capable of spreading the material to the desired width shall be used.
- D.      Compaction requirements: The moisture content shall be maintained within 2% of the

material's optimum moisture. The maximum dry density for bank run gravel shall be in accordance with AASHTO T180. For GASB, the dry density shall be in accordance with MSMT 321. Compaction shall begin by making a single pass with a steel wheeled roller weighing not less than 8 tons or such a weight as to provide the compaction density mentioned above. All rolling shall be done longitudinally beginning at the sides, overlapping the shoulder at least a foot, and progressing towards the center of the road, parking lot, tennis courts, multi-use court or any other facility requiring a stone base. The compaction operation shall continue until all compaction marks are eliminated and the layer/course is properly compacted.

- E. After the compaction has been completed by the Contractor, the Construction Manager or his representative will witness the stone base surface proof rolling by contractor and if he is not satisfied with the compaction will require the Contractor to re-compact, remove the stone to check the sub-base and adjust it if necessary, delay the rolling to permit drying of the subgrade, reconstruction of the entire base or sub-base, or request the Geotech engineer or an approved lab check the density of the stone base at the contractor's expense and at no cost to the Commission.
- F. These methods shall apply for each layer/course of stone base, should there be more than one layer of stone base.
- G. Tolerances after spreading, laying and compacting a stone base shall be no more than 1/2 inch from designed grade. The compacted thickness of the stone base, duly approved by the Commission, shall be as per plans, sections, and details for the various facilities requiring a stone base. Serpentine origin crushed stone shall be used only if it is to be covered by asphalt paving or concrete.

#### **212.04            MEASUREMENT AND PAYMENT**

- A. Payment will be full compensation for all material, labor, equipment, tools and incidental items necessary to complete the work. Payment shall be made on a unit rate or lump sum basis as shown in the bid proposal; or shall be considered incidental to other bid items if not specifically listed on bid forms.



## **SECTION 308R - SEDIMENT AND EROSION CONTROL**

### **308.01.01      STANDARDS AND SPECIFICATIONS**

All sediment control measures shall be installed and maintained per latest MCDPS Standards for Erosion and Sediment Control, the latest MDE/WMA/NRCS/MASCD Maryland Standards and Specifications for Erosion and Sediment Control, and the MDE/WMA National pollution Discharge Elimination System (NPDES) Notice of Intent (NOI) General Permit for construction activities. Please refer to Maryland Department of Transportation, State Highway Administration's Specifications entitled, "Standard Specifications for Construction and Material" dated January 2008, revisions thereof, or additions thereto.

### **308.02            MATERIALS**

See 2008 MSHA specifications section 308.02 Material.

### **308.03            CONSTRUCTION**

See MSHA specifications section 308.03 Construction . Add the following:

- A. Upon approval of the construction contract and issuance of the Notice to Proceed, the M-NCPPC Construction Manager will arrange a pre-construction meeting between Montgomery County DPS Sediment Control Inspection Staff, the General Contractor, appropriate M-NCPPC staff, and any other required county, state or jurisdictional personnel.
  - 1. The Contractor will be provided with copies of the Sediment Control Permit and all other required permits at this time, and must keep a copy of each permit on site at all times.
  - 2. The Contractor shall not start any construction prior to this meeting.
  - 3. Contractor shall review and understand Sequence of Construction and present any concerns to Construction Manager prior to start of work.
- B. Installation of sediment controls shall begin only after the Sediment Control Inspector has granted approval, and shall include any modifications to the approved Sediment Control Plan that the Sediment Control Inspector has required. Contractor is responsible for proper installation of all controls and coordinate field adjustments to ensure functioning throughout construction.
- C. All subsequent notifications for inspection and coordination with the Sediment Inspector are the responsibility of the Contractor. Events requiring Sediment Control inspection and approval include, but may not be limited to start of grading, compliance with warning notices, lifting of stop work orders for violations, start of temporary or permanent stabilization, removal of Sediment Control facilities, and any other pertinent events noted in the plans or specifications.

- D. Grading shall be accomplished throughout the entire project such that: existing surface drainage pathways and existing pipe/culvert conveyance systems outside of the limits of disturbance are not impacted; hazardous conditions are not created; erosive conditions are not created outside of the limits of disturbance as a result of site work; and uncontrolled sediment will not pass or collect into existing drainage systems and their downstream tributaries.
- E. The Contractor shall be aware of current onsite graded conditions and ensure that sequence of site work and drainage area delineations comply with the approved sediment control plans. The Contractor shall ensure all disturbed and unstabilized drainage areas are properly conveyed to the sediment control device specified on the approved sediment control plans. The Contractor shall identify offsite drainage patterns and ensure LOD crossings of drainage paths are appropriately stabilized and/or clean water conveyances around work areas are established during construction.
- F. Maintenance and repair of all sediment control facilities shall be the responsibility of the Contractor. The Contractor shall inspect and properly maintain all sediment control facilities at the end of each working day to ensure that the sediment control device will not be overburdened by sediment-laden runoff during storm events. M-NCPPC and MCDPS inspectors will also conduct regular inspections of the facilities and inform the contractor of any required maintenance and/or repairs.
- G. Infiltration or porous structures—such as porous asphalt, porous concrete, concrete pavers and stone trenches—shall be protected and kept clean at all times from dirt and debris after installation and until final approval by MCDPS and M-NCPPC. The contractor shall, at a minimum, sweep, vacuum, and use hand blowers at regular intervals to comply with this requirement
- H. The Contractor is required to perform weekly inspections of all sediment controls on the entire site as well as after every rain or snow event, as part of the MDE/WMA NPDES NOI general permit requirements. All findings shall be documented on the MDE inspection forms provided at the pre-construction meeting. The completed inspection forms shall remain on-site at all times and be accessible to all who ask to review these documents.
- I. M-NCPPC may require the Contractor to install additional sediment controls to improve sediment removal without impacting the functioning of the approved Sediment Control Plan. Examples of additional controls including installing a second row of silt/super silt fence and installing erosion control matting to disturbed areas.
- J. Dust and Airborne Contaminates Control:
1. The Contractor shall provide water as necessary to reduce airborne dust when directed by the Construction Manager, at no additional cost to the M-NCPPC.
- K. The Contractor shall ensure that all public and private roads used by construction equipment are maintained in safe conditions and kept clean of sediment and debris. Sediment shall be removed from truck tires via stabilized construction entrances, tire wash racks, or by other acceptable methods before leaving the construction site. Routine

maintenance shall be performed on the roadways as necessary, including sweeping, vacuuming, or other acceptable methods and as directed by M-NCPPC.

When washing construction equipment, rinsate shall be directed towards approved-sediment control devices. Rinsate from equipment that is used to handle and transport concrete shall be directed towards watertight concrete washout structures per design criteria and details in Section H-6 of the 2011 MDE Sediment and Erosion Control manual.

L. Removal of sediment control facilities:

1. Once the project has been completed, and all disturbed areas have been stabilized as called for in the plans, Contractor should contact the M-NCPPC Inspector and MCDPS Sediment Control Inspector for approval to remove the sediment control features. Note that seeded areas must have a visible stand of vegetation prior to this inspection.
2. When permitted, the Contractor shall remove all sediment control features and regrade such areas to proposed designed grades and seed and/or sod them as required.

**308.04            MEASUREMENT AND PAYMENT**

Payment will be full compensation for all material, labor, equipment, tools and incidental items necessary to complete the work. Periodic maintenance of sediment control measures as directed by engineer or DPS inspector shall be included in the bid prices for sediment control items. No extra payment shall be made for maintenance or removal of sediment control measures. Payment shall be made on a unit rate or lump sum basis as shown in the bid proposal.

## **SECTION 322R - STORM DRAINAGE AND STORMWATER MANAGEMENT**

### **322.01      DESCRIPTION**

Work includes all labor, material and equipment to construct storm drain systems and stormwater management facilities, including all appurtenances as shown on the drawings and as specified. The work shall include, but not be limited to, excavation, dewatering, backfilling, concrete and masonry work, embankments, filters, outlet works, structures, piping, appurtenances, completion of as built plans and closure of applicable associated jurisdictional permits, acceptance of the SWM facility maintenance by Montgomery County Department of Permitting Services (MCDPS) and M-NCPPC, and/or other related applicable jurisdictions, and all incidental items to complete the work as shown on the Drawings and as specified.

#### **322.01.2      QUALITY ASSURANCE**

The most restrictive requirements of the latest publications of the following specifications will be complied with for this project:

1. Maryland DNR, WRA, Stormwater Management Division Standards and Specifications for Infiltration, February 1984 and updates in 2011.
2. Montgomery County Government Department of Transportation Storm Drain Design Criteria and Standards latest edition.
3. USDA Natural Resources Conservation Service –Maryland Code No. 378 Standards and Specifications for Ponds, latest edition.
4. Maryland Department of the Environment 2000 Maryland Stormwater Management Design Manual, Volumes I and II, including supplements.
5. Maryland Department of Transportation State Highway Administration Standard Specifications for Construction and Materials, July 2008.
6. Montgomery County Department of Permitting Services (MCDPS) –Stormwater Management Pond construction specifications.

#### **322.01.3      RELATED WORK UNDER OTHER SECTIONS**

1. See Section 321443 Porous Unit Paving
2. See Section 321243 Flexible Porous Paving

### **322.02      MATERIALS**

- A. Pipes: All pipes shall be certified and meet the MSHA Standard Specifications for Construction and Material, July 2008, Section 905. All reinforced concrete pipes through stormwater management embankments shall have bell and spigot joints with rubber gaskets and conform to ASTM Designation C-361, Type A-25, unless otherwise specified on Drawings.

Storm drain pipes, as installed, will conform as applicable to the following minimum standards:

Reinforced Concrete Pipe ----- A.A.S.H.T.O M-170

Corrugated Steel Pipe ----- A.A.S.H.T.O M-36

Corrugated Aluminum Pipe ----- A.A.S.H.T.O. M-196

High Density Polyethylene-----A.A.S.H.T.O M-252, A.A.S.H.T.O M-294

- For 12”- 60” Storm Drain or SWM Pipes use A.A.S.H.T.O M-294-Type-S
- For 4”- 12” Perforated Drain Pipes use A.A.S.H.T.O M-252-Type-C or use A.A.S.H.T.O M-294-Type-S

Polyvinyl chloride pipe PVC schedule 40&80-----ASTM D1785

All corrugated metal pipe will be helically corrugated, 16 gauge minimum, with ½” x 2 2/3” corrugations, unless otherwise noted.

Pipes labeled CMP on this plan may be either steel or aluminum. Aluminum surfaces that are in contact with concrete will be painted with one coat of zinc chromate primer.

- B. Portland cement concrete, structures: MSHA Standard Specifications for Construction and materials, July 2008, Sections 420, 902, 905, 908, 909, 911, 913, 915, 917, and 921.
- C. Precast Concrete structures: MSHA Standard Specifications for construction and materials, July 2008, Section 305.03.06. Concrete design shall meet the requirements of ACI 350, Environmental Engineering Concrete Structures, with freezing and thawing exposures. Concrete shall be a type II or IIA cement, with a 28 day compressive strength of 4500 psi for cast in place and 5000 psi for pre-cast structures. Concrete shall also meet the requirements of Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, Section 420.
- D. Brick for inlets: MSHA Standard Specifications for construction and materials, July 2008, Section 903.
1. Cement for mortar: MSHA Standard Specifications for Construction and Materials, July 2008, Section 902.
  2. Sand for mortar: MSHA Standard Specifications for Construction and Materials, July 2008, Section 901.01, Table 901A.
  3. Mortar: All mortar shall be composed of the cement and sand specified in Section 322.02 above. For brick masonry, the proportions by volume shall be one part of cement to two parts of sand. Mortar shall be freshly mixed in small batches for the work at hand. Tight boxes of platforms, made for the purpose, shall be used. The sand and cement shall be thoroughly mixed dry, in the proper proportions, until a uniform color has been produced, whereupon a sufficient quantity of water shall be added, and the mass further mixed so as to produce a stiff pat of the proper consistency. Approved methods of machine mixing may be employed. Mortar shall be used within thirty minutes after mixing, and all hard or otherwise damaged mortar shall be wasted. Re-tempering of mortar will not be permitted.
- E. Pipe joint material: Shall be in conformance with the State of Maryland Highway Standard Specifications Section 907.06. All Pipe joints shall be made soil and watertight.

- F. Manholes and miscellaneous structures shall meet the requirements of Montgomery County DPWT Standards. All storm drain structures are subject to modification by the engineer to meet field conditions. Where the drop on the main line through a structure can be accommodated by an invert slope of 1 ½ foot horizontal to 1 foot vertical or flatter, a rounded bottom shaped channel will be built conforming to the inlet and outlet pipes. The sidewalls of the shaped channel shall extend to the crowns of the pipes in the structure. Otherwise, the bottom of the structure shall be lined with granite blocks that are at least 4 inches thick with no shaped channel required. The bottom shall slope ½” per foot toward the invert of the outlet pipe.
- G. Embankment material: Shall be as specified on Drawings, required by appropriate reference documents, and confirmed by on-site Geotechnical Engineer.
- H. Cast-in-place concrete: Concrete shall meet the requirements of Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, Section 420.
- I. Filter media: All filter media shall conform to the latest Montgomery County standards for the individual device.
- J. Montgomery County-Approved Structures: All structures shown on design plans are approved by Montgomery County. Any proposed substitution must be approved by Montgomery County in writing in advance of construction. The Contractor shall be responsible for all engineering, submittals, and coordination required to obtain Montgomery County revision approvals. All work must be coordinated with and approved by M-NCPPC Construction Manager. In no instance shall M-NCPPC accept a completed system that provided a lower treatment level than the original design.
- K. Marking/Stenciling concrete structures: All marking materials shall conform to the latest M-NCPPC standards for storm drain marking.

### **322.03 CONSTRUCTION**

#### **A. Storm Drainage**

- 1. Handling and alignment of pipe: Pipe shall be carefully handled and lowered into the trench. In laying pipe, special care shall be taken to insure that each length shall abut against the next in such a manner that there shall be no shoulder or unevenness of any kind along the inside of the bottom half of the pipe line.
- 2. Bedding Materials:
  - A. For HDPE and non-metal pipes: Bedding material shall meet the requirements of ASTM D2321 Class I material, with the exception that (per AASHTO Section 30) the maximum particle size of the bedding materials shall be 1.25 in. (32 mm). The bedding material upper limit shall be equal to one-third of the pipes O.D., unless otherwise directed by the MNPCCP Construction Manager. A minimum of 6” of loosely compacted bedding material shall be provided below the bottom surface of the pipe prior to pipe placement. Final backfill material shall meet the requirements of ASTM D2321 Class I, Class II, or Class III material.

All initial and final backfill material shall be placed in 6 to 8 inch lifts and compacted to a minimum 90% Standard Proctor Density.

- B. Bedding material for concrete pipes: Bedding material shall consist of a well-graded mixture of stone, gravel, and sand in accordance with AASHTO M145 type A-1, A-3. This is further described and identified as “Class C bedding” found in the American Concrete Pipe Association “Concrete pipe & Box culvert installation” guidelines: [www.concrete-pipe.org/pdf/installation\\_guide.pdf](http://www.concrete-pipe.org/pdf/installation_guide.pdf).
  - C. For other pipe installations not included above, follow the most stringent guidelines of the latest publications from WSSC and MCDOT.
3. Pipe placement and foundation: Before joints are made, each pipe shall be well bedded on a solid foundation and no pipe shall be brought into position until the preceding length has been thoroughly embedded and secured in place. Any defects due to settlement shall be repaired by the Contractor at his own expense. When plastic pipe is used, the Contractor shall periodically check for pipe deflection during pipe installation and within 30 days of the completion of the project. The internal diameter of plastic storm drain pipes shall not be reduced by more than 5 percent of its design diameter. If the installation does not meet these requirements, the pipe shall be removed and replaced at no additional cost to the Commission. Bell holes shall be dug sufficiently large to insure the making of proper joints. No pipes shall ever be supported by the bell joints only. Trench widths shall conform to the latest regulations found in the MCDOT Storm Drain design criterion which is equal to the outside diameter of the pipe plus 18 inches on both sides of pipe, or 2 times the outside diameter of the pipe, whichever is narrower. Where any portion of the proposed storm drain system is located in a fill section, Contractor shall provide select fill material compacted to 95% A.A.S.H.T.O. T-99 density from original undisturbed ground up to structure bottom slabs and pipe bedding.
  4. Equipment for handling material: Proper and suitable tools and appliances for the safe and convenient handling and laying of pipes shall be used.
  5. Cleaning pipe: The pipes shall be thoroughly cleaned before they are laid and shall be kept clean until acceptance of the completed work. The open ends of all pipelines shall be provided with a stopper carefully fitted so as to keep dirt and other substances from entering. This stopper shall be kept in the end of the pipe line at all times when laying is not in actual progress.
  6. Cutting the pipe: Whenever a pipe requires cutting, to fit into the line or to bring it to the required location, the work shall be done in a satisfactorily manner so as to leave a smooth end. Cost of cutting the pipe shall be included in the unit price for the pipe.
  7. Trench water: The excavation in which the pipe is being laid shall be kept free from water and no joint shall be made under water. Water shall not be allowed to rise in the excavation until the joint material has received its set. Care shall be used to secure water tightness and to prevent damage to, or disturbing of, the joints during the backfilling process, or at any other time.
  8. Laying the pipe in freezing weather: No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when the Commission Construction Manager shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of excavation, unless all required precautions as to the minimum length of open trench and promptness of backfilling are observed.

9. Grade all disturbed areas to provide positive drainage.
10. After Stabilizing site, all Storm Drain Inlets are to be marked/stenciled with M-NCPPC issued decals. Contractor shall coordinate with M-NCPPC construction manager to obtain and return materials.
11. Splash/Plunge Pool: Use specified class of rip-rap. Use geotextile as specified in the plans, and protect from punching, cutting, or tearing. Repair any damage by placing another piece of geotextile over the damaged part or by completely replacing the geotextile. Provide a minimum of one foot overlap for all repairs and for joining two pieces of geotextile. Prepare the subgrade to the required lines and grades. Compact any fill required in the subgrade to a density of approximately that of the surrounding undisturbed material. Embed the geotextile a minimum of 4 inches and extend the geotextile a minimum of 6 inches beyond the edge of the scour hole. Stone for the plunge pool may be placed by equipment. Construct to the full course thickness in one operation and in such a manner as to avoid displacement of underlying materials. Deliver and place the stone for the plunge pool in a manner that will ensure that it is reasonably homogeneous with the smaller stones and spalls filling the voids between the larger stones. Place stone for the plunge pool in a manner to prevent damage to the geotextile. Hand place to the extent necessary. At the plunge pool outlet, place the stone so that it meets the existing grade. Maintain line, grade, and cross section. Keep outlet free of erosion. Remove accumulated sediment and debris. After high flows inspect for scour and dislodged riprap. Make repairs immediately.

## B. Stormwater Management

The construction of all stormwater management facilities shall conform to the approved drawings, Montgomery County Stormwater Management construction standards, MDE Stormwater Design Manual Volumes I&II, and the State of Maryland Highway Standard Specifications. The Contractor is responsible for fully understanding the design and functions of the proposed facilities and for constructing facilities in full compliance with design standards and the approved plans.

### 1. Design Engineer (DE) and Geotechnical Engineer (GEO)

The Contractor shall designate a Design Engineer (DE). The purpose of the DE is to oversee and inspect the construction of all stormwater management facilities and related stormwater management structures at no additional cost to MNCPPC. The minimum qualifications of the DE shall be: 1) submitted to M-NCPPC for approval; 2) familiar with the design, construction, and functionality of stormwater management facilities; and, 3) a licensed Professional Engineer (PE) registered in the State of Maryland.

The DE shall be solely responsible for overseeing, inspecting, and certifying that all stormwater-related facilities are built per the approved project plans and specifications. This includes all above and below ground structural and material components. The DE shall verify all critical inverts and elevations throughout construction to ensure conformance with approved designs. This information shall be provided to M-NCPPC in a timely manner during construction. The DE shall make any corrections and adjustments required to fully provide required design volumes, function, and structural integrity of facilities at no additional cost to the owner. The DE shall also verify that all site improvements, flow paths, and drainage areas to each facility are in conformance with the approved design plans.



The DE shall be responsible for signing any applicable MCDPS inspection checklists related to each stormwater-related facility. Note: all applicable inspection checklists should be shown on the project plans; in the event that they are not, they can be provided at the contractor's request.

The Contractor shall also designate a Geotechnical Engineer (GEO) as required per MCDPS stormwater management facilities checklist(s). The minimum qualifications of the GEO shall be: 1) submitted to M-NCPPC for approval; 2) familiar with the design, construction, and functionality of stormwater management facilities; and, 3) a licensed Professional Engineer (PE) registered in the State of Maryland.

The GEO shall be responsible for overseeing, inspecting, and certifying that all geotechnical-related project elements for all stormwater management facilities are built per the approved project plans and specifications at no additional cost to MNCPPC. Note the geotechnical elements are listed in the MCDPS stormwater management facilities checklist(s) as appropriate for the project, and checklist responsibilities shall be coordinated with the designated DE.

Any minor adjustments to the design plans during construction of a stormwater management facility shall be reviewed and approved by DE and/or GEO in coordination with the MCDPS inspector.

## 2. Shop Drawings and As-Built Plans

All Shop Drawings shall be sealed by a PE and submitted to M-NCPPC, and other related applicable jurisdictions, for review and approval prior to initiating construction.

Upon completion of construction, the Contractor is responsible for providing MCDPS, and/or other related applicable jurisdictions, As-Built plans sealed by the DE and GEO (if GEO is required) and any necessary supporting documentation. Supporting documentation may include the DPS As-Built/Record Drawing Plan Review Checklist, all of the signed or initialed inspection checklists for the related facilities, and copies of all the construction material and delivery tickets for the related facilities. The Contractor is responsible for coordinating the closeout inspection with MCDPS, and shall make any and all repairs to the facility and/or As-Built plan revisions, as required by MCDPS, to obtain final As-Built plan approval and final release of permit. All repairs/revisions required by MCDPS to release the permit shall be made at no additional costs to the owner.

## 3. Stormwater Facility Maintenance

The Contractor shall be solely responsible for maintenance of all stormwater-related facilities until MCDPS, or other related applicable jurisdictions, conducts the closeout inspection and releases the permit. The Contractor shall also perform any required maintenance to the facility to ensure full functionality, and any final required punch-list items as required by M-NCPPC, prior to final M-NCPPC acceptance of the facility.

### **322.04 MEASUREMENT AND PAYMENT**

Payment will be full compensation for all material, labor, equipment, tools and incidental items necessary to complete the work. Payment shall be made on a unit rate or lump sum basis as shown in the bid proposal. Payment for as built drawing and closure of stormwater management permit will be paid under section 111 – As Built Drawing (Record Drawing) and Support Documentations. Full

Payment for stormwater management related bid items (up to 20% of the full value of this item) maybe withheld at the discretion of the Commission pending MCDPS and/or other applicable jurisdictions approval of as built plans.

## **SECTION 504R – HOT MIX ASPHALT PAVEMENT**

### **504.01 DESCRIPTION**

Construct hot mix asphalt (HMA) pavement.

### **504.02 MATERIALS**

### **MSHA, 2008 STD. SPECS**

Performance Graded Asphalt Binders	904.02
Tack Coat	904.03
Hot Mix Asphalt Mixes	904.04
Crack Filler	911.01
Production Plant	915

### **504.03 CONSTRUCTION**

#### **Quality Control Plan**

At least 30 days prior to the placement of any HMA pavement, submit a Plant quality Control Plan to the Office of Materials Technology (OMT) and a Field Quality Control Plan to the District Engineer's representative for approval. The Quality Control Plans shall contain a statistically based procedure of random sampling and shall show how the Contractor proposes to control the equipment, materials, production, and paving operations to ensure conformance with these Specifications. A Master Plant and Field Quality Control Plan shall be submitted for this prior to approval. When a Master Field Quality Control Plan is submitted and approved, an addendum shall be submitted for each specific Contract. The Contractor shall discuss the QC Plan requirements in the pre-construction, pre-pave and progress meetings.

The Field Quality control Plan shall contain:

- A. Production plants, location of plants with respect to the project site, personnel qualifications, inspection and record keeping methods, and minimum frequencies of sampling and testing as specified in MSMT 735, Table 2.
- B. Corrective actions that will be taken for unsatisfactory construction practices and deviations from the material specifications.

The Engineer may require the Contractor to construct a control strip any time during placement of HMA based on the evaluation of compaction results.

#### **504.03.14 Pavement Surface Checks**

Have an approved 10 foot straightedge available at all times. After final compaction of each course, the surface of each pavement course shall be true to the established line and grade and shall be sufficiently smooth so that when tested with the straightedge placed upon the surface parallel with the center line, the surface does not deviate more than 1/8 in. The transverse slope of the finished surface of each course when tested with the straightedge placed perpendicular to the center line shall not deviate more than 3/16 in.

Check transverse joints using the straightedge immediately after the initial rolling. When the surface of each course varies more than 1/8 in. from true, make immediate corrections so that the finished joint surface is within tolerance.

Areas that are tested and reported in accordance with the Pavement Surface Profile Specification are not applicable to 504.03.14.

#### **504.03.15 Curbs, Gutters, Etc.**

Where permanent curbs, gutters, edges, and other supports are planned, they shall be constructed and backfilled prior to placing the HMA.

#### **504.03.16 Shoulders**

Shoulders abutting the HMA surface course of any two-lane pavement that is being used by traffic shall be completed as soon as possible after completion of the surface course on that lane. Construct shoulders as specified.

#### **504.03.17 Pavement Profile**

Refer to the Pavement Surface Profile requirements specified in the Contract Documents.

### **504.04 MEASUREMENT AND PAYMENT**

Hot Mix Asphalt pavement will be measured and paid for at the Contract unit price. The payment will be full compensation for furnishing, hauling, placing all materials including antistripping additive, tack coat, control strip, pot hole and spall repairs, setting of line and grades where specified, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

#### **Temporary Tie-Ins**

Placement and removal of the temporary tie-in where hot mix asphalt is being applied to the traveled way carrying traffic will not be measured but the cost will be incidental to the pertinent Hot Mix Asphalt item.

Removal of the existing pavement or structure for the final tie-in will not be measured but the cost will be incidental to the pertinent Hot Mix Asphalt item.

**Adjustments**

Adjustment of existing visible manholes, valve boxes, inlets, or other structures will not be measured but the cost will be incidental to the Hot Mix Asphalt item.

Adjustment of existing manholes, valve boxes, inlets, or other structures that are encountered below the existing grade will be considered for payment in conformance with SHA GP-4.07.

**Removal of Existing Raised/Recessed Pavement Markers**

Removal of existing raised/recessed pavement markers will not be measured but the cost will be incidental to the Hot Mix Asphalt item.

Removal of existing raised/recessed pavement markers that are encountered below the existing pavement will be considered for payment in conformance with GP-4.07.

**504.04.01      PRICE ADJUSTMENT FOR HOT MIX ASPHALT MIXTURE AND PAVEMENT DENSITY**

A price adjustment will be made as specified in SHA GP-5.02 when the hot mix asphalt properties or pavement density does not conform to Specifications. The Contract unit price will be adjusted for noncompliance with HMA properties and pavement density in conformance with these procedures. A pay reduction for pavement density will be based on individual core test data for a given lot and the lot average density as specified in this section.

Pay adjustment due to noncompliance with the density requirements will be made against the adjusted Contract unit price for Hot Mix Asphalt in conformance with Table 504. Price adjustment will be waived for that portion of the pavement where the engineer determines that inadequate density is due to a poor foundation.

**TABLE 504**

<b>DENSE GRADED HOT MIX ASPHALT MIXES PERCENT OF MAXIMUM DENSITY</b>		
<b>LOT AVERAGE</b>	<b>NO INDIVIDUAL BELOW</b>	<b>PAY FACTOR %</b>
92.0 – 97.0	91.0	100
91.0 – 97.0	90.0	95
90.0 – 97.0	90.0	90
89.0 – 97.0	89.0	85
Less than 89.0	-	75.0 or rejected as determined by the Engineer

Note 1: When any test data is above 97.0, the Engineer may determine to Make additional pay reduction or reject.

Contractor's quality control test data will be used in all analysis of compaction compliance in conformance with 504.03.10.

Acceptance of a mixture lot will be in conformance with Sections 904, 915, and MSMT 735. A composite pay factor (CPF) for asphalt content, gradation, and mixture will be based on the total estimated percent of the lot that is within Specification limits as computed using the quality level analysis in conformance with MSMT 735.

Contractor's quality control test data will be used in all analysis of mixture compliance in conformance with 504.03.10.

The Lot payment for in-place density will be computed using the following formula:

$$LP_{ipd} = (CP) \times (DF) \times (TL)$$

where:

LP<sub>ipd</sub> = Lot payment in-place density  
CP = Contract unit price  
DF = Density pay factor from Table 504.04  
TL = Tonnage per lot.

The Lot payment for asphalt content and gradation will be computed using the following formula:

$$LP_{md} = (CP) \times (MF) \times (TL)$$

where:

LP<sub>md</sub> = Lot payment for mix design  
CP = Contract unit price  
TL = Tonnage per lot  
MF = Mixture pay factor (refer to MSMT 735 for CMPWSL):  
when CMPWSL is less than 90%, MF = 55 + 0.5 CMPWSL  
when CMPWSL is greater than or equal to 90%, MF = 100

An in-place density lot containing material with a pay factor of less than 1.0 may be accepted at the reduced pay factor, provided the pay factor for density is at least 0.85 and there are no isolated defects identified by the Engineer.

A mixture lot containing material with a pay factor of less than 1.0 may be accepted at the reduced pay factor, provided the composite pay factor for asphalt content and grading is at least 0.75 and there are no isolated defects identified by the Engineer.

An in-place density lot containing nonconforming material that fails to obtain at least a 0.85 pay factor and a mixture lot containing nonconforming material that fails to obtain at least 0.75 pay factor for asphalt content and gradation, will be evaluated by the Engineer to determine its acceptance. When the Engineer determines to reject a lot, the lot shall be replaced at no additional cost to the Administration.

When less than three mix samples have been obtained at the time of the acceptance sampling or at the time a lot is terminated, the Engineer will determine if the material in a shortened lot will be considered a part of a the previous lot, or will be accepted based on the individual test data.

**MNCPPC Materials Chart**

A.

<i><b>SUPERPAVE</b></i>	<i><b>BINDER</b></i>	<i><b>LIFT THICKNESS</b></i>	<i><b>TYPE OF LAYER</b></i>
4.75 mm	PG 64-22	½” MIN. ½” MAX	Very Fine Surface
9.5 mm	PG 64-22	¾” MIN. 1 1/2” MAX	Fine Surface
12.5 mm	PG 64-22	1 ½” MIN. 2” MAX	Medium surface *1
19.0 mm	PG 64-22	2” MIN. 3” MAX	Fine Base
25.0 mm	PG 64-22	3” MIN. 4” MAX.	Course Base

\*1) To be used for Hiker/Biker Trails (3” Lift Thickness Max.)

B. Protective Non-woven Membrane for Paving: AMOCO Petromat 4597 or approved equal. Installation shall be in accordance with manufactures specifications.

## **SECTION 550 – THERMOPLASTIC PAVING MARKING**

### **550.01      DESCRIPTION**

This specification covers a reflectorized pavement striping material of the type that is applied to a road surface in a molten state with premixed glass beads by spray or extrusion means, with a supplemental surface application of glass spheres. When applied properly and at the designated thickness and width the stripe shall, upon cooling, be reflectorized and be able to resist deformation by traffic. The applied material shall be impervious to degradation by motor oil, diesel fuel, grease deposits and ice-preventative chemicals.

### **550.02      MATERIAL REQUIREMENTS**

The thermoplastic pavement marking materials used in this contract shall meet the following specifications. This specification covers reflectorized oil and grease impervious thermoplastic road marking materials which are (1) hot extrusion applied with a surface application of glass spheres and (2) heat fused applied. The properly applied markings shall be reflectorized and able to durably resist degradation and deformation by traffic.

The thermoplastic materials shall be homogenously composed of pigment, filler, resins, and glass reflectorizing spheres, and shall be available in both yellow and white.

Composition: The pigment, beads and filler shall be uniformly dispersed in the resin. The materials shall be free from all skins, dirt, and foreign objects and shall comply with requirements according to Table 1. Only new materials shall be acceptable for use on this project.

<b>COMPONENT</b>	<b>WHITE</b>	<b>YELLOW</b>
Binder (see note A )	18.0% min	18.0% min
Glass Beads (AAASHTO M247 Type D )	30.0 – 40.0%	30.0 – 40.0%
Titanium Dioxide	10.0% min	--
Yellow Pigments	--	2.0% min
Calcium Carbonate	42.0% max	50.0% max

**Note A:** The alkyd binder shall consist of a mixture of synthetic resins ( at least one of which is solid at room temperature ) and a high boiling point plasticizer. At least one third of binder composition shall be solid maleic modified glycerol ester resin and shall be no less than 8% by



eight of the entire material formulation. The alkyd binder shall not contain petroleum based hydrocarbon resins.

**Note B:** The percentage of yellow pigment can be reduced if lead pigments are eliminated from the formulation.

Temperature - The molten material temperature shall be between 400 and 440 F unless otherwise recommended by the manufacturer, and approved by the Engineer.

Primer - A primer shall be used if thermoplastic is applied to Portland cement concrete. Any primer used shall be compatible with the thermoplastic material.

Thickness - The pavement markings shall yield a solid thickness range of 80 to 95 mils above the roadway surface across the middle two-thirds of the line width when tested as specified in MSMT 729.

Glass Beads - Glass beads shall be uniformly applied to the surface of the molten thermoplastic at the minimum rate of 7 to 9 lb/ 100 ft<sup>2</sup>, as specified in MSMT 729.

Color - The color of the dry markings shall match Federal Standard 595 (13538 – yellow or 17886 – white). The Contractor shall supply the specified color chips for the Engineer’s use to visually determine that the thermoplastic material matches the specified color.

Retro reflectance - The millicandel/lux/square meter values taken anytime within the first 30 days shall conform to the following:

**RETROREFLECTANCE**

<b>COLOR</b>	<b>RETROREFLECTIVITY</b>	<b>CORRECTIVE ACTION</b>
White	equal to or greater than 250	None
Yellow	equal to or greater than 150	
White	less than 250	Necessary corrective actions, including grinding if necessary, and re-tracing.
Yellow	less than 150	

The “Drop-On” glass beads shall conform to AASHTO specifications M-247-81 except as follows: The glass beads shall have the following gradation:

<b>US Sieve Number</b>	<b>Percent Passing</b>
20	100
30	75-95
50	15-35

80	0-5
100	0

The “Drop-On” glass beads shall be smooth, clear and free from air inclusions. The beads shall have a minimum refractive index of 1.50 and shall be a minimum of 80% true spheres overall, and minimum 70% true spheres on each sieve. The beads shall be moisture proof coated and shall meet the requirements of AASHTO M-247-81 Section 4.4.2 to insure optimum embedment of 60-65 percent (60-65%) in various thermoplastic traffic marking systems. The material shall set to bear traffic in not more than 2 minutes when the air temperature is 50 degrees F and not more than 10 minutes when the air temperature is 90 degrees F.

Bond Strength – After heating the thermoplastic material for four hours at 425 degrees F the bond strength to Portland Cement Concrete shall exceed 180 psi (1.24 Mpa Method ASTM D4796-88)

Cracking Resistance – For at least 90 days after application the materials shall show no cracks other than with substrate cracking.

Smear and Softening Resistance – During the life of the materials, the applied markings shall not smear or soften apart from substrate movement.

**550.03            QUALITY ASSURANCE**

Methods of Sampling and Testing: The Commission reserves the right to require the contractor to perform any quality assurance testing necessary to determine compliance with these specifications. Testing required shall be by industry standard and shall be the responsibility of the contractor and performed at no cost to the Commission.

The Contractor shall obtain and provide to the Construction Manager, as part of the material submittal package, a written material specification compliance certification from the thermoplastic manufacturer, stating that the material being used on this contract meets the materials specifications in the Contract.

**550.04            APPLICATION REQUIREMENTS**

The molten applied thermoplastic material shall readily screed/extrude at temperatures between 400 degrees F and 440 degrees F from the approved equipment to produce a line which shall be continuous and uniform in shape having sharp dimensions.

The application of additional glass beads by drop-on methods shall be at a minimum rate of 8 lbs. per 100 sq ft of marking. Ambient and surface temperatures shall be at least 50 degrees F and rising at the time of application.

Method of Application:

The Contractor shall furnish and install machine-applied extruded and/or sprayed hot thermoplastic with glass spheres (pre mixed and drop-on) in the proper ratio to immediately produce a highly reflective marking as described elsewhere in these specifications, in accordance with the details in this contract and the following provisions.

#### Surface Preparation:

In order to insure maximum possible adhesion, the pavement surface upon which the pavement markings are to be placed shall be properly cleaned from grease, oil, mud, dust, dirt, grass, loose gravel, and other deleterious material prior to the application of the Thermoplastic pavement markings, and/or primer/sealer. Cleaning is required on all surfaces which are to receive new pavement markings, and shall be considered incidental to the application of the markings.

#### Primer-Sealer:

It shall be the responsibility of the contractor to recommend to the Construction Manager and obtain the Construction Manager's concurrence as to whether primer-sealer is required on a given pavement in order to meet the material manufacturer's warranty conditions. Generally, on all Portland Cement concrete pavement surfaces and aged asphalt-concrete pavements having less than eighty percent (80%) bituminous concrete, primer-sealer shall be applied to the area where the thermoplastic pavement markings are to be placed. Also, the Commission reserves the right to direct the Contractor to apply primer/sealer for any given markings.

The primer/sealer shall be that recommended by the manufacturer of the thermoplastic material, and approved by the Construction Manager. The material shall form a continuous film which shall dry rapidly and adhere to the pavement. The material shall not discolor nor cause any noticeable change in the appearance of the pavement outside the of the finished pavement markings. All solvents shall have evaporated from the primer/sealer prior to the application of the molten thermoplastic materials. A sample of the primer/sealer and the recommended method of application must be submitted to the Construction Manager, and shall have been approved by the Construction Manager and the manufacturer of the material before application.

The Construction Manager has the authority to require the Contractor to apply the primer/sealer using a separate vehicle which may require additional traffic control.

Payment for application of primer/sealer and any additional traffic control will be incidental to the marking item.

### **550.05            REMOVAL OF EXISTING PLASTIC OR PAINTED MARKINGS**

When called for in the contract or otherwise as directed by the Construction Manager, removal of existing painted or plastic pavement markings shall be accomplished by the Contractor using equipment and methods specifically approved by the Construction Manager. Marking removal shall not be by the "painting out" with black paint method nor shall it result in excessive scarring of the pavement. No more than 1/8 inch depth of scarred pavement will be allowed. At least 90 percent of all markings shall be removed.

As directed by the Construction Manager, the Contractor shall be responsible for sweeping or otherwise adequately cleaning up debris after completion of markings required to be removed by the Construction Manager because they are improperly located or otherwise incorrect or improper. Unless permitted otherwise by the Construction Manager, where old markings are removed, the new markings must be applied the same day as the old markings are removed. Whenever grinding, scraping, sandblasting, or other operations are performed, the work shall be conducted in such manner that the finished pavement surface is not damaged or left in a pattern that will mislead or misdirect motorists. When these operations are completed, the pavement markings shall be cleaned to remove residue and debris resulting from the cleaning work.

Where cleaning and/or removal of pavement paint striping or objectionable material is being performed within ten (10) feet of a lane occupied by traffic, the residue removal shall be by method(s) approved by the Construction Manager.

Any damage to the pavement or pavement joint materials caused by pavement marking removal shall be repaired by the Contractor at not cost to the Commission by methods acceptable to the Construction Manager.

The removal of pavement markings will be measured and paid for at the contract price as shown in the Bid Documents.

No direct payment will be made for the removal of existing pavement markings which have not been authorized by the Construction Manager.

#### **550.06            PRE-MARKING OF LINES**

When a line is required to be placed in the same location as an existing painted line, and existing painted markings not required to be removed are visible, they shall be retraced (i.e. new markings installed in exactly the same locations, patterns, and dimensions as the old markings). However, if the existing markings are to be removed or are not visible, or if new roadway surface has been placed before markings installation occurs, or if the contract requires a line to be installed where none currently exists, the Contractor will be required to pre-mark as directed by the Construction Manager and subsequently shall install the required markings in accordance with the requirement of other sections of the specifications.

The actual placement of the pavement markings at any such site shall not be performed until the pre-marking has been inspected and approved by the Construction Manager. Pre-marking is incidental to the pavement marking installation work and there will be no separate payment for pre-marking.

#### **550.07            MAINTENANCE OF TRAFFIC**

All work shall be performed in accordance with Part VI of the Manual on Uniform Traffic Control Devices (MUTCD) and section 104 of the MSHA Standard Specifications for Construction and Materials.. The Contractor shall furnish and place all warning devices, flag persons, and other traffic control devices required to direct, control and protect the traveling public while marking operations are in progress. Maintenance of traffic for this work will be paid under the Maintenance of Traffic item if an item is included in the bid proposal, otherwise it will be considered incidental to the work.

#### **550.08            WARRANTIES**

The thermoplastic pavement marking materials and glass beads furnished under this contract shall assume the manufacturer's warranty for these materials and shall be guaranteed by the supplier against failure due to traffic oil degradation.

The contractor shall assume all costs arising from the use of patented materials, equipment, devices or processes used on or incorporated in the work, and agrees to indemnify and hold harmless the

Commission and its duly authorized representatives from all suits at law or action of every nature for, or on account of , the use of any patented materials equipment, devices or processes. Further, the material shall meet the requirements of this specification for a period of one year.

**550.09            METHOD OF MEASUREMENT AND PAYMENT**

Payment will be full compensation for all material, labor, equipment, tools, and incidental items necessary to complete the work. Payment shall be made on a unit rate or lump sum basis as shown in the bid proposal.

## **SECTION 602R – CURB, COMBINATION CURB AND GUTTER**

### **602.01 DESCRIPTION**

Construct concrete curb, header curb, mountable curb, flush curb, concrete combination curb and gutter.

### **602.02 MATERIALS**

### **MSHA, 2008 STD. SPECS**

Crusher Run Aggregate CR-6	901.01
Aggregate	901.01, Size No. 57
Curing Materials	902.07
Form Release Compound	902.08
Concrete Mix No. 3	902.10
Reinforcement Steel	908.01
Joint Sealer	911.01
Preformed Joint Filler	911.02

### **602.03 CONSTRUCTION**

Place the curb on a clean, dry, and stable base.

When required, backfill the curb after it has sufficiently hardened to prevent damage. Consolidate the backfill by tamping or rolling.

### **602.04 MEASUREMENT AND PAYMENT**

The payment will be full compensation for all concrete, forms, excavation, backfill, disposal of excess material, drainage openings, joint sealer, and for all material, labor, equipment, tools and incidentals necessary to complete the work.

Curb, Combination Curb and Gutter, will be measured and paid for at the Contract unit price per linear foot. Concrete Curbs, and Concrete Combination Curb and Gutter will be measured along the front face of the curb.

## **SECTION 611 – DETECTABLE WARNING SURFACE**

Refer to MDSHA Section 611 and note revisions below.

### **611.04 Measurement and Payment**

DELETE: The first sentence.

Detectable warning surfaces will be measured and paid for at the Contract unit price per square foot.

INSERT:

Detectable Warning Surfaces shall not be measured, but will be incidental to the concrete ramp unit price per each.

Refer to MDSHA Section 925 and note revisions below.

### **925.02 Composition**

DELETE: The first sentence:

Warning surfaces shall be either flexible or rigid.

INSERT:

Warning surfaces shall be rigid.

### **925.03 Size.**

INSERT: At the end of the section:

Acceptable manufacturer: Hanover Architectural Products, or approved equal.

- Detectable Warning Paver; 11 ¾” square, 2 ¼” thickness

### **925.05 Color**

INSERT: At the end of the section:

Hanover Red 15, or as selected from the full range of colors by the M-NCPPC Construction Manager. The Contractor shall submit color samples from the full range of available colors to the Construction Manager for review and approval.

## **Section 705R - SEEDING AND SODDING FOR TURF AREAS**

### **705.01 DESCRIPTION**

- A. Hydroseeding: This work shall consist of soil preparation, hydroseeding, addition of soil amendments (follow 32 94 00 Planting Soil), mulching, overseeding, and mowing all areas designated for turf establishment as specified in the Contract Documents or as directed by the M-NCPPC Construction Manager.
- B. Sodding: This work shall consist of soil preparation, addition of soil amendments (as determined by the soil test results), watering, and placing grass sod on prepared areas, as specified in the Contract Documents or as directed by the M-NCPPC Construction Manager.

### **705.01.01 QUALITY ASSURANCE**

- A. Submit for approval proposed seed mixture.
- B. Submit Manufacturer's certificates of purity and guarantees of germination in accordance with Maryland Seed Law to the M-NCPPC Construction Manager.
- C. Follow Section 32 94 00 Planting Soil for quality assurance of soil and soil testing.
- E. Turf Grass Conditions will not be accepted if there is a poor or thin stand; improper application of sod, dead grass or sod, use of seed mixtures or sod other than approved in specifications, improper fertilizer application either uneven spreading or insufficient amounts, or failure to re-fertilize during extended acceptance, and the presence of persistent weeds established in turf areas.

### **705.01.02 REFERENCE STANDARDS**

- A. Landscape Specification Guidelines, latest edition, Landscape Contractor's Association (LCA) of Maryland, Virginia and The District of Columbia.
- B. "Recommended Turf grass cultivars for Professional Seed Mixtures," University of Maryland Turfgrass Technical Update TT-77, most recent edition (updated annually), formerly Agronomy Mimeo 77, or AM-77.

### **705.02 Materials**

- A. Planting Soil:  
  
Follow section 32 94 00 Planting Soil



B. Grass Seed:

Shall be Maryland Certified. It shall be fresh, clean, new crop seed mixed in the proportion shown and testing to no more than .02% weed seed and 85% minimum germination. Approved varieties shall be selected "Recommended Turfgrass cultivars for Professional Seed Mixtures," University of Maryland Turfgrass Technical Update TT-77, most recent edition (See Section 705.3) A copy of this publication can be obtained from the M-NCPPC Construction Manager or by visiting the Maryland Turfgrass Council website <http://www.md turf council.org> or by calling them at 410-836-2876. A minimum application rate shall be approximately 300 pounds per acre (7 lbs/1000ft ) unless plans specifically state another rate of application.

Minimum Percentages of Grass Seed:

SEED MIXTURE TO BE:	<u>% BY WEIGHT</u>	<u>% PURITY</u>	<u>% GERMINATION</u>
Kentucky Bluegrass	10%	98%	85%
Turf-type Tall Fescue*	70%	98%	90%
Perennial Rye Grass	20%	98%	85%

\*Use a single cultivar or seed in blends

C. Mulch:

1. Bright, small grain type straw. Shall be free of rot and noxious weed seeds. Apply 1/2"-3/4" thick layer or 60-80 bales/acre.
2. Hydro mulch: Wood cellulose applied at a net dry weight of 750 pounds per acre. See LCA, Landscape Specification Guidelines, Seeding and Sodding specifications, Section 5.3 Mulching Materials, for detailed specifications.
3. Erosion Control Blankets acceptable as determined by M-NCPPC Construction Manager.

D. Mulching and Stabilizing Materials:

All straw mulch shall be bound with a suitable binder or straw shall be rolled thoroughly with a crimping roller in several directions to prevent erosion of the soil and/or mulch. See LCA, Landscape Specification Guidelines, Seed and Sod specifications, Section 5.3 Stabilizing Materials, for detailed specifications.

E. Sod:

1. Shall be Maryland Certified (labeled), inspected and approved by the Maryland Department of Agriculture.
2. Label must be presented to the M-NCPPC Construction Manager at the time of delivery and prior to installation for approval.
3. Sod shall be a 90/10 mix with 90% of the mix shall be a blend of three turf type tall fescues, and at least 10% Bluegrass. Approved varieties shall be selected "Recommended Turfgrass cultivars for Professional Seed Mixtures," University of Maryland Turfgrass Technical Update TT-77 most recent edition. A copy of this publication can be obtained from the M-NCPPC Construction Manager or by visiting the Maryland Turfgrass Council website <http://www.md turf council.org> or by calling them at 410-836-2876.
4. Specifications for Sod Materials
  - a. Thickness of Cut: The thickness of the roots and soil should be ½" to ¾".
  - b. Pad Size: Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be 5%. Broken pads and torn or uneven ends will not be acceptable.
  - c. Strength of Sod Sections: Under ideal conditions, standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10% of the section **without the use of netting.**
  - d. Sod Viability: Sod shall not be harvested or transplanted under drought conditions.
  - e. Time Limitations: Under optimal conditions, sod shall be harvested, delivered and installed within a period of 36 hours. However, because sod is a perishable commodity, if high temperatures and low moisture extremes occur, its viability declines and installation should occur within 24 hours from harvest. Sod not transplanted within this period shall be inspected and approved or rejected by the M-NCPPC Construction Manager prior to installation.

F. Sod Staples:

On slopes greater than 3:1 or steeper sod shall be stapled at a minimum of 4 staples per square yard of sod.

## **705.03    CONSTRUCTION**

Final Soil Grading and Preparation shall be inspected by the M-NCPPC Construction Manager before seeding and/or sodding commences.

Seed, Sod, and Soil Amendment Rates and Specifications shall adhere to those in Section 32 94 00 Planting Soil, unless specifically changed in this contract.

### **Seeding and Mulching:**

1. Final grade and seedbed must be approved by the M-NCPPC Construction Manager before seeding begins and upon completion of the seedbed. Failure to get the seed bed approved may result in doing the seedbed preparation over.
2. Seeding may be done immediately thereafter, provided the topsoil has remained in a good, friable condition and has not become muddy or hard. If it has become hard, it shall be tilled to friable condition again, and re-inspected.
3. Weeds and undesirable grasses growing on existing grade that is to be seeded and/or sodded must be cut and removed before soil preparations begins. In some instances an M-NCPPC approved herbicide may be used as directed and approved by M-NCPPC construction manager. Contractor must have current MD Dept. of Agriculture certified pesticide applicator performing work. Signage and pesticide records shall follow MDA regulations. Copies of all application records shall be submitted to construction manager.
4. Before seeding or sodding all soils shall be prepared in accordance with Section 32 94 00 Planting Soil

### **Dry Application:**

- a. Seed Installation: Cultipacker Seeder: This method applies to seed just below soil surface and covers the seed in a single operation. Seed should be applied within the top ¼” of the soil in two different directions for best results.  
  
Drop-type/Broadcast Spreader: Apply seed within top ¼” of the soil in two directions for best results. To improve soil/seed contact the entire area shall be rolled.
- b. Mulching: Apply mulching material to retain moisture and minimize erosion. See Section 705.2, section C for application rates.

- c. Stabilizing: Stabilize the mulch by either mulch anchoring tool, cellulose fiber, liquid mulch binders or mulch netting.

**Hydroseeding:**

- a. Installation:

Water, seed and fertilizer method: The mixture shall be sprayed on the previously prepared seedbed in the form of an aqueous mixture. Refer to “Recommended Turfgrass Cultivars for certified sod and professional seed mixtures,” for recommended seeding rates. All mixture shall be constantly agitated from the time they are mixed until they are finally applied to the seedbed.

If fertilizer is mixed into the slurry, no more than 30 minutes should lapse before it is applied to prevent the fertilizer from burning the seed. Care shall be exercised to ensure uniform coverage.

- b. Straw shall be applied by hand or with a straw blower and stabilized. The same rates and procedures shall be followed as detailed in Dry Application above.
- c. Seed, fertilizer, water and cellulose fiber method: The application procedure for this method is the same as for the first method above. The rate of cellulose fiber is 50 pounds per 100 gallons of water. Follow manufacturer’s recommended rates.

**Sodding:**

Sod shall conform to materials in Section 705.02 Paragraph E of these specifications.

1. Soil preparation shall conform to Section 329400 Planting Soils.
2. Sodding may be done immediately thereafter, provided the bed has remained in a good condition and has not become muddy or hard. If it has become hard it shall be tilled to a friable condition again, and re-inspected by the M-NCPPC Construction Manager.
3. Moistening soil: During periods of high temperature, lightly irrigate the soil immediately prior to laying the sod.
4. Starter Strip: The first row of sod shall be laid in a straight line with subsequent rows placed parallel to and tightly against each other. Lateral joints shall be staggered to promote more uniform growth and strength. Care shall be exercised to ensure that

the sod is not stretched or overlapped and that all joints are butted tightly in order to prevent voids, which would cause air-drying of the roots.

5. **Sloping Terrain:** On sloping terrain (3 to 1 or steeper), where erosion may be a problem, sod should be installed perpendicular to slope when possible with staggered joints and secured by staples. Staples are to be driven flush with sod. Sod in swales shall be stapled. Use only lengths of four feet or more in ditch inverts and swales. Sod joints shall be staggered.
6. No sod shall be applied to frozen ground and/or frozen sod is not to be laid.
7. **Watering and Rolling:** The contractor shall lightly water sod during installation to prevent excessive drying. As sodding is completed in any one section, an entire area shall be rolled. It shall then be thoroughly irrigated so that the underside of the new sod pad and soil immediately below the sod are thoroughly wet. The contractor shall be responsible to have adequate water available at the site prior to and during installation of sod, unless otherwise stated.

#### **PLANTING AND TIMING**

A. Regular Seeding Season

Spring - March 1-May 15

Fall - September 1-October 15

Optimum seeding time is late August to mid October

B. Regular Sodding Season

Spring - (March 1 to May 1)

Fall - (October 1 to November 15)

- C. To begin seed and sod installation, obtain approval from the M-NCPPC Construction Manager. To seed or sod at times other than those listed, requires the approval of the M-NCPPC Construction Manager.

#### **MAINTENANCE OF NEWLY SEEDED AND SODDED AREAS**

- A. Maintenance of grass areas shall consist of watering, mowing, weeding, re-seeding and/or re-sodding as necessary to obtain an approved stand of grass. Maintenance shall continue until M-NCPPC Construction Manager accepts the project.
- B. In the absence of rainfall, during the first week of seed or sod installation, watering shall be performed daily by the Contractor or as often as deemed necessary by the M-NCPPC Construction Manager. Water must be in sufficient quantities to maintain

moist soil to a depth of 4 inches. The total shall be equal to the equivalent of at least 1 inch of water per week. Watering shall continue until the stand of turf is accepted. For seeded areas, bare spots, which persist after three weeks of favorable growing weather, shall be re-cultivated, re-seeded, raked and rolled. Re-seeding of bare spots shall be done as many times as necessary until an acceptable stand of turf is established. For sodded areas, bare spots shall be re-sodded until deemed acceptable. If the turf stand is not accepted by the following seeding and sod season, the Contractor shall re-seed or sod and fertilize, as necessary, the unaccepted areas at no additional charge to M-NCPPC.

- C. If stand provides between 40% and 90% ground coverage, overseed and fertilize using half of the rates originally applied. If stand provides less than 40% coverage, reestablish stand following original rates and procedures.
- D. Flooded, washed-out, rilled or otherwise damaged or defective areas of seeding, sod, mulch, grade, swales or berms shall be reconstructed and all grades re-established in accordance with the grade plans or other specifications or when, in the judgment of the M-NCPPC Construction Manager, such defects or damages are the result of poor workmanship, or failure to meet the requirements of the specifications.
- E. All mowing shall be the Contractor's responsibility until final acceptance of the project. No mowing shall remove more than one-third of the grass blade length. Heavy mowing, resulting in grass piles shall be "double mowed" or the contractor shall remove piles. Height of the grass shall be maintained between two and a half and three inches, unless otherwise specified.
- F. Following are some examples of delays in final acceptance of a project:
  - 1. Improper Grades:
    - a. Low or high spots on flat or fairly level areas.
    - b. Improper drainage such as, swales, low areas, rip-rapped outlets and paved areas.
    - c. Washed out or rilled areas.
    - d. Exposed debris.
  - 2. Turf Grass Conditions:
    - a. Poor or thin stand; improper application of sod, dead grass or sod; use of seed mixtures or sod, other than approved in specifications.

b. Improper fertilizer application - Uneven spreading, insufficient amounts, failure to re-fertilize during extended acceptance.

c. Persistent weeds established in turf areas.

**705.04**      **MESUREMENT AND PAYMENT**

Payment will be full compensation for all material, labor, equipment, tools and incidental items necessary to complete the work. Payment shall be made on a unit rate or lump sum basis as shown in the bid proposal.

## **SECTION 721R- TREE PRESERVATION**

### **721.01      DESCRIPTION**

This work includes: Implementing all arboricultural activities related to tree preservation and protection of existing trees on site as shown on plans and directed by M-NCPPC Arborist. The work includes, but is not limited to, tree protection fencing and signs, pruning, root pruning, mulching, fertilization, and other remedial activities.

### **721.01.1      QUALITY ASSURANCE**

- A.      Standards: All trees on site which are to be preserved will be prepared and treated to maximize their potential for survival and improve their health and condition. All work will be performed to meet or exceed current industry standards. This will also be at the minimum the standards most recently published by the ANSI and the “Trees Technical Manual; Guidance for Implementation of Montgomery County’s Forest Conservation Law”.
  
- B.      Company Qualifications: Qualifications to be submitted with bid include the following: Contractor will provide an arborist with current certification from the International Society of Arboriculture and the American Society of Consulting Arborists (ASCA). Verification of membership in good standing in the National Arborist Association (NAA). This person shall be responsible for seeing that all work is performed to standards in a safe and professional manner.
  
- C.      Equipment and Safety:
  - 1.      Equipment: All applicable Federal, State, and Local regulations shall be followed. The Contractor will be responsible for damage to property resulting from equipment, including fluid leakage or damage resulting from equipment failure. All incidents of this type shall be reported immediately to the M-NCPPC Construction Manager.
  
  - 2.      Safety shall be a primary concern while working on the property. Qualified company shall have an established safety program and adhere to all N.A.A., O.S.H.A., and A.N.S.I. standards applicable to the tree care industry. This includes all electrical and utility requirements as well as personal equipment and safe work procedures. All accidents resulting in property damage or personal injury shall be reported immediately to the M-NCPPC Construction Manager.
  
  - 3.      The Contractor shall be responsible for any damage to structures, installations, fixtures, paving, concrete, plant materials and any other items on the property which result from the execution of work prescribed. All work is to be performed in the safest manner possible in order to avoid damage of any kind.



#### 4. Pesticide Applications

- a. If pesticide applications are required, a Certified Pesticide Applicator shall be responsible for supervision of all applications of pesticides on the property. The name and certification number of certified applicator(s) assigned to this job shall be submitted to the M-NCPPC Construction Manager.
- b. All pesticides shall be applied in strict accordance with label instructions and all applicable federal, state, and local requirements. All pesticide applications shall be approved by the M-NCPPC Construction Manager prior to application. Pesticide Labels and Material Safety Data sheets shall be available for all pesticides while on the site.

#### D. Definitions:

1. Tree Diameter shall be defined as diameter at breast height (dbh) which is the average tree diameter at 4.5 feet, measured from the ground on the uphill side of the tree.
2. Tree Caliper shall be defined as the diameter of the trunk at 6" above the soil for trees up to 6" in caliper and diameter at 12" above the soil for trees up to 12" caliper.
3. Critical Root Zone shall be defined as 1.5-foot of radius for every inch of trunk diameter at four feet six inches above ground level on the uphill side of the tree.
4. Tree Preservation Area shall be defined as all areas outside limits of construction which contain trees and all areas within the limits of construction which are designated as tree preservation areas on the plans and/or in the field by fencing and signage.
5. Supersonic Airtool (SSAT): Hand held tool designed to focus highly compressed air (90-125 psi) provided from a large diesel air compressor (185-375 cfm) at speeds close to Mach 2 (approx. 1400 mph) at the working tip of the tool. Recently in wide use by arboricultural firms and consultants for multiple purposes including but not limited to the following: root collar investigation, CRZ investigation, root pruning especially large roots > 1.5" diameter or root pruning where existing underground cables or conduits are located, excavation for utilities within CRZs, radial decompaction and restoration of compacted soils, insertion of piers, footers, and pilings within the protected CRZs during construction.
6. Root Aeration Mat (RAM): Triple-ply geocomposite matting used to distribute compressive loads under grade fills and pavement, resists compaction of soil CBR, provide atmospheric air / gas exchange to top soil and roots within Critical

Root Zones of protected trees. This prevents suffocation of roots under grade fills and pavement sections such as parking lots and driveways. It consists of an extruded high density polyethylene diamond mesh inner grid covered by 2 layers of non - woven, needle punched, geotextile fabric. The top layer is typically 8oz fabric and the bottom is a 4oz fabric. Material thicknesses are specified depending upon loading factors such as structural fill vs non- structural.

## **721.02      MATERIALS**

### **A.      Fertilizer:**

1.      Granular: 30-7-7 with 50% of nitrogen in slow release form. Formula shall contain micronutrient compliment.
2.      Liquid: 30-10-7 arboricultural grade. Nitrogen shall be 67% slow release in the form of urea formaldehyde. Potassium shall be derived from soluble potash. Phosphorous shall be in the form of phosphoric acid.

### **B.      Root stimulant: Roots<sup>tm</sup> concentrate; Essential<sup>tm</sup>, manufactured by Growth Products Limited; MycorTree Saver Injectable, manufactured by Plant Health Care, Incorporated, 440 William Pitt Way, Pittsburg, Pennsylvania, 15238, (412) 826-5445; or equivalent product subject to approval of Construction Manager.**

### **C.      Tree Protection Fence: Tree protection fence shall be a minimum of four feet high. Welded Wire: 14 gauge galvanized welded wire with 2" x 4" openings attached to 6' minimum "T"- steel posts, driven at least 2' into ground @ 10 foot intervals or approved equivalent. Brightly colored flagging shall be attached to top of fence to ensure visibility.**

Chain Link: 11 ½ gauge Galvanized. All posts are 1.5 to 2 inch O.D. @ 10 foot intervals or approved equivalent.

### **D.      Tree Protection Signage: Signs shall be laminated or otherwise weatherproof and printed in bold text so as to be easily read from a distance of 20 feet. Wording on signage shall be provided in both English and Spanish.**

### **E.      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. The exact specification of materials for root aeration or protection matting shall be determined by the Contract Arborist and Contractor for submittal and review. Existing soils shall be assessed for supportive characteristics as well proposed equipment, staging, and stockpiling shall be reviewed with construction managers to prescribe correct materials and combinations. Other factors to consider include slope, drainage, E & S requirements, frequency and duration of loading, static loading versus**

dynamic loading.

**721.03**      **CONSTRUCTION**

- A.     Schedule: Contractor's Arborist shall be responsible for performing all arboricultural activities included within the scope of this specification. All activities will commence immediately upon notice to proceed. Activities will be completed in a continuous manner and coordinated to prevent delay of other construction processes.
  
- B.     Labor: Contractor's Arborist will dedicate labor and equipment as necessary to complete the work. It shall be the Contractor's Arborist's responsibility to maintain a consistent crew on the job site in order to complete work in a timely manner. It will be the Contractor's Arborist's responsibility to supervise work and scheduling and see that work progresses in an efficient manner.
  
- C.     Meeting: The Contractor shall be required to contact the M-NCPPC Construction Manager to set up a meeting in the field to review the location of trees to be saved and limits of construction. Any potential conflicts between construction and preservation shall be addressed at that time.
  
- D.     Notifications: Contractor's Arborist shall notify the M-NCPPC Site Plan Enforcement Inspector from the Development Review Division (FCP Plans) and the Construction Manager Arborist of any site condition changes which may affect work progress.
  
- E.     Initial Work: No other construction activity may occur on site until tree preservation fencing has been installed and approved by the M-NCPPC Site Plan Enforcement Inspector from the Development Review Division and the Construction Manager Arborist.
  
- F.     Construction Activity: All construction activity within the areas fenced off around the trees shall be prohibited. This shall include the following activities:
  - 1.     Parking or driving of equipment, machinery or vehicles of any type.
  
  - 2.     Storage of any construction materials, equipment, stockpiling, excavation or fill, soil, gravel, etc.
  
  - 3.     Dumping of any chemicals, (i.e. paint thinner from cleaning brushes), wash-out materials from cleaning equipment, concrete or mortar remainder, trash, garbage, or debris of any kind.
  
  - 4.     Burning within or in proximity to protected areas.
  
  - 5.     Felling trees into protected areas.

6. Trenching or grading within the Critical Root Zones of protected trees for any purpose without notifying the M-NCPPC Construction Manager 10 days in advance of operation in writing. This includes utilities, lighting, irrigation, drainage etc.
- G. Tree Preservation Area: Any work required by plans which is in a tree preservation area shall be performed by hand. All work will be performed in a manner to prevent compaction, siltation and disturbance of the root mat of all associated trees and understory trees. At no time shall tree protection fencing be removed or relocated without permission of M-NCPPC Arborist Construction Manager.
- H. Subcontractor: The contractor shall be responsible for insuring that all subcontractors are aware of tree preservation specifications.
- I. Critical Root Zone: Contractor may operate equipment within the root zone of trees to be preserved only if buffered with 1/2" plywood with a 6" layer of wood chips underneath; or 12 inches of wood chips. Approval from M-NCPPC Construction Manager is required prior to operation of any equipment in tree preservation areas. Root protection measures shall be inspected and maintained throughout construction.
- J. Location: Contractor will be responsible for installation of tree protection fencing around trees and groups of trees to be preserved. See plan for location.
- K. Flagging: Prior to installation, Contractor shall flag or paint location of fencing in field for verification by M-NCPPC Construction Manager.
- L. Bid: Contractor shall include installation, maintenance, and removal of fencing in bid.
- M. Tree Protection Fence: Fencing shall remain in place and be continuously maintained for duration of construction.
- N. Signs: Signs prohibiting access to preservation areas shall be placed at least every thirty feet along preservation fencing. Signs shall be as shown on the drawings. Minimum size shall be 10 x 12 inches square. Material must be plastic or other weatherproof material.
- O. Root Pruning: See plan for Final locations for root pruning to be performed determined in the field in conjunction with both tree protection and sediment control fencing and approved by the Construction Manager. Root pruning shall be performed wherever grades will be lowered within the critical root zone of a tree to be preserved. Root pruning shall be to the depth of excavation, or 24 inches, whichever is less. A Vermeer RT 200 with the optional root cutter or a approved equal trencher or vibratory plow shall be used to prune roots. The blade will be sharpened daily prior to the beginning of the operations. The supersonic air tool will be used when roots larger than 2" in diameter are exposed to facilitate root pruning or when root pruning the inner third of a trees critical roots. Roots over 1-1/2" in diameter shall have a clean cut made on the surface of the root which is still attached to the tree. This cut shall be made with a handsaw or chain

saw as soon as larger root is severed encountered.

Backfill the root-pruning trench with excavated soil, compact to not exceed 85% within CRZs, and mark location for future reference. Silt fence maybe installed in trench prior to backfilling as long as trench is not open for longer than 48 hours without watering.

Root pruning work will not be done when more than the top one-inch of soil is frozen. Root pruning will not be undertaken when the soil is wet and conditions are muddy.

- P. SSAT Excavation: Provide layout of proposed utility for excavation for review by the MNCPPC Inspector. The SSAT shall be used by a trained arborist worker with documented experience in root pruning and construction utility excavation. Provide supplemental watering prior to excavation should soil moisture be less than satisfactory to facilitate excavation, lessen air-born dust, and maintain root moisture. For thick turf provide sod cutter to remove sod prior to use. Provide temporary heavy duty tarps to catch excavated soil and reduce compaction from foot traffic. If equipment is being used for further excavation, pipe laying, or backfill, substitute tarps with temporary root protection matting with strength to reduce compaction of existing grade. Provide temporary vertical barrier or tent as needed to prevent flying debris from vehicles or structures or pedestrians. Provide second experienced worker to guard for pedestrians, vehicles, or safety shut off should equipment malfunction. Backfill and compact per project specifications. Cover with mulch or turf per project specifications.
- Q. Root Aeration Matting: Provide experienced qualified arborist to layout and install Root Aeration Matting under grade fill. Protect area(s) designated for RAM during installation of perimeter controls and clearing operation. Provide hand clearing of trees, shrubs, vines and stumps within area. Mow weeds or turf to 3" height. Provide backfill of pot -holes with site soil or drainage stone for support. Rake or leaf blow debris and leaves. Barren soil is not mandatory. Provide orientation for at least one edge of RAM to near daylight with cover by mulch or less than one inch of topsoil; or provide permanent venting tubes from buried RAM edge to daylight. Cover tube ends with perforated caps. Provide regular root pockets within RAM materials in non-structural grade fills to allow new roots to grow up through matting into new fill. Root pockets not to exceed 12"x12" spaced 6' on center. Provide 12" staples or turf nails to hold RAM material prior to filling. Provide onsite instruction to site work contractor and review of backfilling procedures over RAM material to prevent shifting, crushing, or bunching. Provide trimming off protruding materials after final grade fill and stabilization is complete.
- R. Fertilizer: All trees indicated shall receive a liquid fertilization. Fertilizer will be applied at a rate of 1.5 pounds of nitrogen per 1,000 square feet of root zone treated. Fertilizer shall be injected using a soil probe at a depth of six inches. Fertilizer shall be applied in three-foot grid pattern evenly distributed throughout the root zone.
- Q. Damage: Contractor will provide services as necessary to respond to damage by construction activities within 48 hours of notification by the M-NCPPC Construction Manager.

- R. Penalties: Failure to comply with specifications may result in penalties as prescribed by Chapter 22A of the Montgomery County Code, Forestry Conservation Law.

**721.04            MEASUREMENT AND PAYMENT**

Payment will be full compensation for all material, labor, equipment, tools and incidental items necessary to complete the work. Payment shall be made on a lump sum rate basis as shown in the bid proposal for the various item stipulated in the proposal.

## **SECTION 722R – PLANTING, INSTALLATION, AFTERCARE AND WARRANTY**

### **722.01      DESCRIPTION**

The Contractor will coordinate the planting to be completed by others in insure that the microbioretention, bioswale, and forest conservation plans may be completed and the permits can be released. The Contractor will be required to place all planting soils and bioretention soils in accordance with section 329400 Planting Soils. It is the Contractor's responsibility to stabilize all soils with mulch and in accordance with the Sediment and Erosion Control.

Mulch and compost will be available through the Commission's recycling facility at the M-NCPPC Pope Farm Nursery at no cost to the Contractor. Contractor is responsible for hauling the materials from the Pope Farm Nursery at 7400 Airport Road in Derwood to the site. Contractor shall coordinate with M-NCPPC Construction Manager prior to acquiring the materials. The request shall be made to the M-NCPPC Construction Manager at least 72 hours prior to obtaining the materials.

## **SECTION 024119 - SELECTIVE DEMOLITION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Demolition and removal of selected site elements.
  - 2. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
  - 1. Section 101 "Site Clearing" for site clearing
  - 2. Section 102 "Removal of existing Facilities" for removal of above- and below-grade improvements.
  - 3. Section 721 "Tree Preservation" for temporary protection of existing trees and plants that are affected by selective demolition.
  - 4. Section 017419 Construction Waste Management and Disposal

#### **1.3 DEFINITIONS**

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Salvage and Reuse: Carefully detach from existing construction, in a manner to prevent damage, salvage on site to be reused in the design as indicated on plans.
- D. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- E. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

#### **1.4 MATERIALS OWNERSHIP**

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



## 1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
  - 4. Review areas where existing site elements are to remain and requires protection.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Interruption of utility services. Indicate how long utility services will be interrupted.
    - a. Develop a schedule that minimizes the disruption of the following utilities:
      - 1) Sewer
        - a) Less than 5 workings Days
      - 2) Fire Alarm
        - a) Less than 5 working Day
      - 3) Fiber Optic
        - a) Less than 5 working Day
      - 4) Telecommunication
        - a) Less than 5 working Day
      - 5) Irrigation System
        - a) Coordinate the ability of the Owner to run the irrigation system from July to August. Provide temporary piping if necessary to insure adequate pressure to run the irrigation system.

## 1.7 FIELD CONDITIONS

- A. Notify M-NCPPC Construction Manager of discrepancies between existing conditions and 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 M-NCPPC Inspector and Owner. Hazardous materials will be removed by Owner under a separate contract.
- 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.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Contact MISS Utility and obtain authorization to dig before any ground disturbance
- B. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- C. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- D. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- E. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Contact engineer.
- F. Survey of Existing Conditions: Record existing conditions by use of drawings
  1. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

### 3.2 UTILITY SERVICES AND ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. M-NCPPC Construction Manager will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  1. Strengthen or add new supports when required during progress of selective demolition.

### 3.4 SELECTIVE DEMOLITION, GENERAL

- A. Removed and Salvaged Items as shown on the drawings to include but not limited to:
  1. Pedestrian Bridge
    - a. Salvaged and placed as directed by M-NCPPC Construction Manager
- B. Removed, salvage and reuse items to include but not limited to the following:
  1. Chain Link Fence Fabric
    - a. Reinstalled as the Deer Fencing
  2. Light Poles
    - a. Installed as the Chain Link Fence Posts
  3. Irrigation
    - a. Reuse or return to the M-NCPPC Construction Manager the heads, valves, backflow preventer, decoders, irrigation boxes, backflow preventer, backflow preventer cage
  4. Stone, Stone Veneer/Simulated Stone Veneer
    - a. Used in rockery walls and in gabion Walls
  5. Woody vegetation
    - a. Well chipped material to be used as mulch mats

- b. Well chipped material may be left on the Brookside Gardens site as directed by the M-NCPPC Construction Manager
- 6. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by M-NCPPC Inspector, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

### 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Parapet Walls at Bridge off Glenallen: Demolish in sections. Cut or chip concrete at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts. Insure that the existing deck to remain is protected and structurally sound.
- B. Stone & Simulated Stone Masonry: Demolish in small sections so that the material can be reused in the gabion walls.
- C. Concrete Slabs-on-Grade & Sidewalks: Full depth saw-cut perimeter of area to be demolished, then break up and remove. Insure areas not to be disturbed are protected to include the building façade, windows, doors, and concrete walks to remain
- D. Asphalt Walks: Full depth saw-cut perimeter of area to be demolished, then break up and remove.

### 3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

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

END OF SECTION 024119

## **SECTION 033300 - ARCHITECTURAL CONCRETE**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes cast-in-place architectural concrete including form facings, reinforcement accessories, concrete materials, concrete mixture design, placement procedures, and finishes.
- B. Related Requirements:
  - 1. Section 079200 "Joint Sealants" for elastomeric joint sealants in contraction and other joints in cast-in-place architectural concrete.
  - 2. Section 321313 "Concrete Paving" for concrete pavement and flatwork finishes.

#### **1.3 DEFINITIONS**

- A. Cast-in-Place Architectural Concrete: Formed concrete that is exposed to view on surfaces of completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.
- B. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
- C. Design Reference Sample: Sample designated by Landscape Architect in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural concrete.
- D. Reveal: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.

#### **1.4 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place architectural concrete to attend, including the following:

- a. Contractor's superintendent.
  - b. Independent testing agency responsible for concrete design mixtures.
  - c. Ready-mix concrete manufacturer.
  - d. Cast-in-place architectural concrete subcontractor.
2. Review concrete finishes and finishing, curing procedures, construction joints, forms and form-removal limitations, reinforcement accessory installation, concrete repair procedures, and protection of cast-in-place architectural concrete.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Formwork Shop Drawings: Show formwork construction including form-facing joints, rustications, construction and contraction joints, form joint-sealant details, form tie locations and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect cast-in-place architectural concrete.
- D. Placement Schedule: Submit concrete placement schedule before start of placement operations. Include locations of all joints including construction joints.
- E. Samples: For each of the following materials:
1. Form-facing panel.
  2. Form ties.
  3. Coarse- and fine-aggregate gradations.
  4. Chamfers and rustications.
- F. Samples for Verification: Architectural concrete Samples, cast vertically, approximately 18 by 18 by 2 inches, of finishes, colors, and textures to match design reference sample. Include Sample sets showing the full range of variations expected in these characteristics.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Material Certificates: For each of the following:
1. Cementitious materials.
  2. Admixtures.
  3. Form materials and form-release agents.
  4. Repair materials.

C. Material Test Reports: For the following, by a qualified testing agency:

1. Aggregates.

#### 1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "NRMCA Quality Control Manual - Section 3, Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

C. Source Limitations for Cast-in-Place Architectural Concrete: Obtain each color, size, type, and variety of concrete material and concrete mixture from single manufacturer with resources to provide cast-in-place architectural concrete of consistent quality in appearance and physical properties.

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5".
2. ACI 303.1, "Specification for Cast-in-Place Architectural Concrete."

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

F. Field Sample Panels: After approval of verification sample and before casting architectural concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, cast vertically for the following

1. Walls taller than 18 inches: 48 by 48 by 6 inches minimum panel, to demonstrate the expected range of finish, color, and texture variations.
2. Seat walls and wall curbs: 18 by 36 by 18 inches minimum panel, to demonstrate the expected range of finish, color, and texture variations.
3. Locate panels as directed by M-NCPPC Construction Manager.
4. Demonstrate methods of curing, aggregate exposure, sealers, and coatings, as applicable.



5. In presence of M-NCPPC Construction Manager, damage part of an exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces.
  6. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
  7. Demolish and remove field sample panels when directed.
- G. Mockups: Before casting architectural concrete, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in the location and of the size indicated or, if not indicated, as directed by M-NCPPC Construction Manager.
  2. Build mockups of typical exterior wall of cast-in-place architectural concrete as shown on Drawings.
  3. Demonstrate curing, cleaning, and protecting of cast-in-place architectural concrete, finishes, and contraction joints, as applicable.
  4. In presence of M-NCPPC Construction Manager, damage part of the exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces.
  5. Obtain M-NCPPC Construction Manager's approval of mockups before casting architectural concrete.
  6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 FORM-FACING MATERIALS

- A. General: Comply with Section 033000 "Cast-in-Place Concrete" for formwork and other form-facing material requirements.
- B. Form-Facing Panels for As-Cast Finishes for seat wall: Steel, glass-fiber-reinforced plastic, or other approved nonabsorptive panel materials that will provide continuous, true, and smooth architectural concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- C. Form-Facing Panels for As-Cast Finishes for underlook and structural walls: Exterior-grade "D" plywood panels.
- D. Rustication Strips: Metal, rigid plastic, or dressed wood with sides beveled and back kerfed; nonstaining; in longest practicable lengths.
- E. Chamfer Strips: Metal, rigid plastic, elastomeric rubber, or dressed wood, 3/4 by 3/4 inch, minimum; nonstaining; in longest practicable lengths.

- F. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800, "Specification 810.1, Expanded Cellular Glazing Tape"; minimum 1/4 inch thick.
- G. Form Joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or Type S, Grade NS, that adheres to form joint substrates.
- H. Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood.
- I. Form-Release Agent: Commercially formulated, colorless form-release agent that will not bond with, stain, or adversely affect architectural concrete surfaces and will not impair subsequent treatments of those surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- J. Form Ties: Factory-fabricated, glass-fiber-reinforced plastic ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish glass-fiber-reinforced plastic ties, not less than 1/2 inch in diameter, of color selected by M-NCPPC Construction Manager from manufacturer's full range.
  - 2. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## 2.2 STEEL REINFORCEMENT AND ACCESSORIES

- A. General: See Structural Drawings for steel reinforcement and other requirements for reinforcement accessories.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufacture according to CRSI's "Manual of Standard Practice."
  - 1. Where legs of wire bar supports contact forms, use gray, all-plastic or CRSI Class 1, gray, plastic-protected bar supports.

## 2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  - 1. Portland Cement: ASTM C 150, Type I
    - a. Fly Ash: ASTM C 618, Class C or Class F.
    - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or Grade 120.
    - c. Silica Fume: ASTM C 1240, amorphous silica.

- B. Normal-Weight Aggregates: ASTM C 33, Class 5S coarse aggregate or better, graded. Provide aggregates from single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse-Aggregate Size: 3/8 inch.
  - 2. Gradation: Uniformly graded.
- C. Normal-Weight Fine Aggregate: ASTM C 33, manufactured or natural sand, from same source for entire Project.
- D. Water: Potable, complying with ASTM C 94/C 94M except free of wash water from mixer washout operations.

#### 2.4 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

#### 2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
  - 1. For integrally colored concrete, curing compound shall be pigmented type approved by color pigment manufacturer.
  - 2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

2.6 REPAIR MATERIALS

- A. Not Allowed

2.7 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of cast-in-place architectural concrete proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed design mixtures based on laboratory trial mixtures.
- B. Proportion concrete mixtures as follows:
1. Compressive Strength (28 Days): 3500 psi.
  2. Maximum Water-Cementitious Materials Ratio: 0.46.
  3. Slump Limit: 3 inches, plus or minus 1 inch.
  4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
  5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch nominal maximum aggregate size.
- C. Cementitious Materials: For cast-in-place architectural concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- E. Admixtures: Use admixtures according to manufacturer's written instructions.

2.8 CONCRETE MIXING

- A. Ready-Mixed Architectural Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.
1. Clean equipment used to mix and deliver cast-in-place architectural concrete to prevent contamination from other concrete.
  2. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 FORMWORK

- A. General: See Structural Drawings for formwork, embedded items, and shoring and reshoring.
- B. Limit deflection of form-facing panels to not exceed ACI 303.1 requirements.
- C. In addition to ACI 303.1 limits on form-facing panel deflection, limit cast-in-place architectural concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  - 1. Class A, 1/8 inch.
- D. Fabricate forms to result in cast-in-place architectural concrete that complies with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-in-place surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.
  - 1. Seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
  - 2. Do not use rust-stained steel form-facing material.
- F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- G. Chamfer exterior corners and edges of cast-in-place architectural concrete.
- H. Coat contact surfaces of wood rustications and chamfer strips with sealer before placing reinforcement, anchoring devices, and embedded items.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- M. Coat contact surfaces of forms with surface retarder, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 REINFORCEMENT AND INSERTS

- A. General: See Structural Drawings for fabricating and installing steel reinforcement. Securely fasten steel reinforcement and wire ties against shifting during concrete placement.
- B. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

### 3.3 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
  - 1. Schedule form removal to maintain surface appearance that matches approved mockups.
  - 2. Cut off and grind glass-fiber-reinforced plastic form ties flush with surface of concrete.
- B. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved 28-day design compressive strength. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- C. Clean and repair surfaces of forms to be reused in the Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for cast-in-place architectural concrete surfaces.

### 3.4 JOINTS

- A. Construction Joints: Install construction joints true to line with faces perpendicular to surface plane of cast-in-place architectural concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by M-NCPCC Construction Manager .
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete. Align construction joint within rustications attached to form-facing material.
  - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - 6. Use bonding agent or epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

- B. Contraction Joints: Form weakened-plane contraction joints true to line with faces perpendicular to surface plane of cast-in-place architectural concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by M-NCPPC Construction Manager .

### 3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, form-release agent, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by M-NCPPC Construction Manager.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 303.1.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. Do not permit vibrators to contact forms.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
  - 4. Do not use chemical accelerators unless otherwise specified and approved in design mixtures.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
  - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of

ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

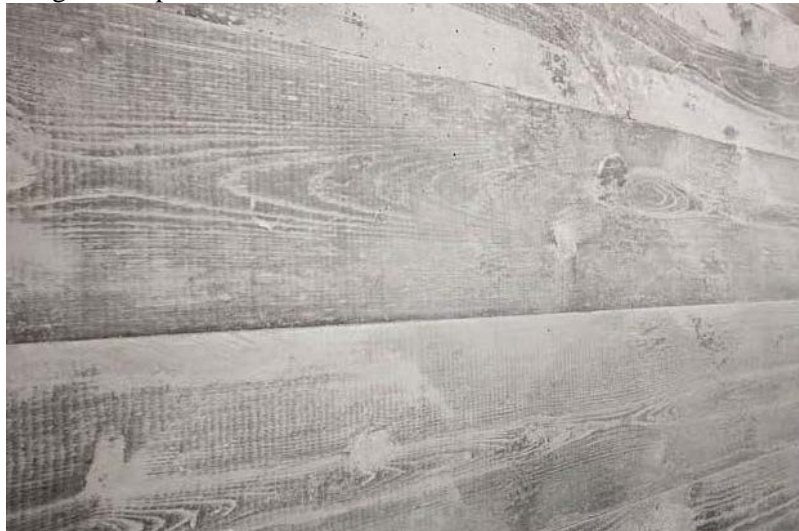
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### 3.6 FINISHES, GENERAL

- A. Architectural Concrete Finish: Match Landscape Architect's design reference sample, identified and described as indicated, to satisfaction of M-NCPPC Construction Manager.
- 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.
  1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.
- C. Maintain uniformity of special finishes over construction joints unless otherwise indicated.

### 3.7 AS-CAST FORMED FINISHES

- A. Rough-Formed Finish for the "Underlook" and Structural walls as indicated on the drawings: As-cast concrete texture imparted by form-facing material. Remove fins and other projections exceeding specified limits on formed-surface irregularities.
  1. Image Examples







- B. Smooth-Formed Finish for Seatwalls: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections exceeding specified limits on formed-surface irregularities. Repair and patch tie holes and defects.
1. Image Example



### 3.8 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.
- B. Begin curing cast-in-place architectural concrete immediately after applying as-cast formed finishes to concrete. Cure according to ACI 308.1, by one or a combination of the following methods that will not mottle, discolor, or stain concrete:
1. Moisture Curing: Keep exposed surfaces of cast-in-place architectural concrete continuously moist for no fewer than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for no fewer than seven days. Immediately repair any holes or tears during curing period; use cover material and waterproof tape.
  3. Curing Compound: Mist concrete surfaces with water. Apply curing compound uniformly in continuous operation by power spray or roller according to manufacturer's

written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

### 3.9 FIELD QUALITY CONTROL

- A. General: Comply with field quality-control requirements in Section 033000 "Cast-in-Place Concrete."

### 3.10 REPAIRS, PROTECTION, AND CLEANING

- A. Repair and cure damaged finished surfaces of cast-in-place architectural concrete when approved by M-NCPPC Construction Manager. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.
  - 1. Remove and replace cast-in-place architectural concrete that cannot be repaired and cured to M-NCPPC Construction Manager's approval.
- B. Protect corners, edges, and surfaces of cast-in-place architectural concrete from damage; use guards and barricades.
- C. Protect cast-in-place architectural concrete from staining, laitance, and contamination during remainder of construction period.
- D. Clean cast-in-place architectural concrete surfaces after finish treatment to remove stains, markings, dust, and debris.
- E. Wash and rinse surfaces according to concrete finish applicator's written instructions. Protect other Work from staining or damage due to cleaning operations.
  - 1. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural concrete finishes.

END OF SECTION 033300

## **SECTION 042000 UNIT MASONRY**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies requirements for construction of masonry unit walls.

#### **1.2 RELATED WORK**

- A. Steel lintels and shelf angles: Section 05 50 00, METAL FABRICATIONS.
- B. Cavity insulation: Section 07 21 13, THERMAL INSULATION.
- C. Flashing: Section 07 60 00, FLASHING AND SHEET METAL.
- D. Sealants and sealant installation: Section 07 92 00, JOINT SEALANTS.
- E. Texture of masonry units: SEE ARCHITECTURAL PLANS

#### **1.3 SUBMITTALS**

- A. Submit SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Samples:
  - 2. Concrete masonry units, when exposed in finish work.
  - 3. Anchors, and ties, one each and joint reinforcing 1200 mm (48 inches) long.
- C. Shop Drawings:
  - 1. Special masonry shapes.
  - 2. Drawings, showing reinforcement, applicable dimensions and methods of hanging soffit or lintel masonry and reinforcing masonry for embedment of anchors for hung fixtures.
  - 3. Masonry units for typical window and door openings, and, for special conditions as affected by structural conditions.
  - 4. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.
- D. Certificates:
  - 1. Certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.
  - 2. Indicating that the following items meet specification requirements:
    - a. Face brick / Ashlar Stone.
    - b. Solid and load-bearing concrete masonry units, including fire-resistant rated units.

3. Testing laboratories facilities and qualifications of its principals and key personnel to perform tests specified.

E. Manufacturer's Literature and Data:

1. Anchors, ties and reinforcement.
2. Shear keys.
3. Reinforcing bars.

#### 1.4 WARRANTY

Warrant exterior masonry walls against moisture leaks and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be five years.

### PART 2 – PRODUCTS

#### 2.2 CONCRETE MASONRY UNITS

- A. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
1. Unit Weight: Normal weight.
  2. Fire rated units for fire rated partitions.
  3. Sizes: Modular.
  4. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.
  5. Use bullnose concrete masonry units at corners exposed in finished work with 25 mm (one inch) minimum radius rounded vertical exterior corners (bullnose units).

#### 2.3 SHEAR KEYS

- A. ASTM D2000, solid extruded cross-shaped section of rubber, neoprene, or polyvinyl chloride, with a durometer hardness of approximately 80 when tested in accordance with ASTM D2240, and a minimum shear strength of 3.5 MPa (500 psi).
- B. Shear key dimensions: Approximately 70 mm by 8 mm for long flange and 38 mm by 16 mm for short flange (2-3/4 inches by 5/16 inch for long flange, and 1-1/2 inches by 5/8 inch for short flange).

#### 2.4 REINFORCEMENT:

- A. Steel Reinforcing Bars: ASTM A615, deformed bars, 420 MPa (Grade 60) for bars No. 10 to No. 57 (No. 3 to No. 18), except as otherwise indicated.

- B. Where 6 mm diameter (No. 2) bars are shown, provide plain, round, carbon steel bars, ASTM A675, 550 MPa (Grade 80).
- C. Shop-fabricate reinforcement bars which are shown to be bent or hooked.
- D. Joint Reinforcement:
  - 1. Form from wire complying with ASTM A951.
  - 2. Galvanized after fabrication.
  - 3. Width of joint reinforcement 40 mm (1 5/8-inches) less than nominal width of masonry wall or partition.
  - 4. Cross wires welded to longitudinal wires.
  - 5. Joint reinforcing at least 3000 mm (10 feet) in length.
  - 6. Joint reinforcing in rolls is not acceptable.
  - 7. Joint reinforcing that is crimped to form drip is not acceptable.
  - 8. Maximum spacing of cross wires 400 mm (16 inches) to longitudinal wires.
  - 9. Trussed Design:
    - a. Longitudinal and cross wires not less than 4 mm (0.16 inch nominal) diameter.
    - b. Longitudinal wires deformed.

## 2.5 ANCHORS, TIES, AND REINFORCEMENT

- A. Steel Reinforcing Bars: ASTM A615M, deformed bars, grade as shown.
- B. Joint Reinforcement:
  - 1. Form from wire complying with ASTM A951.
  - 2. Galvanized after fabrication.
  - 3. Width of joint reinforcement 40 mm (0.16 inches) less than nominal width of masonry wall or partition.
  - 4. Cross wires welded to longitudinal wires.
  - 5. Joint reinforcement at least 3000 mm (10 feet) in length.
  - 6. Joint reinforcement in rolls is not acceptable.
  - 7. Joint reinforcement that is crimped to form drip is not acceptable.
  - 8. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
  - 9. Trussed Design:
    - a. Longitudinal and cross wires not less than 4 mm (0.16 inch nominal) diameter.
    - b. Longitudinal wires deformed.
- C. Adjustable Veneer Anchor for Frame Walls:
  - 1. Two piece, adjustable anchor and tie.

2. Anchor and tie may be either type; use only one type throughout.
3. Loop Type:
  - a. Anchor: Screw-on galvanized steel anchor strap 2.75 mm (0.11 inch) by 19 mm (3/4 inch) wide by 225 mm (9 inches) long, with 9 mm (0.35 inch) offset and 100 mm (4 inch) adjustment. Provide 5 mm (0.20 inch) hole at each end for fasteners.
  - b. Ties: Triangular tie, fabricated of 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Ties long enough to engage the anchor and be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer.
4. Angle Type:
  - a. Anchor: Minimum 2 mm (16 gage) thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide hole near end of outstanding leg to suit upstanding portion of tie.
  - b. Tie: Fabricate from 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Form "L" shape to be embedded not less than 50 mm (2 inches) into the bed joint of the masonry veneer and provide upstanding leg to fit through hole in anchor and be long enough to allow 50 mm (2 inches) of vertical adjustment.

D. Dovetail Anchors:

1. Corrugated steel dovetail anchors formed of 1.5 mm (0.0598 inch) thick by 25 mm (1 inch) wide galvanized steel, 90 mm (3-1/2 inches) long where used to anchor 100 mm (4 inch) nominal thick masonry units, 140 mm (5-1/2 inches) long for masonry units more than 100 mm (4 inches) thick.
2. Triangular wire dovetail anchor 100 mm (4 inch) wide formed of 4 mm (9 gage) steel wire with galvanized steel dovetail insert. Anchor length to extend at least 75 mm (3 inches) into masonry, 25 mm (1 inch) into 40 mm (1-1/2 inch) thick units.
3. Form dovetail anchor slots from 0.6 mm (0.0239 inch) thick galvanized steel (with felt or fiber filler).

E. Individual ties:

1. Rectangular ties: Form from 5 mm (3/16 inch) diameter galvanized steel rod to a rectangular shape not less than 50 mm (2 inches) wide by sufficient length for ends of ties to extend within 25 mm (1 inch) of each face of wall. Ties that are crimped to form drip are not permitted.
2. Adjustable Cavity Wall Ties:
  - a. Adjustable wall ties may be used at Contractor's option.

- b. Two piece type permitting up to 40 mm (1-1/2 inch) adjustment.
  - c. Form ties from 5 mm (3/16 inch) diameter galvanized steel wire.
  - d. Form one piece to a rectangular shape 105 mm (4-1/8 inches) wide by length required to extend into the bed joint 50 mm (2 inches).
  - e. Form the other piece to a 75 mm (3 inch) long by 75 mm (3 inch) wide shape, having a 75 mm (3 inch) long bent section for engaging the 105 mm (4-1/8 inch) wide piece to form adjustable connection.
- F. Wall Ties, (Mesh or Wire):
1. Mesh wall ties formed of ASTM A82, W0.5, 2 mm, (16 gage) galvanized steel wire 13 mm by 13 mm (1/2 inch by 1/2 inch) mesh, 75 mm (3 inches) wide by 200 mm (8 inches) long.
  2. Rectangular wire wall ties formed of W1.4, 3 mm, (9 gage) galvanized steel wire 50 mm (2 inches) wide by 200 mm (8 inches) long.
- G. Corrugated Wall Tie:
1. Form from 1.5 mm (0.0598 inch) thick corrugated, galvanized steel 30 mm (1-1/4 inches) wide by lengths so as to extend at least 100 mm (4 inches) into joints of new masonry plus 38 mm (1-1/2 inch) turn-up.
  2. Provide 5 mm (3/16 inch) hole in turn-up for fastener attachment.
- H. Adjustable Steel Column Anchor:
1. Two piece anchor consisting of a 6 mm (1/4 inch) diameter steel rod to be welded to steel with offset ends, rod to permit 100 mm (4 inch) vertical adjustment of wire anchor.
  2. Triangular shaped wire anchor 100 mm (4 inches) wide formed from 5 (3/16 inch) diameter galvanized wire, to extend at least 75 mm (3 inches) into joints of masonry.
- I. Adjustable Steel Beam Anchor:
1. Z or C type steel strap, 30 mm (1 1/4 inches) wide, 3 mm (1/8 inch) thick.
  2. Flange hook not less than 38 mm (1 1/2 inches) long.
  3. Length to embed in masonry not less than 50 mm (2 inches) in 100 mm (4 inch) nominal thick masonry and 100 mm (4 inches) in thicker masonry.
  4. Bend masonry end not less than 40 mm (1 1/2 inches).
- J. Ridge Wall Anchors:
1. Form from galvanized steel not less than 25 mm (1 inch) wide by 5 mm (3/16 inch) thick by 600 mm (24 inches) long, plus 50 mm (2 inch) bends.
  2. Other lengths as shown.



## 2.6 PREFORMED COMPRESSIBLE JOINT FILLER

- A. Thickness and depth to fill the joint as specified.
- B. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
- C. Non-Combustible Type: ASTM C612, Class 5, 1800 degrees F.

## 2.7 ACCESSORIES

- A. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.
- B. Box Board:
  - 1. Mineral Fiber Board: ASTM C612, Class 1.
  - 2. 25 mm (1 inch) thickness.
  - 3. Other spacing material having similar characteristics may be used subject to the Contracting Officer's Technical Representative (COTR)'s approval.
- C. Masonry Cleaner:
  - 1. Detergent type cleaner selected for each type masonry used.
  - 2. Acid cleaners are not acceptable.
  - 3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.
- D. Fasteners:
  - 1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
  - 2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
  - 3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting

## PART 3 – EXECUTION

### 3.1 JOB CONDITIONS

- A. Protection:
  - 1. Cover tops of walls with non-staining waterproof covering, when work is not in progress. Secure to prevent wind blow off.
  - 2. On new work protect base of wall from mud, dirt, mortar droppings, and other materials that will stain face, until final landscaping or other site work is completed.
- B. Cold Weather Protection:
  - 1. Masonry may be laid in freezing weather when methods of protection are utilized.
  - 2. Comply with MSJC and "Hot and Cold Weather Masonry Construction Manual".

### 3.2 CONSTRUCTION TOLERANCES

- A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:
- B. Maximum variation from plumb:
  - 1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
  - 2. In 6000 mm (20 feet) - 10 mm (3/8 inch).
  - 3. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).
- C. Maximum variation from level:
  - 1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
  - 2. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).
- D. Maximum variation from linear building lines:
  - 1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
  - 2. In 12 000 mm (40 feet) or more - 19 mm (3/4 inch).
- E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
  - 1. Minus 6 mm (1/4 inch).
  - 2. Plus 13 mm (1/2 inch).
- F. Maximum variation in prepared opening dimensions:
  - 1. Accurate to minus 0 mm (0 inch).
  - 2. Plus 6 mm (1/4 inch).

### 3.3 INSTALLATION GENERAL

- A. Keep finish work free from mortar smears or spatters, and leave neat and clean.
- B. Anchor masonry as specified in Paragraph, ANCHORAGE.
- C. Wall Openings:
  - 1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
  - 2. If items are not available when walls are built, prepare openings for subsequent installation.
- D. Tooling Joints:
  - 1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
  - 2. Tool while mortar is soft enough to be compressed into joints and not raked out.
  - 3. Finish joints in exterior face masonry work with a jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.

4. Tool Exposed interior joints in finish work concave unless specified otherwise.

E. Partition Height:

1. Extend partitions at least 100 mm (four inches) above suspended ceiling or to overhead construction where no ceiling occurs.
2. Extend following partitions to overhead construction.
  - a. Where noted smoke partitions, FHP (full height partition), and FP (fire partition) and smoke partitions (SP) on drawings.
  - b. Both walls at expansion joints.
  - c. Corridor walls.
  - d. Walls at stairway and stair halls, elevators, dumbwaiters, trash and laundry chute shafts, and other vertical shafts.
  - e. Walls at refrigerator space.
  - f. Reinforced masonry partitions
3. Extend finish masonry partitions at least four-inches above suspended ceiling and continue with concrete masonry units or structural clay tile to overhead construction:

F. Lintels:

1. Openings with no structural steel lintel indicated require angle lintels per the "Miscellaneous Lintel Schedule" on the structural drawings.
2. Use steel lintels per the "Lintel Schedule" on the structural drawings for openings in brick, masonry, and elevator openings unless shown otherwise.
3. Doors having overhead concealed door closers require a steel lintel, and a pocket for closer box.
4. Length for minimum bearing of 6 inches at ends.

G. Wall, Furring, and Partition Units:

1. Lay out field units to provide for running bond of walls and partitions, with vertical joints in second course centering on first course units unless specified otherwise.
2. Align head joints of alternate vertical courses.
3. At sides of openings, balance head joints in each course on vertical center lines of openings.
4. Use no piece shorter than 100 mm (4 inches) long.
5. On interior partitions provide a 6 mm (1/4 inch) open joint for caulking between existing construction, exterior walls, concrete work, and abutting masonry partitions.
6. Use not less than 100 mm (4 inches) nominal thick masonry for free standing furring unless shown otherwise.

7. Do not abut existing plastered surfaces except suspended ceilings with new masonry partitions.
- H. Use not less than 100 mm (4 inches) nominal thick masonry for fireproofing steel columns unless shown otherwise.
- I. Before connecting new masonry with previously laid, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.
- J. When new masonry partitions start on existing floors, machine cut existing floor finish material down to concrete surface.
- K. Structural Steel Encased in Masonry:
  1. Where structural steel is encased in masonry and the voids between the steel and masonry are filled with mortar, provide a minimum 25 mm (1 inch) mortar free expansion space between the masonry and the steel by applying a box board material to the steel before the masonry is laid.
  2. Do not place spacing material where steel is bearing on masonry or masonry is bearing on steel.
- L. Chases:
  1. Do not install chases in masonry walls and partitions exposed to view in finished work, including painted or coated finishes on masonry.
  2. Masonry 100 mm (4 inch) nominal thick may have electrical conduits 25 mm (1 inch) or less in diameter when covered with soaps, or other finishes.
  3. Full recess chases after installation of conduit, with mortar and finish flush.
  4. When pipes or conduits, or both occur in hollow masonry unit partitions retain at least one web of the hollow masonry units.
- M. Wetting and Wetting Test:
  1. Test and wet brick in accordance with BIA 11B.
  2. Do not wet concrete masonry units before laying.
- N. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.
- O. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.

- P. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.
- Q. Allow not less than the following minimum time to elapse after completion of members before removing shores or forms, provided suitable curing conditions have been obtained during the curing period.
  - 1. 10 days for girders and beams.
  - 2. 7 days for slabs.
  - 3. 7 days for reinforced masonry soffits.

### 3.4 ANCHORAGE

#### A. Veneer to Frame Walls:

- 1. Use adjustable veneer anchors.
- 2. Fasten anchor to stud through sheathing with self drilling and tapping screw, one at each end of loop type anchor.
- 3. Space anchors not more than 400 mm (16 inches) on center vertically at each stud.

#### D. Anchorage of Abutting Masonry:

- 1. Anchor interior 100 mm (4 inch) thick masonry partitions to exterior masonry walls with wall ties. Space ties at 600 mm (2 foot) maximum vertical intervals. Extend ties 100 mm (4 inches) minimum into masonry.
- 2. Anchor interior masonry bearing walls or interior masonry partitions over 100 mm (4 inches) thick to masonry walls with rigid wall anchors spaced at 400 mm (16 inch) maximum vertical intervals.
- 3. Anchor abutting masonry walls and partitions to concrete with dovetail anchors. Install dovetail slots vertically in concrete at centerline of abutting wall or partition. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals. Secure anchors to existing wall with two 9 mm (3/8 inch) by 75 mm (3 inch) expansion bolts or two power-driven fasteners.
- 4. Anchor abutting interior masonry partitions to existing concrete and existing masonry construction, with corrugated wall ties. Extend ties at least 100 mm (4 inches) into joints of new masonry. Fastened to existing concrete and masonry construction, with powder actuated drive pins, nail or other means that provides rigid anchorage. Install anchors at 400 mm (16 inch) maximum vertical intervals.

#### E. Masonry Furring:

1. Anchor masonry furring less than 100 mm (4 inches) nominal thick to masonry walls or to concrete with corrugated wall ties or dovetail anchors.
2. Space not over 600 mm (2 feet) on centers in both directions.

### 3.5 REINFORCEMENT

#### A. Joint Reinforcement:

1. Use as joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
2. Reinforcing may be used in lieu of individual ties for anchoring brick facing to CMU backup in exterior masonry walls.
3. Brick veneer over frame backing walls does not require joint reinforcement.
4. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.
5. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry, except where other type anchors are required for anchorage of masonry to concrete structure.
6. Joint reinforcement is required in every other course of stack bond CMU masonry.
7. Wherever brick masonry is backed up with stacked bond masonry, joint reinforcement is required in every other course of CMU backup, and in corresponding joint of facing brick.
8. Use joint reinforcement every course below grade.

#### B. Steel Reinforcing Bars:

1. Install in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for lintels and bond beam horizontal reinforcement. Install in wall cavities of reinforced masonry walls where shown.
2. Use grade 60 bars if not specified otherwise.
3. Bond Beams:
  - a. Form Bond beams of load-bearing concrete masonry units filled with ASTM C476 grout and reinforced with 2-#15m (#5) reinforcing steel unless shown otherwise. Do not cut reinforcement.
  - b. Brake bond beams only at expansion joints and at control joints, if shown.
4. Stack Bond:
  - a. Locate additional joint reinforcement in vertical and horizontal joints as shown.
  - b. Anchor vertical reinforcement into the foundation or wall or bond beam below and hold in place.

- c. Provide temporary bracing for walls over 8 ft. tall until permanent horizontal bracing is completed.
5. Grout openings:
  - a. Leave cleanout holes in double wythe walls during construction by omitting units at the base of one side of the wall.
  - b. Locate 75 mm x 75 mm (3 in. x 3 in.) min. clean-out holes at location of vertical reinforcement.
  - c. Keep grout space clean of mortar accumulation and sand debris. Clean the grout space every day using a high pressure jet stream of water, or compressed air, or industrial vacuum, or by laying wood strips on the metal ties as the wall is built. If wood strips are used, lift strips with wires as the wall progresses and before placing each succeeding course of wall ties.

### 3.8 ISOLATION SEAL

- A. Where full height walls or partitions lie parallel or perpendicular to and under structural beams or shelf angles, provide a separation between walls or partitions and bottom of beams or shelf angles not less than the masonry joint thickness unless shown otherwise.
- B. Insert in the separation, a continuous full width strip of non-combustible type compressible joint filler.
- C. Where exposed in finish work, cut back filler material in the joint enough to allow for the joint to be filled with sealant material specified in Section 07 92 00, JOINT SEALANTS.

### 3.10 CONCRETE MASONRY UNITS

- A. Kind and Users:
  1. Provide special concrete masonry shapes as required, including lintel and bond beam units, sash units, and corner units. Use solid concrete masonry units, where full units cannot be used, or where needed for anchorage of accessories.
  2. Provide solid load-bearing concrete masonry units or grout the cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
  3. Provide rounded corner (bullnose) shapes at opening jambs in exposed work and at exterior corners.
  4. Do not use brick jambs in exposed finish work.
  5. Use concrete building brick only as filler in backup material where not exposed.

6. Masonry assemblies shall meet the required fire resistance in fire rated partitions of type and construction that will provide fire rating as shown.
7. Where lead lined concrete masonry unit partitions terminate below the underside of overhead floor or roof deck, fill the remaining open space between the top of the partition and the underside of the overhead floor or roof deck, with standard concrete masonry units of same thickness as the lead lined units.

B. Laying:

1. Lay concrete masonry units with 10 mm (3/8 inch) joints, with a bond overlap of not less than 1/4 of the unit length, except where stack bond is required.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill such voids with mortar or grout.
7. Provide a 6 mm (1/4 inch) open joint for caulking between existing construction, exterior walls, concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so that cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings not less than 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge the masonry against the steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes shown.
12. Steel reinforcement, at time of placement, free of loose flaky rust, mud, oil, or other coatings that will destroy or reduce bond.
13. Steel reinforcement in place before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place by centering clips, caging devices, tie wire, or other approved methods, vertically at spacings noted.
16. Support vertical bars near each end and at intermediate intervals not exceeding 192 bar diameters.



17. Reinforcement shall be fully encased by grout or concrete.
18. Splice reinforcement or attach reinforcement to dowels by placing in contact and secured or by placing the reinforcement within 1/5 of the required bar splice length.
19. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
20. Grout cells of concrete masonry units, containing the reinforcing bars, solid as specified under grouting.
21. Cavity and joint horizontal reinforcement may be placed as the masonry work progresses.
22. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth, except at walls receiving waterproofing where joints shall be flush.

### 3.12 GROUTING

#### A. Preparation:

1. Clean grout space of mortar droppings before placing grout.
2. Close cleanouts.
3. Install vertical solid masonry dams across grout space for full height of wall at intervals of not more than 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
4. Verify reinforcing bars are in cells of units or between wythes as shown.

#### B. Placing:

1. Place grout by hand bucket, concrete hopper, or grout pump.
2. Consolidate each lift of grout after free water has disappeared but before plasticity is lost.
3. Do not slush with mortar or use mortar with grout.
4. Interruptions:
  - a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inch) below top of last masonry course.
  - b. Grout from dam to dam on high lift method.
  - c. A longitudinal run of masonry may be stopped off only by raking back one-half a masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.

#### C. Puddling Method:

1. Double wythe masonry constructed grouted in lifts not to exceed 300 mm (12 inches) or less than 50 mm (2 inches) wide.
2. Consolidate by puddling with a grout stick during and immediately after placing.

3. Grout the cores of concrete masonry units containing the reinforcing bars solid as the masonry work progresses.

D. Low Lift Method:

1. Construct masonry to a height of 1.5 m (5 ft) maximum before grouting.
2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

E. High Lift Method:

1. Do not pour grout until masonry wall has properly cured a minimum of 4 hours.
2. Place grout in lifts not exceeding 1.5 m (5 ft).
3. Exception:  
Where the following conditions are met, place grout in lifts not exceeding 3.86 m (12.67 ft).
  - a. The masonry has cured for at least 4 hours.
  - b. The grout slump is maintained between 254 and 279 mm (10 and 11 in).
  - c. No intermediate reinforced bond beams are placed between the top and the bottom of the pour height.
4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into the preceding lift to close any shrinkage cracks or separation from the masonry units.

### 3.13 PLACING REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Contract Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 25 mm (1 inch), whichever is greater.
- C. For columns, piers and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1 1/2 times the nominal bar diameter or 38 mm (1-1/2 inches), whichever is greater. Provide lateral ties as indicated.
- D. Splice reinforcement bars where shown; do not splice at other places unless accepted by the Contracting Officer's Technical Representative (COTR). Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

- E. Provide not less than minimum lap as indicated on shop drawings, or if not indicated, as required by governing code.
- F. Weld splices where indicated. Comply with the requirements of AWS D1.4 for welding materials and procedures.
- G. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.
- H. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement not less than 150 mm (6 inches) at ends. Use prefabricated “L” and “T” sections to provide continuity at corners and intersections. Cut and bend joint reinforcement as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- I. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
- J. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

### 3.15 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

- A. Do not wet concrete masonry units (CMU).
- B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 10 mm (3/8 inch) joints.
- C. Where solid CMU units are shown, lay with full mortar head and bed joints.
- D. Walls:
  - 1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
  - 2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
  - 3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small

mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

E. Columns, Piers and Pilasters:

1. Use CMU units of the size, shape and number of vertical core spaces shown. If not shown, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.
2. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.
3. Where bonded pilaster construction is shown, lay wall and pilaster units together to maximum pour height specified.

F. Grouting:

1. Use "Fine Grout" per ASTM C476 for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
2. Use "Coarse Grout" per ASTM C476 for filling 100 mm (4 inch) spaces or larger in both horizontal directions.
3. Grouting Technique: At the Contractor's option, use either low-lift or high-lift grouting techniques subject to requirements which follow.

G. Low-Lift Grouting:

1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 mm<sup>2</sup> (8 square inches) in vertical cores to be grouted.
2. Place vertical reinforcement prior to grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).
3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 foot) height, or if bond beam occurs below 1.5 m (5 foot) height, stop pour 38 mm (1-1/2 in) below top of bond beam.
4. Pour grout using chute container with spout or pump hose. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 38 mm (1-1/2 inches) below top course of pour.
5. Bond Beams: Stop grout in vertical cells 38 mm (1-1/2 inches) below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

H. High-Lift Grouting:

1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 75 mm (3 inches) and 6450 mm<sup>2</sup> (10 square inches), respectively.

2. Provide cleanout holes in first course at all vertical cells which are to be filled with grout.
3. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
4. Construct masonry to full height of maximum grout pour specified, prior to placing grout.
5. Limit grout lifts to a maximum height of 1.5 m (5 feet) and grout pour to a maximum height of 7.3 m (24 feet), for single wythe hollow concrete masonry walls, unless otherwise indicated.
6. Place vertical reinforcement before grouting. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 3 m (10 feet).
7. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosed before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.
8. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.
9. Place horizontal beam reinforcement as the masonry units are laid.
10. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.
11. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than 4.1 mm diameter (8 gage) wire ties spaced 400 mm (16 inches) o.c. for members with 500 mm (20 inches) or less side dimensions, and 200 mm (8 inches) o.c. for members with side dimensions exceeding 500 mm (20 inches).
12. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
13. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.

14. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Contracting Officer's Technical Representative (COTR).
15. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow not less than 30 minutes, nor more than one hour between lifts of a given pour. Mechanically consolidate each grout lift during pouring operation.
16. Place grout in lintels or beams over openings in one continuous pour.
17. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 25 mm (1 inch) of vertically reinforced cavities, during construction of masonry.
18. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

### 3.16 CLEANING AND REPAIR

#### A. General:

1. Clean exposed masonry surfaces on completion.
2. Protect adjoining construction materials and landscaping during cleaning operations.
3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
4. Remove mortar droppings and other foreign substances from wall surfaces.

#### C. Concrete Masonry Units:

1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
2. Allow mud to dry before brushing.

### 3.17 WATER PENETRATION TESTING

- A. Seven days before plastering or painting, in the presence of Contracting Officer's Technical Representative (COTR), test solid exterior masonry walls for water penetration.
- B. Direct water on masonry for a period of one hour at a time when wind velocity is less than five miles per hour.
- C. Should moisture appear on inside of walls tested, make additional tests at other areas as directed by Contracting Officer's Technical Representative (COTR).
- D. Correct the areas showing moisture on inside of walls, and repeat test at repaired areas, to insure that moisture penetration has been stopped.

E. Make water test at following locations:

1. Eight places on Elevator #16 and coordinate with waterproofing membrane system tests.

END OF SECTION 042000

## SECTION 044300 - STONE MASONRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes the following applications of stone masonry:
  - 1. Anchored to concrete backup.
  - 2. Anchored to unit masonry backup.
  - 3. Anchored to Hollow Structural Steel (HSS)
- B. Related Sections:
  - 1. Section 044300 "Unit Masonry" for horizontal joint reinforcement and veneer anchors.
  - 2. Section 033300 "Architectural Concrete"

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. For stone varieties proposed for use on Project, include test data indicating compliance with physical properties required by referenced ASTM standards.
  - 2. Anchors
- B. Samples:
  - 1. For each stone type indicated.
  - 2. For each color of mortar required.

#### 1.3 QUALITY ASSURANCE

- A. Hold a preconstruction meeting with the M-NCPPC Construction Manager, Landscape Architect, General Contractor, and Mason to verify the masonry Work
- B. Installer Qualifications: Stone Mason with a minimum of 5 years completing similar work
  - 1. At a minimum, any subcontractors for the **masonry work** must provide written evidence (through references) of five (5) years prior experience as detailed in the specifications. Selected Contractor must also provide three (3) examples of stone veneered wall and unit paving projects located in the DC Metro Area over the past 2 years with photographs of the above projects.
- C. Source Limitations: Obtain each type of stone from the same quarry.
  - 1. Quarry must be within 25miles of project site



- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build a minimum of three (3) mockups of full-thickness sections of each type of masonry stone wall demonstrating typical raked joints, mortar color, craftsmanship, corners, capping curing; and standard of workmanship.
    - a. If the first three mockups are not adequate, the contractor will continue to build mockups at no additional cost to the Owner until a mockup is satisfactorily accepted
  2. Build mockups of decorative concrete paving in the location and of the size and directed by the M-NCPPC Inspector and not less than 36 inches by 48 inches or as directed by M-NCPPC Construction Manager.
  3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless M-NCPPC Construction Manager specifically approves such deviations in writing.
  4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.4 PROJECT CONDITIONS

- A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work.
- B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried.
- C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

### PART 2 - PRODUCTS

#### 2.1 STONE

- A. Carderock® Stone:
1. Veneer
  2. Rubble style
  3. Setting bed 4" to 6"
  4. Somewhat irregular in shape
  5. Corners many with reasonably square edges for corners, 6" to 12" in height
  6. Lengths up to 60"
- B. Carderock® Thin Ashlar:
1. Height 3 ½ " and 7 ½"

- C. Carderock® Sawn Corners:
- D. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
  - 1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.
- E. Hydrated Lime: ASTM C 207, Type S.
- F. Masonry Cement: ASTM C 91.
- G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in stone masonry mortar.
  - 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. Davis Colors; True Tone Mortar Colors.
    - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
    - c. Solomon Colors; SGS Mortar Colors.
- H. Colored Cement Product: Packaged blend made from or and mortar pigments, all complying with specified requirements, and containing no other ingredients.
  - 1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
  - 2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Colored Portland Cement-Lime Mix:
      - 1) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
      - 2) Lafarge North America; Eaglebond.
      - 3) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
    - b. Colored Masonry Cement:
      - 1) Essroc, Italcementi Group; Brixment-in-Color.
      - 2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Masonry Cement.
      - 3) Lafarge North America; Magnolia Masonry Cement.
      - 4) Lehigh Cement Company; Lehigh Custom Color Masonry Cement.
- I. Aggregate: ASTM C 144 and as follows:
  - 1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
  - 2. White Aggregates: Natural white sand or ground white stone.

3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
  
- J. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.
  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. Boiardi Products Corporation.
    - b. Bonsal.
    - c. Bostik Findley Inc.
    - d. C-Cure.
    - e. Custom Building Products.
    - f. DAP Inc.
    - g. Laticrete International, Inc.
    - h. MAPEI Corp.
    - i. Summitville Tiles, Inc.
    - j. TEC Specialty Construction Brands; H. B. Fuller Company.
  
- K. Water: Potable.

## 2.2 VENEER ANCHORS FOR THE GATE HOUSE

- A. Materials:
  1. Hot-Dip Galvanized-Steel Sheet: ASTM A 1008/A 1008M, cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M, Class B-2.
  
- B. Corrugated-Metal Veneer Anchors: Not less than 0.030-inch-thick by 7/8-inch-wide hot-dip galvanized steel sheet with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch.

## 2.3 VENEER ANCHORS FOR ALL OTHER WALLS

- A. MATERILAS
  1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
  2. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
  
- B. Size: Sufficient to extend at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.
  
- C. Concrete Wall Veneer Anchors: Units consisting of a metal dovetail triangular tie and matching dovetail slot cast in the concrete complying with the following requirements:

1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hohmann & Barnard, Inc; 315 Flexible Dovetail Brick Tie and 305 Dovetail Slot
    - b. Wire-Bond; 2102 Dovetail Triangular Tie and 1304 dovetail slot
  2. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
- D. Hollow Structural Steel Veneer Anchors: Units consisting of a metal dovetail triangular tie and matching dovetail slot cast in the concrete complying with the following requirements:
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hohmann & Barnard, Inc; 315 Flexible Dovetail Brick Tie and 305 Dovetail Slot
    - b. Wire-Bond; 2102 Dovetail Triangular Tie and 1304 dovetail slot "Structural Performance Characteristics" Subparagraph below is based on BIA Technical Note No. 28B.
  2. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.

#### 2.4 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.
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. Diedrich Technologies, Inc.
    - b. Dominion Restoration Products.
    - c. EaCo Chem, Inc.
    - d. Hydrochemical Techniques, Inc.
    - e. Prosoco, Inc.

#### 2.5 MORTAR MIXES

- A. General: Do not use admixtures unless otherwise indicated.
1. Do not use calcium chloride.
  2. Limit cementitious materials in mortar to portland cement and lime.
  3. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.

- B. Mortar for Stone Masonry: Comply with ASTM C 270, Proportion Specification.
  - 1. Mortar for Setting Stone: Type N
  - 2. Mortar for Pointing Stone: Type N
- C. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.
- D. Cement-Paste Bond Coat: Mix either neat cement and water or cement, sand, and water to a consistency similar to that of thick cream.
  - 1. For latex-modified portland cement setting-bed mortar, substitute latex admixture for part or all of water, according to latex-additive manufacturer's written instructions.
- E. Mortar for Scratch Coat over Metal Lath: 1 part portland cement, 1/2 part lime, 5 parts loose damp sand, and enough water to produce a workable consistency.
- F. Mortar for Scratch Coat over Unit Masonry: 1 part portland cement, 1 part lime, 7 parts loose damp sand, and enough water to produce a workable consistency.
- G. Pigmented Mortar: Use colored cement product.
  - 1. Pigments shall not exceed 10 percent of portland cement by weight.
  - 2. Pigments shall not exceed 5 percent of masonry cement by weight.

## 2.6 MASONRY SEALERS

- A. Proprietary Masonry Sealer: Manufacturer's water-based PSS 20 sealer designed for protecting facades and walls from graffiti and bill sticking marks.
  - 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. KEIM Mineral Coatings of America, Inc.

## 2.7 FABRICATION

- A. Select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated.
- B. Shape stone for type of masonry (pattern) as follows:
  - 1. Split-bed, random-range ashlar with random course heights and random lengths (interrupted coursed).
  - 2. Size range: 6"-18" x 6"-18"

- C. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved samples and mockups.
  - 1. Finish: Rock face (pitched face)
  - 2. Finish for Copings: Rock face (pitched face)
    - a. Finish exposed ends of copings same as front and back faces.

## 2.8 PATTERN EXAMPLES

- A. Self capping stone walls: Carder Rock Veneer stone wall intermixed with 35 percent Caderock Ashlar stone
  - 1. Pattern Example



Gatehouse Base: Carderock Long Ashlar

2. Pattern Example



B. Water Wall: Carder Rock Veneer stone wall intermixed with 15 percent Carderock Ashlar stone

1. Pattern Example





### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Accurately mark stud centerlines on face of weather-resistant sheathing paper before beginning stone installation.
- B. Coat concrete and unit masonry backup with asphalt dampproofing.

#### 3.2 SETTING OF STONE MASONRY, GENERAL

- A. Perform necessary field cutting and trimming as stone is set.
  - 1. Pitch face at field-split edges as needed to match stones that are not field split.
- B. Perform necessary field cutting and trimming as stone is set.
  - 1. Use power saws to cut stone that is fabricated with saw-cut surfaces.
- C. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.
- D. Arrange stones in three-course, random-range ashlar pattern with random course heights, random lengths (interrupted coursed), and uniform joint widths.
- E. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.
- F. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/8 inch at narrowest points or more than 3/8 inch at widest points.
- G. Provide sealant joints of widths and at locations indicated.
  - 1. Keep sealant joints free of mortar and other rigid materials.
  - 2. Sealing joints is specified in Division 07 Section "Joint Sealants."

#### 3.3 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/2 inch in 40 feet or more. For external corners, and other conspicuous lines, do not exceed 1/2 inch in 40 feet or more.
- B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/2 inch in 40 feet or more.
- C. Variation of Linear Building Line: For position shown in plan, do not exceed 3/4 inch in 40 feet or more.



- D. Measure variation from level, plumb, and position shown in plan as variation of the average plane of the face of each stone from level, plumb, or dimensioned plane.
- E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.
- F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

#### 3.4 INSTALLATION OF ANCHORED STONE MASONRY

- A. Anchor stone masonry to concrete with corrugated-metal veneer anchors unless otherwise indicated. Secure anchors by inserting dovetailed ends into dovetail slots in concrete.
- B. Anchor stone masonry to unit masonry with corrugated-metal veneer anchors unless otherwise indicated. Embed anchors in unit masonry mortar joints or grouted cells for distance at least one-half of unit masonry thickness.
- C. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches , through stone masonry and with at least 5/8-inch cover on outside face.
- D. Space anchors to provide not less than 1 anchor per 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.
- E. Space anchors not more than 16 inches o.c. vertically and 24 inches o.c. horizontally. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.
- F. Set stone in full bed of mortar with full head joints unless otherwise indicated. Build anchors into mortar joints as stone is set.
- G. Rake out joints for pointing with mortar to depth of not less than 1/2 inch. Rake joints to uniform depths with square bottoms and clean sides.

#### 3.5 POINTING

- A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.
- B. Point stone joints by placing and compacting pointing mortar in layers not more than 3/8 inch deep. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.
- C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:
  - 1. Joint Profile: Raked – 1”-1.5” depth.

### 3.6 ADJUSTING AND CLEANING

- A. Remove and replace stone masonry of the following description:
  - 1. Broken, chipped, stained, or otherwise damaged stone.
  - 2. Stone may be repaired if methods and results are approved by Architect.
  - 2. Defective joints.
  - 3. Stone masonry not matching approved samples and mockups.
  - 4. Stone masonry not complying with other requirements indicated.
- B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
  - 3. Clean stone masonry by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised II, using job-mixed detergent solution.

### 3.7 EXCESS MATERIALS AND WASTE

- A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.
- B. Disposal as Fill Material: Dispose of clean masonry waste; including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
  - 1. Crush masonry waste to less than 4 inches in greatest dimension.
  - 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving."
  - 3. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 044300

## **SECTION 047200 - CAST STONE MASONRY**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
1. Cast stone window sills.
  2. Cast stone steps.
  3. Cast stone entry signs.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include dimensions and finishes.
- B. Shop Drawings: Show fabrication and installation details for cast stone units and sign. Include dimensions, details of reinforcement and anchorages if any and indication of finished faces.
1. Provide full size drawings for the text size, text font, text layout
- C. Samples for Verification:
1. For each color and texture of cast stone required, 10 inches square in size.
  2. For colored mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicated types and amounts of pigments used.
  3. Paint color used for the sign painting

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturer.
- B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364

#### **1.4 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute.
- B. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work.
- B. Pack, handle, and ship cast stone units in suitable packs or pallets.
  - 1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
  - 2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

## PART 2 - PRODUCTS

### 2.1 CAST STONE UNITS SILLS AND STEPS

- A. 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:
  - 1. Advanced Cast Stone
  - 2. Continental Cast Stone
  - 3. Leito Enterprises
  - 4. Midwest Cast Stone
  - 5. Siteworks inc.
  - 6. Stonco
  - 7. Equivalent as approved by M-NCPPC Construction Manager.
- B. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.
  - 1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
  - 2. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
  - 3. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
  - 4. Provide drips on projecting elements unless otherwise indicated.
- C. Cure units as follows:
  - 1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
  - 2. Keep units damp and continue curing to comply with one of the following:
- D. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
- E. Colors and Textures: As selected by M-NCPPC Construction Manager from manufacturer's full range.

## 2.2 CAST STONE SIGNS

- A. 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:
1. Advanced Cast Stone
  2. Continental Cast Stone
  3. Leito Enterprises
  4. Midwest Cast Stone
  5. Siteworks inc.
  6. Stonco
  7. Equivalent as approved by M-NCPPC Construction Manager.
- B. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.
1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
  2. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
  3. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
  4. Provide letters that are cut or cast into the cast stone
- C. Cure units as follows:
1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
  2. Keep units damp and continue curing to comply with one of the following:
- D. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
- E. Colors and Textures: As selected by M-NCPPC Construction Manager from manufacturer's full range.
- F. Font
1. Letters: to be 8 ½" Tall
  2. Style: Garamond;
  3. Verify the font size and style with the M-NCPPC Construction Manager
- G. Paint for Lettering
1. Exterior Latex paint with reflective glass beads
  2. Color: Bronze from the full range of Manufactures Colors including custom
  3. Verify the color with the M-NCPPC Construction Manager

## 2.3 ACCESSORIES

- A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666
- B. Dowels: 1/2-inch- diameter, round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666

- C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner complying with requirements in Section 042000 "Unit Masonry," and expressly approved for intended use by cast stone manufacturer and cleaner manufacturer.

## 2.4 MORTAR

- A. Comply with requirements in Section 042000 "Unit Masonry" for mortar materials and mixes.
  - 1. For setting mortar, use Type N.
  - 2. For pointing mortar, use Type N.
  - 3. Pigmented Mortar: Use colored cement product.

## PART 3 - EXECUTION

### 3.1 SETTING CAST STONE IN MORTAR

- A. Install cast stone units to comply with requirements in Section 044300 "Stone Masonry."
- B. Set units in full bed of mortar with full head joints unless otherwise indicated.
  - 1. Build concealed flashing into mortar joints as units are set.
  - 2. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
- C. Provide sealant joints at copings and other horizontal surfaces, at expansion, control, and pressure-relieving joints, and at locations indicated.
  - 1. Keep joints free of mortar and other rigid materials.
  - 2. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

### 3.2 PAINT FOR SIGN LETTERS.

- A. Paint letters with crisp lines and in conformance with the mockup

### 3.3 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.
- B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean cast stone as work progresses.
  - 1. Remove mortar fins and smears before tooling joints.
  - 2. Remove excess sealant immediately, including spills, smears, and spatter.

- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone to comply with requirements in Section 042000 "Unit Masonry."

END OF SECTION 047200

## **SECTION 054216 COLD-FORMED METAL DECK FRAMING**

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Cold-formed Metal Deck Framing including:
  - 1. Track/Ledgers.
  - 2. Joists.
  - 3. Box beams.
- B. Accessories: Metal hangers and fasteners.

#### 1.2 RELATED SECTIONS

- A. Section 00 33 00 – Concrete for abutments
- B. Section 31 62 20 –Prefabricated foundation system
- C. Section 06 15 00 –Decking
- D. Section 05 52 13 –Pipe and Tube Railings

#### 1.3 REFERENCES

- A. ASTM International
  - 1. ASTM A1003 – Standard Specification for Steel Sheet, Carbon Metallic and Nonmetallic Coated for Cold Formed Framing Members.

#### 1.4 COORDINATION

- A. Coordinate blocking and support requirements for railing posts refer to Section 05 52 13- Pipe and Tube Railings
- B. Coordinate support posts refer to Section 06 10 00 - Exterior Rough Carpentry
- C. Coordinate footings refer to Section 31 62 10 - Prefabricated Pier



#### 1.5 SUBMITTALS

- A. Product Data: Submit manufacturer current technical literature for each type of product.
- B. Shop Drawings:
  - 1. Provide plans and details which include layout, spacing, and sizes of metal deck framing.
  - 2. Include details showing anchorage to primary structure, bracing of deck framing, required blocking, and bridging.
- C. Maintenance and Care Documentation Shop Drawings:
  - 1. Provide documentation indicating how to maintain and care for material.
- D. Quality Assurance Submittals
  - 1. Manufacturer Instructions: Provide manufacturer's written instructions including proper material storage, material handling, installation sequence, and attachment methods.
  - 2. Test Report: Submit ICC ES Report: ER-4943P indicating properties of deck framing materials.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Installer shall have a minimum of three (3) years experience in the installation of products listed in this section.

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver framing materials and components in manufacturer's original, unopened, undamaged packaging with identification labels intact.
- B. Store materials on dry, level, firm, and clean surface. Elevate material at one end to allow moisture run-off, cover and ventilate to allow air to circulate and moisture to escape.

#### 1.8 WARRANTY

- A. Limited Warranty:
  - 1. Standard form in which manufacturer agrees that under normal use and service conditions steel deck framing components shall be free from material defects in workmanship and materials and will not become structurally unfit. Structurally unfit shall be defined as corrosion causing a perforation on the component
  - 2. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Trex® Company, Inc.; (800-289-8739) (www.trex.com); 160 Exeter Drive; Winchester, Virginia 22603. Or approved equal

2.2 COLD-FORMED STEEL DECK FRAMING

- A. Recycled content of deck framing material shall have a minimum postconsumer and preconsumer recycled content of 25 percent.
- B. Steel Sheet: ASTM A1003; structural grade, hot-dipped galvanized coating G60 meeting requirements for corrosion protection.

1. 1-5/8 inch wide deck joist:

- a. Grade: 33; Class 1.
- b. Thickness: 0.0451 inch (18 gauge). c. Height: 8 inches.

2. 2 inch wide deck joist:

- a. Grade 50, Class 3.
- b. Thickness: 0.0713 inch (14 gauge). c. Height: 8 inches.

3. Track or ledger: Grade 50, Class 3.

- a. Grade 50, Class 3.
- b. Thickness: 0.0713 inch (14 gauge). c. Height: 8-1/4 inches.

4. Single and Double Box beams: Grade 50, Class 3. a.

- Grade 50, Class 3.
- b. Thickness: 0.0713 inch (14 gauge).
- c. Height: 8-3/4 inches.

- B. Finish: Baked polyester/ceramic blend coating.
  - a. Color: Standard from Manufacture

2.3 ACCESSORIES

- A. Brackets: Galvanized steel, type as recommended by manufacturer.
- B. Bolts, nuts, and screws: Galvanized steel, type as recommended by manufacturer.
- C. Elevations Universal Connector & Elevations Start Clip (or equal)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that footings are in the proper location per shop drawings

### 3.2 PREPARATION

- A. Prepare posts to accept box beam, as detailed on shop drawings.
- B. Install angle brackets on box beam at joist spacing indicated on shop drawings prior to installing box beam on support posts.

### 3.3 INSTALLATION

- A. Complete installation as directed by the manufacturer's specifications and installation manual to include but not limited to the following.
  - 1. Attach ledger to primary structure using fasteners at spacing indicated on approved shop drawings.
  - 2. Attach box beam to support posts using post brackets.
  - 3. Lay-out joists at spacing indicated on approved shop drawings.
    - a. Attach to beam and ledger with angle brackets.
    - b. Provide blocking between joists in locations indicated on approved shop drawings.
    - c. Attach front track (rim joist) at each joist, top and bottom.
  - 4. Provide blocking between joists to support railing posts as shown on construction documents and approved shop drawings

### 3.4 CLEANING AND PROTECTION

- A. Remove scrap material from site and legally recycle off site.
- B. Touch-up tracks, joists and box beams scratched during framing with manufacturer approved touch-up paint. Prepare metal and apply touch-up paint per manufacturer's instructions.

END OF SECTION

## **SECTION 05 50 00 METAL FABRICATIONS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified.
  - 1. Support for Wall and Ceiling Mounted Items
  - 2. Frames<sup>3</sup>. Loose Lintels
  - 3. Columns

#### **1.2 RELATED WORK**

- B. Colors, finishes, and textures: PER SCHEDULE FOR FINISHES.
- C. Prime and finish painting: Section 09 91 00, PAINTING.

#### **1.3 SUBMITTALS**

- B. Manufacturer's Literature and Data:
- C. Shop Drawings:
  - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
  - 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
  - 3. Provide templates and rough-in measurements as required.
- D. Manufacturer's Certificates:
  - 1. Anodized finish as specified.
  - 2. Live load designs as specified.
- E. Design Calculations for specified live loads including dead loads.
- F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

#### 1.4 QUALITY ASSURANCE

- A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type shall be the same and be made by the same manufacturer.
- C. Assembled product to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

#### PART 2 - PRODUCTS

##### 2.1 DESIGN CRITERIA

- A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.

##### 2.2 MATERIALS

- A. Structural Steel: ASTM A36.
- B. Stainless Steel: ASTM A167, Type 302 or 304.
- C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
- D. Floor Plate:
  - 1. Steel ASTM A786.
  - 2. Aluminum: ASTM B632.
- E. Steel Pipe: ASTM A53.
  - 1. Galvanized for exterior locations.
  - 2. Type S, Grade A unless specified otherwise.
  - 3. NPS (inside diameter) as shown.
- F. Cast-Iron: ASTM A48, Class 30, commercial pattern.
- G. Malleable Iron Castings: A47.
- H. Primer Paint: As specified in Section 09 91 00, PAINTING.
- I. Stainless Steel Tubing: ASTM A269, type 302 or 304.
- J. Modular Channel Units:

1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
2. Form channel with in turned pyramid shaped clamping ridges on each side.
3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

K. Grout: ASTM C1107, pourable type.

L. Insect Screening: ASTM D3656.

## 2.3 HARDWARE

### A. Rough Hardware:

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

### B. Fasteners:

1. Bolts with Nuts:
  - a. ASME B18.2.2.
  - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
  - c. ASTM F468 for nonferrous bolts.
  - d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

## 2.4 FABRICATION GENERAL

### A. Material

1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

B. Size:

1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

C. Connections

1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.

5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship

1. General:

- a. Fabricate items to design shown.
- b. Furnish members in longest lengths commercially available within the limits shown and specified.
- c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
- d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
- e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
- f. Prepare members for the installation and fitting of hardware.
- g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
- h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.

2. Welding:

- a. Weld in accordance with AWS.
- b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
- c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
- d. Finish welded joints to match finish of adjacent surface.

3. Joining:

- a. Miter or butt members at corners.
- b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.



4. Anchors:

- a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
- b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.

5. Cutting and Fitting:

- a. Accurately cut, machine and fit joints, corners, copes, and miters.
- b. Fit removable members to be easily removed.
- c. Design and construct field connections in the most practical place for appearance and ease of installation.
- d. Fit pieces together as required.
- e. Fabricate connections for ease of assembly and disassembly without use of special tools.
- f. Joints firm when assembled.
- g. Conceal joining, fitting and welding on exposed work as far as practical.
- h. Do not show rivets and screws prominently on the exposed face.
- i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:

1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
2. Aluminum: NAAMM AMP 501.
  - a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
  - b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
  - c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
  - d. Painted: AA-C22R10.
3. Steel and Iron: NAAMM AMP 504.
  - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
  - b. Surfaces exposed in the finished work:

- 1) Finish smooth rough surfaces and remove projections.
  - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
  - c. Shop Prime Painting:
    - 1) Surfaces of Ferrous metal:
      - a) Items not specified to have other coatings.
      - b) Galvanized surfaces specified to have prime paint.
      - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
      - d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
      - e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.
    - 2) Non ferrous metals: Comply with MAAMM-500 series.
  4. Stainless Steel: NAAMM AMP-504 Finish No. 4.
- G. Protection:
1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
  2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

## 2.5 SUPPORTS

### A. General:

1. Fabricate ASTM A36 structural steel shapes as shown.
2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
3. Field connections may be welded or bolted.

### B. For Wall Mounted Items:

1. For items supported by metal stud partitions.
2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.
3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.

4. Steel hat channels where shown. Flange cut and flatted for anchorage to stud.
5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.

## 2.6 FRAMES

### B. Channel Door Frames:

1. Fabricate of structural steel channels of size shown.
2. Miter and weld frames at corners.
3. Where anchored to masonry or embedded in concrete, weld to back of frame at each jamb, 5 mm (3/16 inch) thick by 44 mm (1-3/4 inch) wide steel strap anchors with ends turned 50 mm (2 inches), and of sufficient length to extend at least 300 mm (12 inches) into wall. Space anchors 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb. Weld clip angles to bottom of jambs and provide holes for expansion bolts.
4. Where anchored to concrete or masonry in prepared openings, drill holes at jambs for anchoring with expansion bolts. Weld clip angles to bottom of frame and provide holes for expansion bolt anchors as shown. Drill holes starting 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb and at top of jamb. Provide pipe spacers at holes welded to channel.
5. Where closure plates are shown, continuously weld them to the channel flanges.
6. Weld continuous 19 x 19 x 3 mm (3/4 x 3/4 x 1/8 inch) thick steel angles to the interior side of each channel leg at the head and jambs to form a caulking groove.
- 7.

## 2.10 LOOSE LINTELS

- A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.
- B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.
- C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.

1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
  2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- E. Provide bearing plates for lintels where shown.
- F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.
- G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.
- H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.
- I. Elevator Entrance:
1. Fabricate lintel from plate bent to channel shape, and provide a minimum of 100 mm (4 inch) bearing each end.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
1. Provide temporary bracing for such items until concrete or masonry is set.
  2. Place in accordance with setting drawings and instructions.
  3. Build strap anchors, into masonry as work progresses.
- C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.
- D. Field weld in accordance with AWS.
1. Design and finish as specified for shop welding.
  2. Use continuous weld unless specified otherwise.
- E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

- F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.
- G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.
- H. Secure escutcheon plate with set screw.

### 3.2 INSTALLATION OF SUPPORTS

- A. Anchorage to structure.
  - 1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
  - 2. Secure supports to concrete inserts by bolting or continuous welding as shown.
  - 3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
  - 4. Secure steel plate or hat channels to studs as detailed.
- B. Supports for Wall Mounted items:
  - 1. Locate center of support at anchorage point of supported item.
  - 2. Locate support at top and bottom of wall hung cabinets.
  - 3. Locate support at top of floor cabinets and shelving installed against walls.
  - 4. Locate supports where required for items shown.

### 3.3 OTHER FRAMES

- A. Set frame flush with surface unless shown otherwise.
- B. Anchor frames at ends and not over 450 mm (18 inches) on centers unless shown otherwise.
- C. Set in formwork before concrete is placed.

### 3.4 STEEL LINTELS

- A. Use lintel sizes and combinations shown or specified.
- B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.
- C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

### 3.5 STEEL COMPONENTS FOR MILLWORK ITEMS

Coordinate and deliver to Millwork fabricator for assembly where millwork items are secured to metal fabrications.

### 3.6 CLEAN AND ADJUSTING

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.
- B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of project.

THE END OF SECTION 055000

## SECTION 055213 - PIPE AND TUBE RAILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Stainless-steel pipe, tube & cable railings.
  2. Stainless-steel toe kick

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails Toe Kick and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
    - b. Infill load and other loads need not be assumed to act concurrently.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

#### 1.3 REFERENCES

- A. ASTM A276 - Stainless Steel Bars and Shapes.
- B. ASTM A312 - Seamless and Welded Austenitic Stainless Steel Pipes.
- C. ASTM A314 - Stainless Steel Billets and Bars for Forging.
- D. ASTM A554 - Welded Stainless Steel Mechanical Tubing.
- E. ASTM A582 - Free-Machining Stainless and Heat-Resisting Steel Bars.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Manufacturer's product lines of mechanically connected railings.
  - 2. Railing brackets.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal:
  - 1. East Coast Cable Solutions or approved equal

#### 2.2 METALS, GENERAL

- A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

#### 2.3 STAINLESS STEEL

- A. Tubing: ASTM A 554, Grade MT 316L.
- B. Pipe: ASTM A 312/A 312M, Grade TP 316L.
- C. Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 316L.
- D. Stainless Steel Cable: 3/16" Diameter Type 316 stainless steel cable



## 2.4 MISCELLANEOUS MATERIALS

- A. Fasteners: Provide the following:
  - 1. Stainless-Steel Railings: Type 316 stainless-steel fasteners for rails and cables
- B. Post-Installed Anchors for concrete installation: Type 316 stainless steel Torque-controlled expansion anchors Torx-Pin (or approved equal) capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency. The anchors must be tamper resistant and have a button top.
- C. Post-Installed Anchors for boardwalk installation: As indicated on the drawings capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- D. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 2.5 FABRICATION

- A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- B. Form work true to line and level with accurate angles and surfaces.
- C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove flux immediately.
  - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- D. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- E. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

- F. Form changes in direction by bending.
- G. Bend members in jigs to produce uniform curvature without buckling or otherwise deforming exposed surfaces.
- H. Close exposed ends of railing members with prefabricated end fittings.
- I. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
- J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
  - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers to transfer loads through wall finishes.

## 2.6 STAINLESS-STEEL FINISHES

- A. Dull Satin Finish: No. 6.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive new cable railing system. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

### 3.2 INSTALLATION

- A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet. Delete first two paragraphs below if railing ends are not returned to walls.
- B. Attach posts to concrete with the surface mounting bracket. Pre-drilled hole for exposed bolt anchorage and install expansion anchors. The surface mounting brackets must be designed to meet the slope. Grouting and shims are not permitted.
- C. Install cable railing system in accordance with manufacturer's instructions at locations indicated on the drawings.
  - 1. Install cable railing system plumb, level, square, and rigid.
  - 2. Anchor cable railing system to mounting surface as indicated on the drawings.

3. Use manufacturer's supplied cable hardware.
4. Terminate and tension cables in accordance with manufacturer's instructions.
5. Tension cables to a minimum of 400 pounds (181.44 kilograms) each in sequence in accordance with manufacturer's instructions.
6. Ensure cables are clean, parallel to each other, and without kinks or sags.
7. Replace defective or damaged components as directed by M-NCPPC Construction Manager.
8. Repair damaged factory-applied finish as directed by M-NCPPC Construction Manager.

### 3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055213

## SECTION 057500.10 – DECORATIVE METAL BASINS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Stainless Steel Fountain Basin
  2. Copper Fountain Basin with a steel substructure

#### 1.2 COORDINATION

- A. Coordinate work of this section with interfacing and adjacent work for proper sequencing. Ensure weather resistance and durability of work and protection of materials and finishes.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
1. Temperature Change: 120 deg F ambient; material surfaces.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Copper
  2. Stainless steel
  3. Steel
  4. Bituminous Paint
- B. Shop Drawings:
1. The Contractor shall submit complete shop drawings to the M-NCPPC Construction Manager for approval, in quantities required for proper distribution and in accordance with the requirements of the General Conditions.
  2. Modifications may be made to the design to simplify the construction of the basins as long as the design intent is met, and quality and strength are not compromised.
    - a. This may be done without any additional cost to M-NCPPC
    - b. This may only be done with written approval from the M-NCPPC Construction Manager

3. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1. Submittals may be rejected if they are difficult to read due to insufficient scale, poor image quality, or poor drafting quality; or if the required information is not included.

C. Samples:

1. 6-inch square samples of fabricated products exposed as finished work. Provide complete with specified finish.

#### 1.5 QUALITY ASSURANCE

A. Fabricator's Qualifications: Company specializing in coppersmith and other decorative metal fabrication with a minimum of ten (10) years prior experience.

1. Provide written evidence (through references) of the experience and 5 examples of relevant projects located in the DC Metro Area over the past 2 years with photographs of the above projects.

B. Mockup for Finishes:

1. Provide a minimum of 3, 6-inch square samples for each type of exposed metal showing the range of finishes to be selected by M-NCPPC. This will be the basis for the finish for the entire basin. If M-NCPPC does not like the samples, continue to fabricate samples at no additional cost to M-NCPPC until a sample is accepted. Retain accepted mock-up as quality standard for acceptance of completed work.

#### 1.6 CLOSEOUT SUBMITTALS

A. Provide maintenance data in Operations and Maintenance manual for maintaining basins

#### 1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading: Protect finish metal faces.

B. Acceptance at Site: Examine each component and accessory as delivered and confirm that material and finish is undamaged.

C. Do not accept or install damaged materials. Storage and Protection: Stack pre-formed material to prevent twisting, bending, and abrasions. Provide ventilation. Prevent contact with materials which may cause discoloration or staining.

## PART 2 - PRODUCTS

### 2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

### 2.2 NON-FERROUS METALS

- A. Copper: ASTM B 370; minimum temper H00 (cold-rolled)

### 2.3 FERROUS METALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **25** percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, **Type 316L**.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, **Type 316**

### 2.4 FINISHES

- A. Copper
  - 1. From the Manufacturers full range of colors to include but not limited to:
    - a. Unfinished
    - b. Brown Statuary Finish
    - c. Light Green Patina Finishes
    - d. Lacquered Finish
- B. Stainless Steel
  - 1. Sandblasted

### 2.5 ACCESSORIES

- A. Solder: ASTM B 32; Provide 50-50 tin/lead or lead free alternative of similar or greater strength solder. Killed acid flux.
- B. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.
- C. Fasteners: Same metal as basin metal or other non-corrosive metal as recommended by sheet manufacturer.
- D. Bituminous Coating: SSPC-Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film), nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

- E. Gaskets: As required to seal joints in decorative formed metal and remain watertight
- F. Filler Metal and Electrodes: Provide type and alloy as necessary for strength, corrosion resistance, and compatibility in fabricated items.
- G. Joint Sealant: One-part, copper compatible elastomeric polyurethane, polysulfide, butyl or silicone rubber sealant as tested by sealant manufacturer for copper substrates.

## 2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds. Locate joints where least conspicuous.
- E. Fabricate seams and other connections to be waterproof.
- F. Weld connections for all pipes. Sealant is not permitted.

## 2.7 FINISHES, GENERAL

- A. Copper Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Apply a bituminous coat on all metal surfaces that will not be seen as directed by the manufacture
- B. Install fabricated basins accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

- C. Do not field weld or solder with the exception of minor pipe connections comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

### 3.2 CLEANING

- A. Remove protective film (if any) from exposed surfaces of copper promptly upon installation. Strip with care to avoid damage to finishes.
- B. Clean exposed surfaces, removing substances that might cause abnormal discoloration of metal. Upon completion of each area of soldering, carefully remove flux and other residue from surfaces. Neutralize acid flux by washing with baking soda solution, and then flushing clear water rinse. Use special care to neutralize and clean crevices.
- C. Clean exposed metal surfaces of substances that would interfere with uniform oxidation and weathering.

### 3.3 PROTECTION

- A. Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.



## **SECTION 061000 ROUGH CARPENTRY**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION:**

Section specifies wood blocking, framing, sheathing, furring, nailers, sub-flooring, rough hardware, and light wood construction.

#### **1.2 RELATED WORK:**

- A. Milled woodwork: Section 06 20 00, FINISH CARPENTRY.
- B. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

#### **1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

#### **1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:**

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 150 mm (6 inches) above grade and cover with well ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

### **PART 2 - PRODUCTS**

#### **2.1 LUMBER:**

- A. Unless otherwise specified, each piece of lumber bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.
  - 1. Identifying marks in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
  - 2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.
- B. Structural Members: Species and grade as listed in the AFPA, National Design Specification for Wood Construction having design stresses as shown.

C. Lumber Other Than Structural:

1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
2. Framing lumber: Minimum extreme fiber stress in bending of 1100.
3. Furring, blocking, nailers and similar items 100 mm (4 inches) and narrower Standard Grade; and, members 150 mm (6 inches) and wider, Number 2 Grade.

D. Sizes:

1. Conforming to Prod. Std., PS20.
2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:

1. At time of delivery and maintained at the site and before enclosure.
2. Boards and lumber 50 mm (2 inches) and less in thickness: Average 15 percent and not to exceed 19 percent.
3. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:

1. Mil Spec. MIL-L-19140 with piece of treated material bearing identification of testing agency and showing performance rating.
2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. Preservative Treatment:

1. Do not treat Heart Redwood and Western Red Cedar.
2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 600 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members used in connection with roofing and flashing materials.
3. Treat other members specified as preservative treated (PT).
4. Preservative treat by the pressure method complying with ASTM D1760, except any process involving the use of Chromated Copper arsenate (CCA) for pressure treating wood is not permitted.

## 2.2 PLYWOOD

- A. Comply with Prod. Std., PS 1.
- B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.
- C. Sheathing:
  - 1. APA rated Exposure 1 or Exterior; panel grade CC or better.
  - 2. Wall sheathing:
    - a. Minimum 9 mm (11/32 inch) thick with supports 400 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 600 mm (24 inches) on center unless specified otherwise.
    - b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.
  - 3. Roof sheathing:
    - a. Minimum 9 mm (11/32 inch) thick with span rating 24/0 or 12 mm (15/32 inch) thick with span rating for supports 400 mm (16 inches) on center unless specified otherwise.
    - b. Minimum 15 mm (19/32 inch) thick or span rating of 40/20 or 18 mm (23/32 inch) thick or span rating of 48/24 for supports 600 mm (24 inches) on center.

## 2.3 STRUCTURAL-USE PANELS

- A. Comply with APA.
- B. Bearing the mark of a recognized association or independent agency that maintains continuing control over quality of panel which identifies compliance by end use, Span Rating, and exposure durability classification.
- C. Wall and Roof Sheathing:
  - 1. APA Rated sheathing panels, durability classification of Exposure 1 or Exterior Span Rating of 16/0 or greater for supports 400 mm (16 inches) on center and 24/0 or greater for supports 600 mm (24 inches) on center.
- D. Subflooring:
  - 1. Under finish wood flooring or underlayment:
    - a. APA rated sheathing panels, durability classification of Exposure 1 or Exterior.
    - b. Span Rating of 24/16 or greater for supports 400 mm (16 inches) on
  - 2. Under resilient floor or carpet.
    - a. APA rated combination subfloor-underlayment grade panels, durability classification of Exposure 1 or Exterior T and G.

- b. Span Rating of 16 or greater for supports 300 mm (16 inches) on center and 24 or greater for supports 600 mm (24 inches) on center.

E. Underlayment:

1. APA rated Exposure 1.
2. Minimum 6 mm (1/4 inch) thick or greater over subfloor.

F. Wood "I" Beam Members:

1. Size and Shape as shown.
2. Cambered and marked "Top up".
3. Plywood webs: PS-1, minimum 9 mm (3/8 inch) thick, unless shown otherwise.
4. Flanges: Kiln dried stress rated dense lumber minimum 38 mm (1-1/2 inch) thick, width as shown.
5. Plywood web fitted into flanges and joined with ASTM D2559 adhesive to form "I" beam section unless shown otherwise.

G. Laminated Veneer Lumber (LVL):

1. Bonded jointed wood veneers with ASTM D2559 adhesive.
2. Scarf jointed wood veneers with grain of wood parallel.
3. Size as shown.

2.4 ROUGH HARDWARE AND ADHESIVES:

A. Anchor Bolts:

1. ASME B18.2.1 and ANSI B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
2. Extend at least 200 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).

B. Miscellaneous Bolts: Expansion Bolts: C1D, A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Use 13 mm (1/2 inch) bolt unless shown otherwise.

C. Washers

1. ASTM F844.
2. Use zinc or cadmium coated steel or cast iron for washers exposed to weather.

D. Screws:

1. Wood to Wood: ANSI B18.6.1 or ASTM C1002.
2. Wood to Steel: ASTM C954, or ASTM C1002.

E. Nails:

1. Size and type best suited for purpose unless noted otherwise. Use aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
  2. ASTM F1667:
    - a. Common: Type I, Style 10.
    - b. Concrete: Type I, Style 11.
    - c. Barbed: Type I, Style 26.
    - d. Underlayment: Type I, Style 25.
    - e. Masonry: Type I, Style 27.
    - f. Use special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.
- F. Framing and Timber Connectors:
1. Fabricate of ASTM A446, Grade A; steel sheet not less than 1.3 mm (0.052 inch) thick unless specified otherwise. Apply standard plating to steel timber connectors after punching, forming and assembly of parts.
  2. Framing Angles: Angle designed with bendable legs to provide three way anchors.
  3. Straps:
    - a. Designed to provide wind and seismic ties with sizes as shown or specified.
    - b. Strap ties not less than 32 mm (1-1/4 inches) wide.
    - c. Punched for fastener.
  4. Metal Bridging:
    - a. Optional to wood bridging.
    - b. V shape deformed strap with not less than 2 nail holes at ends, designed to nail to top and side of framing member and bottom and side of opposite member.
    - c. Not less than 19 mm by 125 mm (3/4 by 5 inches) bendable nailing flange on ends.
    - d. Fabricated of 1 mm (0.04 inch) minimum thick sheet.
  5. Joist Hangers:
    - a. Fabricated of 1.6 mm (0.063 inch) minimum thick sheet, U design unless shown otherwise.
    - b. Heavy duty hangers fabricated of minimum 2.7 mm (0.108 inch) thick sheet, U design with bent top flange to lap over beam.

6. Timber Connectors: Fabricated of steel to shapes shown.
  7. Joist Ties: Mild steel flats, 5 by 32 mm (3/16 by 1-1/4 inch size with ends bent about 30 degrees from horizontal, and extending at least 400 mm (16 inches) onto framing. Punch each end for three spikes.
  8. Wall Anchors for Joists and Rafters:
    - a. Mild steel strap, 5 by 32 mm (3/16 by 1-1/4 inch) with wall ends bent 50 mm (2 inches), or provide 9 by 130 mm (3/8 by 5 inch) pin through strap end built into masonry.
    - b. Strap long enough to extend onto three joists or rafters, and punched for spiking at each bearing.
    - c. Strap not less than 100 mm (4 inches) embedded end.
  9. Joint Plates:
    - a. Steel plate punched for nails.
    - b. Steel plates formed with teeth or prongs for mechanically clamping plates to wood.
    - c. Size for axial eccentricity, and fastener loads.
- G. Adhesives:
1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.
  2. For structural laminated Wood: ASTM D2559.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

- A. Conform to applicable requirements of the following:
1. AFPA National Design Specification for Wood Construction for timber connectors.
  2. AITC Timber Construction Manual for heavy timber construction.
  3. AFPA WCD-number 1, Manual for House Framing for nailing and framing unless specified otherwise.
  4. APA for installation of plywood or structural use panels.
  5. ASTM F 499 for wood underlayment.
  6. TPI for metal plate connected wood trusses.
- B. Fasteners:
1. Nails.
    - a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA Manual for House Framing where detailed nailing requirements are not specified in

nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.

- b. Use special nails with framing connectors.
  - c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.
  - d. Use eight penny or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
  - e. Use 16 penny or larger nails for nailing through 50 mm (2 inch) thick lumber.
  - f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.
  - g. Nailing Schedule; Using Common Nails:
    - 1) Joist bearing on sill or girder, toe nail three-8d or framing anchor
    - 2) Bridging to joist, toe nail each end two-8d
    - 3) Ledger strip to beam or girder three-16d under each joint.
    - 4) Subflooring or Sheathing:
      - a) 150 mm (6 inch) wide or less to each joist face nail two-8d.
      - b) Subflooring, more than 150 mm (6 inches) wide, to each stud or joint, face nail three-8d.
      - c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 150 mm (6 inches) on center and at intermediate supports 250 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 300 mm (12 inches) at supported edges and 500 mm (20 inches) o.c. at intermediate supports.
2. Bolts:
- a. Fit bolt heads and nuts bearing on wood with washers.
  - b. Countersink bolt heads flush with the surface of nailers.
  - c. Embed in concrete and solid masonry or use expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
  - d. Use toggle bolts to hollow masonry or sheet metal.
  - e. Use bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 600 mm (24 inch) intervals between end bolts. Use clips to beam flanges.

3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
  - a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
  - b. ASTM C 954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be used where practical to anchor to solid masonry, concrete, or steel.
5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Use metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
  - a. Where shown or option to nails.
  - b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
  - c. Spaced same as nails.
7. Installation of Timber Connectors:
  - a. Conform to applicable requirements of the NFPA National Design Specification for Wood Construction.
  - b. Fit wood to connectors and drill holes for fasteners so wood is not split.
- C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
  1. Space anchor bolts 1200 mm (4 feet) on centers between ends and within 150 mm (6 inches) of end. Stagger bolts from side to side on plates over 175 mm (7 inches) in width.
  2. Use shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
  3. Closely fit, and set to required lines.
- D. Cut notch, or bore in accordance with NFPA Manual for House-Framing for passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.
- E. Blocking Nailers, and Furring:
  1. Install furring, blocking, nailers, and grounds where shown.
  2. Use longest lengths practicable.
  3. Use fire retardant treated wood blocking where shown at openings and where shown or specified.
  4. Layers of Blocking or Plates:
    - a. Stagger end joints between upper and lower pieces.



- b. Nail at ends and not over 600 mm (24 inches) between ends.
- F. Underlayment:
1. Where finish flooring of different thickness is used in adjoining areas, use underlayment of thickness required to bring finish flooring surfaces into same plane.
  2. Apply to dry, level, securely nailed, clean, wood subfloor without any projections.
  3. Fasten to subfloor as specified in ASTM F499.
  4. Plywood and particle underlayment may be glue-nailed to subfloor.
  5. Butt underlayment panels to a light contact with a 1 mm (1/32 inch) space between plywood or hardboard underlayment panels and walls, and approximately 9 mm (3/8 inch) between particleboard underlayment panels and walls.
  6. Stagger underlayment panel end joints with respect to each other and offset joints with respect to joints in the subfloor at least 50 mm (2 inches).
  7. After installation, avoid traffic on underlayment and damage to its finish surface.
- G. Sheathing:
1. Use plywood or structural-use panels for sheathing.
  2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.
  3. Set nails not less than 9 mm (3/8 inch) from edges.
  4. Install 50 mm by 100 mm (2 inch by 4 inch) blocking spiked between joists, rafters and studs to support edge or end joints of panels.
  5. Match and align sheathing which is an extension of work in place to existing.

THE END OF SECTION 061000

## SECTION 061500 - WOOD DECKING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Solid-sawn wood black locust decking.

#### 1.3 Related Sections:

- A. Section 05 42 16 "Cold-Formed Metal Deck Framing" For items associated with the structure of the boardwalk
- B. Section 05 52 13 "Pipe and Tube Railings" for items associated with the railing and toe kick

### PART 2 - 05 52 13..Pipe and Tube Railings

#### 2.1 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. Hidden Attachment Clips
- B. Samples: 24 inches long, showing the range of variation to be expected in appearance of wood decking.
- C. Installer Qualifications

#### 2.2 QUALITY ASSURANCE

- A. Standard for Solid-Sawn Wood Decking: Comply with AITC 112.
- B. Installer Qualifications:
  - 1. Deck installer shall have no less than 2 similar projects using black locust decking.
- C. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of flexible porous pavement to demonstrate typical joints; deck spacing, working around the stainless steel post installation and standard of workmanship/craftsmanship.
  - a. The mockup should be no smaller than 10 linear feet of the boardwalk.
  - b. If the mockup is not adequate, the contractor will continue to build mockups at no additional cost to the Owner until a mockup is satisfactorily accepted
2. Mockup will be used as a basis for final acceptance by the M-NCPPC Construction Manager.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless M-NCPPC Inspector specifically approves such deviations in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### 2.3 DELIVERY, STORAGE, AND HANDLING

- A. Schedule delivery of wood decking to avoid extended on-site storage and to avoid delaying the Work.
- B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings. Stack wood decking with surfaces that are to be exposed in the final Work protected from exposure to sunlight.

## PART 3 - PRODUCTS

### 3.1 WOOD DECKING, GENERAL

- A. Provide Black Locust Lumber from the following provider:
  1. Black Locust Lumber Inc. or approved equal  
PO Box 685 | Pittstown, NJ | 08867  
tel: 908-735-8871 | fax: 908-735-6893
- B. Certified Wood: Wood decking shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

### 3.2 SOLID-SAWN WOOD DECKING

- A. Wood Species:
  - a. Black Locust :
- B. Wood: Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated.

- C. Decking Nominal Size: 5/4-inch x 6-inch
- D. Decking Grade: Premium Grade  
Based on the "Gree-Dex" Grade Specifications A product innovated by Black Locust Lumber Inc. or approved equal. This product comes from the "Best of the Best" Black Locust grown in the Eastern USA. Each individual piece is carefully inspected to insure premiere, quality, durability, and appearance. The most beautiful knots, 3" in diameter and less are admitted to show the real beauty of this species. Minor mineral streaks and small bark insertions are also admitted, giving you the satisfied feeling of natural characteristics. Checks less than 1/12th of the board length are also admitted.
- E. Grade Stamps: Factory mark each item with grade stamp of grading agency. Apply grade stamp to surfaces that will not be exposed to view.
- F. Face Surface: Smooth.
- G. Edge Pattern: Channel grooved to accept hidden fasteners.

### 3.3 ACCESSORY MATERIALS

- A. Fasteners for Solid-Sawn Decking: Provide Trex Hideaway Hidden Fasteners or approved equal

### 3.4 FABRICATION

- A. Shop Fabrication: Fabricate decking lumber to the sizes indicated with a milled groove to attach it to the sub structure with the hidden fasteners.

## PART 4 - EXECUTION

### 4.1 EXAMINATION

- A. Examine metal substructure and support framing in areas to receive wood decking for compliance with installation tolerances and other conditions affecting performance of wood decking.
- B. Examine decking from the mill to insure that it meets the required grading. Any lumber that does not appear to meet the required grading can be rejected by the M-NCPPC Construction Manager
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 4.2 INSTALLATION

- A. Install wood decking with crown up.

- B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.
- C. Secure decking to framing with concealed decking fasteners to comply with the Manufacture's written instruction.
- D. Install metal framing anchors, deck fasteners, & handrail post anchors to comply with manufacturer's written instructions.

4.3 ADJUSTING

- A. Replace damaged decking if require as directed by the M-NCPPC Construction Manager.

END OF SECTION 061500

## **SECTION 061600 - SHEATHING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

**A. Section Includes:**

1. Wall sheathing.

#### **1.2 ACTION SUBMITTALS**

**A. Product Data:** For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements.

### **PART 2 - PRODUCTS**

#### **2.1 WALL SHEATHING**

**A. Plywood Wall Sheathing:** Exterior, Structural I sheathing.

#### **2.2 FASTENERS**

**A. General:** Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION, GENERAL**

**A.** Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
  - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
- D. Coordinate wall 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.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

### 3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Wall and Roof Sheathing:
    - a. Screw to cold-formed metal framing.
    - b. Space panels 1/8 inch apart at edges and ends.

THE END OF SECTION 061600

## **SECTION 026000 FINISH CARPENTRY**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. This section specifies exterior and interior millwork.
- B. Items specified.
  - Counter Top

#### **1.2 RELATED WORK**

- A. Fabricated Metal brackets, bench supports and countertop legs: Section 05 50 00, METAL FABRICATIONS.
- B. Framing, furring and blocking: Section 06 10 00, ROUGH CARPENTRY.
- D. Color and texture of finish: See Drawings
- E. Other Countertops: Division 11, EQUIPMENT and Division 12, FURNISHINGS.
- F. Electrical light fixtures and duplex outlets: Division 26, ELECTRICAL.

#### **1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. Millwork items – Half full size scale for sections and details 1:50 (1/4-inch) for elevations and plans.
  - 2. Show construction and installation.
- B. Samples:
  - 1. Plastic laminate finished plywood or particleboard, 150 mm by 300 mm (six by twelve inches).
  - 2. Acrylic Panels –
    - a. Samples for Approval
      - i. Submit (qty. 3) 3 inch by 3 inch samples for each material type and color of solid polymer for color approval.
      - ii. Submit (qty. 3) fin samples with color on edge and color on bottom of solid polymer for color process selection, shape and fit approval.
- C. Certificates:
  - 1. Indicating preservative treatment and fire retardant treatment of materials meet the requirements specified.
  - 2. Indicating moisture content of materials meet the requirements specified.
- D. List of acceptable sealers for fire retardant and preservative treated materials.



E. Manufacturer's literature and data:

1. Finish hardware
2. Sinks with fittings
3. Electrical components

1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect lumber and millwork from dampness, maintaining moisture content specified both during and after delivery at site.
- B. Store finishing lumber and millwork in weathertight well ventilated structures or in space in existing buildings designated by Resident Engineer. Store at a minimum temperature of 21<sup>0</sup>C (70<sup>0</sup>F) for not less than 10 days before installation.
- C. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

PART 2 - PRODUCTS

2.1 LUMBER

A. Grading and Marking:

1. Lumber shall bear the grade mark, stamp, or other identifying marks indicating grades of material.
2. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
3. The inspection agency for lumber shall be approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Sizes:

1. Lumber Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which product is produced.
2. Millwork, standing and running trim, and rails: Actual size as shown or specified.

C. Hardwood: MM-L-736, species as specified for each item.

D. Softwood: PS-20, exposed to view appearance grades:

1. Use C select or D select, vertical grain for transparent finish including stain transparent finish.

2. Use Prime for painted or opaque finish.

E. Use edge grain Wood members exposed to weather.

## 2.2 PLYWOOD

### A. Softwood Plywood:

1. Prod. Std.

2. Grading and Marking:

a. Each sheet of plywood shall bear the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood.

b. The mark shall identify the plywood by species group or identification index, and shall show glue type, grade, and compliance with PS1.

3. Plywood, 13 mm (1/2 inch) and thicker; not less than five ply construction, except 32 mm (1-1/4 inch) thick plywood not less than seven ply.

4. Plastic Laminate Plywood Cores:

a. Exterior Type, and species group.

b. Veneer Grade: A-C.

5. Shelving Plywood:

a. Interior Type, any species group.

b. Veneer Grade: A-B or B-C.

6. Other: As specified for item.

### B. Hardwood Plywood:

1. HPVA: HP.1

2. Species of face veneer shall be as shown or as specified in connection with each particular item.

3. Inside of Building:

a. Use Type II (interior) A grade veneer for transparent finish.

b. Use Type II (interior) Sound Grade veneer for paint finish.

4. On Outside of Building:

a. Use Type I, (exterior) A Grade veneer for natural or stained and varnish finish.

b. Use Type I, (exterior) Sound Grade veneer for paint finish.

5. Use plain sliced rotary cut white birch unless specified otherwise.

## 2.3 PLASTIC LAMINATE

- A. Exposed decorative surfaces including countertops, both sides of cabinet doors, and for items having plastic laminate finish. General Purpose, TYPE TBD
- C. Cabinet Interiors including Shelving: Both of following options to comply with NEMA, CLS as a minimum.
  - 1. Plastic laminate clad plywood or particle board.
  - 2. Resin impregnated decorative paper thermally fused to particle board.
- D. Backing sheet on bottom of plastic laminate covered wood tops: Backer, Type HGP.
- E. Post Forming Fabrication, Decorative Surfaces: Post forming, Type HGP.

## 2.4 ADHESIVE

- A. For Plastic Laminate: Fed. Spec. A-A-1936.
- B. For Interior Millwork: Unextended urea resin, unextended melamine resin, phenol resin, or resorcinol resin.
- C. For Exterior Millwork: Unextended melamine resin, phenol resin, or resorcinol resin.

## 2.5 MOISTURE CONTENT

- A. Moisture content of lumber and millwork at time of delivery to site.
  - 1. Interior finish lumber, trim, and millwork 32 mm (1-1/4 inches) or less in nominal thickness: 12 percent on 85 percent of the pieces and 15 percent on the remainder.
  - 2. Exterior treated or untreated finish lumber and trim 100 mm (4 inches) or less in nominal thickness: 15 percent.
  - 3. Moisture content of other materials shall be in accordance with the standards under which the products are produced.

## E. MISCELLANEOUS

- 1. FASTENERS: Use hardware as specified by Architect or Designer. When installing hardware care should be taken to not over-tighten the fasteners. Rubber or nylon washers and/or grommets may be used if needed.
- 2. MAINTENANCE: Follow manufacturers' recommendations and guidelines

## 2.6 FABRICATION

- A. General:
  - 1. Except as otherwise specified, use AWI Custom Grade for architectural woodwork and interior millwork.

2. Finish woodwork shall be free from pitch pockets.
3. Except where special profiles are shown, trim shall be standard stock molding and members of the same species.
4. Plywood shall be not less than 13 mm (1/2 inch), unless otherwise shown or specified.
5. Edges of members in contact with concrete or masonry shall have a square corner caulking rebate.
6. Fabricate members less than 4 m (14 feet) in length from one piece of lumber, back channeled and molded as shown.
7. Interior trim and items of millwork to be painted may be fabricated from jointed, built-up, or laminated members, unless otherwise shown on drawings or specified.
8. Plastic Laminate Work:
  - a. Factory glued to either a plywood or a particle board core, thickness as shown or specified.
  - b. Cover exposed edges with plastic laminate, except where aluminum, stainless steel, or plastic molded edge strips are shown or specified. Use plastic molded edge strips on 19 mm (3/4-inch) molded thick or thinner core material.
  - c. Provide plastic backing sheet on underside of countertops, vanity tops, thru-wall counter and sills including back splashes and end splashes of countertops.
  - d. Use backing sheet on concealed large panel surface when decorative face does not occur.

L. Counter or Work Tops:

1. Fabrication with plastic laminate over 32 mm (1-1/4 inch) thick core unless shown otherwise.
  - a. Use decorative laminate for exposed edges of tops 38 mm (1-1/2 inches) wide and on back splash and end splash. Use plastic or metal edges for top edges less than 38 mm (1-1/2 inches) wide.
  - b. Assemble back splash and end splash to counter top.
  - c. Use one piece counters for straight runs.
  - d. Miter corners for field joints with overlapping blocking on underside of joint.
2. Fabricate wood counter for work benches as shown.

### PART 3 - EXECUTION

#### 3.1 ENVIRONMENTAL REQUIREMENTS

- A. Maintain work areas and storage areas to a minimum temperature of 21<sup>0</sup>C (70<sup>0</sup>F) for not less than 10 days before and during installation of interior millwork.
- B. Do not install finish lumber or millwork in any room or space where wet process systems such as concrete, masonry, or plaster work is not complete and dry.

#### 3.2 INSTALLATION

- A. General:
  - 1. Millwork receiving transparent finish shall be primed and back-painted on concealed surfaces. Set no millwork until primed and back-painted.
  - 2. Secure trim with fine finishing nails, screws, or glue as required.
  - 3. Set nails for putty stopping. Use washers under bolt heads where no other bearing plate occurs.
  - 4. Seal cut edges of preservative and fire retardant treated wood materials with a certified acceptable sealer.
  - 5. Coordinate with plumbing and electrical work for installation of fixtures and service connections in millwork items.
  - 6. Plumb and level items unless shown otherwise.
  - 7. Nail finish at each blocking, lookout, or other nailer and intermediate points; toggle or expansion bolt in place where nails are not suitable.
  - 8. Exterior Work: Joints shall be close fitted, metered, tongue and grooved, rebated, or lapped to exclude water and made up in thick white lead paste in oil.

THE END OF SECTION 062000

## **SECTION 07 21 13 THERMAL INSULATION**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION:**

- A. This section specifies thermal and acoustical insulation for buildings.
- B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

#### **1.2 RELATED WORK**

- A. Insulation for insulated wall panels:

#### **1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES .
- B. Manufacturer's Literature and Data:
  - 1. Insulation, each type used
  - 2. Adhesive, each type used.
  - 3. Tape
- C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed.

#### **1.4 STORAGE AND HANDLING:**

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

### **PART 2 - PRODUCTS**

#### **2.1 INSULATION – GENERAL:**

- A. Where thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified.
- B. Where "R" value is not specified for insulation, use the thickness shown on the drawings.
- C. Where more than one type of insulation is specified, the type of insulation for each use is optional, except use only one type of insulation in any particular area.
- D. Insulation Products shall comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Perlite composite board	23 percent post consumer recovered paper
Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material
Foam-in-place	5 percent recovered material
Glass fiber reinforced	6 percent recovered material
Phenolic rigid foam	5 percent recovered material
Rock wool material	75 percent recovered material

The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

2.2 MASONRY CAVITY WALL INSULATION:

- A. Mineral Fiber Board: ASTM C612, Type II, faced with a vapor retarder having a perm rating of not more than 0.5.
- B. Polyurethane or Polyisocyanurate Board: ASTM C591, Type I, faced with a vapor retarder having a perm rating of not more than 0.5.
- C. Polystyrene Board: ASTM C578, Type X.
- D. Perlite Board: ASTM C728.
- E. Cellular Glass Block: ASTM C552, Type I or IV.

2.3 PERIMETER INSULATION IN CONTACT WITH SOIL:

- A. Polystyrene Board: ASTM C578, Type IV, V, VI, VII, or IX where covered by soil or concrete.
- B. Cellular Glass Block: ASTM C552, Type I or IV.

2.4 EXTERIOR FRAMING OR FURRING INSULATION:

- A. Batt or Blanket: Optional.
- B. Mineral Fiber: ASTM C665, Type II, Class C, Category I where framing is faced with gypsum board.
- C. Mineral Fiber: ASTM C665, Type III, Class A where framing is not faced with gypsum board.

2.5 ACOUSTICAL INSULATION:

- A. Mineral Fiber boards: ASTM C553, Type II, flexible, or Type III, semirigid (4.5 pound nominal density).
- B. Mineral Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.
- C. Thickness as shown; of widths and lengths to fit tight against framing.

2.6 SOUND DEADENING BOARD:

- A. Mineral Fiber Board: ASTM C612, Type IB, 13 mm (1/2 inch thick).
- B. Perlite Board: ASTM C728, 13 mm (1/2 inch thick).

2.7 RIGID INSULATION:

- A. On the inside face of exterior walls, spandrel beams, floors, bottom of slabs, and where shown.
- B. Mineral Fiber Board: ASTM C612, Type IB or 2.
- C. Perlite Board: ASTM C728.
- D. Cellular Glass Block: ASTM C552, Type I.

2.8 MASONRY FILL INSULATION:

- A. Vermiculite Insulation: ASTM C516, Type II.
- B. Perlite Insulation: ASTM C549, Type IV.

2.9 FASTENERS:

- A. Staples or Nails: ASTM F1667, zinc-coated, size and type best suited for purpose.
- B. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 50 mm (two inches) in diameter.
- C. Impaling Pins: Steel pins with head not less than 50 mm (two inches) in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.

2.10 ADHESIVE:

- A. As recommended by the manufacturer of the insulation.
- B. Asphalt: ASTM D312, Type III or IV.
- C. Mortar: ASTM C270, Type 0.

2.11 TAPE:

- A. Pressure sensitive adhesive on one face.
- B. Perm rating of not more than 0.50.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Install insulation with the vapor barrier facing the heated side, unless specified otherwise.
- B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.



- C. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.
- D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

### 3.2 MASONRY CAVITY WALLS:

- A. Mount insulation on exterior faces of inner wythes of masonry cavity walls and brick faced concrete walls. Fill joints with same material used for bonding.
- B. Bond polystyrene board to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of insulation manufacturer.
- C. Bond mineral fiberboard, polyurethane or polyisocyanurate board, and perlite board to surfaces with adhesive as recommended by insulation manufacturer.
- D. Bond cellular glass insulation to surfaces with hot asphalt or adhesive cement.

### 3.3 PERIMETER INSULATION:

- A. Vertical insulation:
  - 1. Fill joints of insulation with same material used for bonding.
  - 2. Bond polystyrene board to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of insulation manufacturer.
  - 3. Bond cellular glass insulation to surfaces with hot asphalt or adhesive cement.
- B. Horizontal insulation under concrete floor slab:
  - 1. Lay insulation boards and blocks horizontally on level, compacted and drained fill.
  - 2. Extend insulation from foundation walls towards center of building not less than 600 mm (24 inches) or as shown.

### 3.4 EXTERIOR FRAMING OR FURRING BLANKET INSULATION:

- A. Pack insulation around door frames and windows and in building expansion joints, door soffits and other voids. Pack behind outlets around pipes, ducts, and services encased in walls. Open voids are not permitted. Hold insulation in place with pressure sensitive tape.
- B. Lap vapor retarder flanges together over face of framing for continuous surface. Seal all penetrations through the insulation.
- C. Fasten blanket insulation between metal studs or framing and exterior wall furring by continuous pressure sensitive tape along flanged edges.
- D. Fasten blanket insulation between wood studs or framing with nails or staples through flanged edges on face of stud. Space fastenings not more than 150 mm (six inches) apart.

- E. Roof Rafter Insulation or Floor Joist Insulation: Place mineral fiber blankets between framing to provide not less than a 50 mm (two inch) air space between insulation and roof sheathing or subfloor.
- F. Ceiling Insulation and Soffit Insulation:
  - 1. Fasten blanket insulation between wood framing or joist with nails or staples through flanged edges of insulation.
  - 2. At metal framing or ceilings suspension systems, install blanket insulation above suspended ceilings or metal framing at right angles to the main runners or framing. Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.
  - 3. In areas where suspended ceilings adjoin areas without suspended ceilings, install either blanket, batt, or mineral fiberboard extending from the suspended ceiling to underside of deck or slab above. Secure in place to prevent collapse or separation of hung blanket, batt, or board insulation and maintain in vertical position. Secure blanket or batt with continuous cleats to structure above.

### 3.5 RIGID INSULATION ON SURFACE OF EXTERIOR WALLS, FLOORS, AND UNDERSIDE OF FLOORS:

- A. On the interior face of solid masonry and concrete walls, beams, beam soffits, underside of floors, and to the face of studs for interior wall finish where shown.
- B. Bond to solid vertical surfaces with adhesive as recommended by insulation manufacturer. Fill joints with adhesive cement.
- C. Use impaling pins for attachment to underside of horizontal surfaces. Space fastenings as required to hold insulation in place and prevent sagging.
- D. Fasten board insulation to face of studs with screws, nails or staples. Space fastenings not more than 300 mm (12 inches) apart. Stagger fasteners at joints of boards. Install at each corner.
- E. Floor insulation:
  - 1. Bond insulation to concrete floors in attic by coating surfaces with hot steep asphalt applied at rate of not less than 11.5 Kg per m<sup>2</sup> (25 lbs/100 sq. ft.), and firmly bed insulation therein.
  - 2. When applied in more than one layer, bed succeeding layers in hot steep asphalt applied at the rate of not less than 11.5 Kg per m<sup>2</sup> per m<sup>2</sup> lbs/100 sq. ft.).
  - 3. Contractors option: Insulation may be installed with nonflammable adhesive in accordance with the manufacturer's printed instructions when a separate vapor retarder is used.

### 3.6 MASONRY FILL INSULATION:

- A. Pour fill insulation in cavity and voids of masonry units from tops of walls, or from sill where windows or other openings occur.

- B. Pour in lifts of not more than 6 m (20 feet).

3.7 ACOUSTICAL INSULATION:

- A. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.
- B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.
- C. Do not compress insulation below required thickness except where embedded items prevent required thickness.
- D. Where acoustical insulation is installed above suspended ceilings install blanket at right angles to the main runners or framing. Extend insulation over wall insulation systems not extending to structure above.
- E. Where semi-rigid insulation is used which is not full thickness of cavity, adhere to one side of cavity maintaining continuity of insulation and covering penetrations or embedments in insulation.

THE END OF SECTION 071213

## **SECTION 074623 – WOOD SIDING, SOFFITS, FASCIA**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Installation of wood siding and soffits on the composting toilet

#### **1.2 RELATED DOCUMENTS**

- A. Section 10 12 00 Composting Toilet

#### **1.3 ACTION SUBMITTALS**

- A. Samples: For each of the following materials:
  - 1. Siding for each type indicated
  - 2. Sheathing Backup

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Material Data
  - 1. For Each material indicated
- B. Qualification Data: For manufacturer and installer

#### **1.5 QUALITY ASSURANCE**

- A. Mockups: Build mockups to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build mockups on 1/4<sup>th</sup> of a long side of the composting toilet including soffit work.
  - 2. Obtain M-NCPPC Inspector's approval of mockups before siding the rest of the Structure.
  - 3. If not approved carefully remove the siding and reinstall new siding at no additional cost to the owner. Siding with holes from nailing will not be permitted for reinstallation
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
  - 5. Approval of the Mockup does not indicate acceptance of the rest of the work

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Schedule delivery of wood to avoid extended on-site storage and to avoid delaying the Work.

- B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings. Stack wood decking with surfaces that are to be exposed in the final Work protected from exposure to sunlight.

## PART 2 - MATERIALS

### 2.1 GENERAL

- A. Provide Black Locust Lumber from the following provider:
  - 1. Black Locust Lumber Inc. or approved equal  
PO Box 685 | Pittstown, NJ | 08867  
tel: 908-735-8871 | fax: 908-735-6893
- B. Certified Wood: Wood decking shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- C. Wood Species:
  - a. Black Locust :
- D. Grade: Premium Grade  
Based on the "Gree-Dex" Grade Specifications A product innovated by Black Locust Lumber Inc. or approved equal. This product comes from the "Best of the Best" Black Locust grown in the Eastern USA. Each individual piece is carefully inspected to insure premiere, quality, durability, and appearance. The most beautiful knots, 3" in diameter and less are admitted to show the real beauty of this species. Minor mineral streaks and small bark insertions are also admitted, giving you the satisfied feeling of natural characteristics. Checks less than 1/12th of the board length are also admitted.
- E. Grade Stamps: Factory mark each item with grade stamp of grading agency. Apply grade stamp to surfaces that will not be exposed to view.
- F. Surface: S4S

### 2.2 PATTERNS AND SIZES

- A. Siding
  - 1. Horizontal ship lap siding with a board covering the seam
  - 2. Size as indicated on plans
- B. Soffit
  - 1. 5/4"x6" nominal tongue and groove
- C. Fascia
  - 1. 5/4"x full depth of the SIP, Green Roof, and Fascia

2.3 Accessories:

- A. Fasteners:
  - 1. 304 stainless steel brads and finish nails as indicated on drawings
  - 2. 304 stainless steel screws 2-1/2 Trim Screws with heads painted gray to match the weathered wood, FastenMaster TrimTop or approved equal
- B. Wood Adhesive
  - 1. Type I Waterproof Glue Titebond III Ultimate or approved Equal
    - a. Color to match wood
- C. Birch Wood Biscuits
- D. Sheathing Backup
  - 1. Benjamin Obdyke HydroGap Drainable Housewrap™ with HydroFlash and HydroTape or Approved Equal

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine sheathing for compliance with installation tolerances and other conditions affecting performance of the siding soffits and fascia board.
- B. Examine material from the mill to insure that it meets the required grading. Any lumber that does not appear to meet the required grading can be rejected by the M-NCPPC Construction Manager
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Siding
  - 1. Install sheathing backup in accordance with the Manufactures specifications.
  - 2. Install sill flashings, wood starter strips, inside corner flashings, edgings and flashings over openings.
  - 3. Install siding, with edges square and horizontal, tight to edges and openings, lapping over metal flashings and trim. Shiplap edges tight and secure. Nail to sheathing to an orderly pattern at 12 inches O.C. at intermediate and 6 inches O.C. at edge locations.
  - 4. The shiplap siding may have intermediate miter with intermediate joints at 45° tight.
    - a. Lengths must be greater than 3 feet
  - 5. The board covering the seam must be continuous
  - 6. Install end corners with joints at 45° tight using biscuits and wood glue per the manufactures specification
    - a. Nail and clamp as necessary to meet the required pressure to hold the glue
    - b. Clean up any glue before it dries

B. Soffit and Fascia

1. Install with edges square and vertical, tight to edges and openings, lapping over metal flashings and trim. Tongue and groove edges tight and secure.
2. Nail to sheathing to an orderly pattern at 12 inches O.C. at intermediate and 6 inches O.C. at edge locations.
3. Screw the Fascia to sheathing to an orderly pattern at 12 inches O.C. at intermediate and 6 inches O.C. at edge locations.
4. The board must be continuous
5. Install end corners with joints at 45° tight using biscuits and wood glue per the manufactures specification
  - a. Nail and clamp as necessary to meet the required pressure to hold the glue
  - b. Clean up any glue before it dries

3.3 ADJUSTING

- A. Replace damaged Soffit, Fascia, or Siding if require as directed by the M-NCPPC Construction Manager.

END OF SECTION 074623

## **SECTION 07 60 00 FLASHING AND SHEET METAL**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

Formed sheet metal work for wall and roof flashing, copings, roof edge metal, fasciae, drainage specialties, and formed expansion joint covers are specified in this section.

#### **1.2 RELATED WORK**

- A. Flashing components of factory finished roofing and wall systems: Division 07 roofing and wall system sections.
- B. Color of factory coated exterior architectural metal and anodized aluminum items:
- C. Integral flashing components of manufactured roof specialties and accessories or equipment: Division 22, PLUMBING sections and Division 23 HVAC sections.
- D. Paint materials and application: Section 09 91 00, PAINTING.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Wind Uplift Forces: Resist the following forces per FM Approvals 1-49 and as coordinated by structural drawing diagram "Roof & Wall Zones" minimum:
  - 1. Zone 1 (Roof): 22 psf uplift
  - 2. Zone 2 (Roof perimeter): 43 psf uplift
  - 3. Zone 3 (Roof corner): 63 psf uplift
  - 4. Zone 5 (Wall edge): 37 psf suction
- B. Wind Design Standard: Fabricate and install copings, roof-edge, flashings, tested per ANSI/SPRI ES-1 to resist design pressure indicated on Drawings.

#### **1.5 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: For all specified items, including:
  - 1. Flashings
  - 2. Copings
  - 3. Fascia-cant
  - 4. Gutter, Conductors, and Downspouts
- C. Manufacturer's Literature and Data: For all specified items, including:
  - 1. Two-piece counterflashing



2. Thru wall flashing
  3. Expansion joint cover, each type
  4. Non-reinforced, elastomeric sheeting
  5. Copper clad stainless steel
  6. Polyethylene coated copper
  7. Bituminous coated copper
  8. Copper covered paper
  9. Fascia-cant
- D. Certificates: Indicating compliance with specified finishing requirements, from applicator and contractor.

## PART 2 - PRODUCTS

### 2.1 FLASHING AND SHEET METAL MATERIALS

- A. Stainless Steel: ASTM A167, Type 302B, dead soft temper.
- B. Copper ASTM B370, cold-rolled temper.
- C. Bituminous Coated Copper: Minimum copper ASTM B370, weight not less than 1 kg/m<sup>2</sup> (3 oz/sf). Bituminous coating shall weigh not less than 2 kg/m<sup>2</sup> (6 oz/sf); or, copper sheets may be bonded between two layers of coarsely woven bitumen-saturated cotton fabric ASTM D173. Exposed fabric surface shall be crimped.
- D. Copper Covered Paper: Fabricated of electro-deposit pure copper sheets ASTM B 370, bonded with special asphalt compound to both sides of creped, reinforced building paper, UU-B-790, Type I, style 5, or to a three ply sheet of asphalt impregnated creped paper. Grooves running along the width of sheet.
- E. Polyethylene Coated Copper: Copper sheet ASTM B370, weighing 1 Kg/m<sup>2</sup> (3 oz/sf) bonded between two layers of (two mil) thick polyethylene sheet.
- F. Aluminum Sheet: ASTM B209, alloy 3003-H14 except alloy used for color anodized aluminum shall be as required to produce specified color. Alloy required to produce specified color shall have the same structural properties as alloy 3003-H14.
- G. Galvanized Sheet: ASTM, A653.
- H. Non-reinforced, Elastomeric Sheeting: Elastomeric substances reduced to thermoplastic state and extruded into continuous homogenous sheet (0.056 inch) thick. Sheeting shall have not less than 7 MPa (1,000 psi) tensile strength and not more than seven percent tension-set at 50 percent elongation when tested in accordance with ASTM D412. Sheeting shall show no cracking or

flaking when bent through 180 degrees over a 1 mm (1/32 inch) diameter mandrel and then bent at same point over same size mandrel in opposite direction through 360 degrees at temperature of -30°C (-20 °F).

## 2.2 FLASHING ACCESSORIES

- A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.
- B. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m<sup>2</sup>( 6 lbs/100 sf).
- C. Bituminous Paint: ASTM D1187, Type I.
- D. Fasteners:
  - 1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.
  - 2. Nails:
    - a. Minimum diameter for copper nails: 3 mm (0.109 inch).
    - b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
    - c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
    - d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
  - 3. Rivets: Not less than 3 mm (1/8 inch) diameter.
  - 4. Expansion Shields: Fed Spec A-A-1925A.
- E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.
- F. Insect Screening: ASTM D3656, 18 by 18 regular mesh.
- G. Roof Cement: ASTM D4586.

## 2.3 SHEET METAL THICKNESS

- A. Except as otherwise shown or specified use thickness or weight of sheet metal as follows:
- B. Concealed Locations (Built into Construction):
  - 1. Copper: 30g (10 oz) minimum 0.33 mm (0.013 inch thick).
  - 2. Stainless steel: 0.25 mm (0.010 inch) thick.
  - 3. Copper clad stainless steel: 0.25 mm (0.010 inch) thick.
  - 4. Galvanized steel: 0.5 mm (0.021 inch) thick.
- C. Exposed Locations:
  - 1. Copper: 0.4 Kg (16 oz).
  - 2. Stainless steel: 0.4 mm (0.015 inch).

3. Copper clad stainless steel: 0.4 mm (0.015 inch).

D. Thickness of aluminum or galvanized steel is specified with each item.

## 2.4 FABRICATION, GENERAL

### A. Jointing:

1. In general, copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints, shall be locked and soldered.
2. Jointing of copper over 0.5 Kg (20 oz) weight or stainless steel over 0.45 mm (0.018 inch) thick shall be done by lapping, riveting and soldering.
3. Joints shall conform to following requirements:
  - a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
  - b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
  - c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
4. Flat and lap joints shall be made in direction of flow.
5. Edges of bituminous coated copper, copper covered paper, nonreinforced elastomeric sheeting and polyethylene coated copper shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
6. Soldering:
  - a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
  - b. Wire brush to produce a bright surface before soldering lead coated copper.
  - c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
  - d. Completely remove acid and flux after soldering is completed.

### B. Expansion and Contraction Joints:

1. Fabricate in accordance with the Architectural Sheet Metal Manual recommendations for expansion and contraction of sheet metal work in continuous runs.
2. Space joints as shown or as specified.
3. Space expansion and contraction joints for copper, stainless steel, and copper clad stainless steel at intervals not exceeding 7200 mm (24 feet).
4. Space expansion and contraction joints for aluminum at intervals not exceeding 5400 mm (18 feet), except do not exceed 3000 mm (10 feet) for gravel stops and fascia-cant systems.

5. Fabricate slip-type or loose locked joints and fill with sealant unless otherwise specified.
6. Fabricate joint covers of same thickness material as sheet metal served.

C. Cleats:

1. Fabricate cleats to secure flashings and sheet metal work over 300 mm (12 inches) wide and where specified.
2. Provide cleats for maximum spacing of 300 mm (12 inch) centers unless specified otherwise.
3. Form cleats of same metal and weights or thickness as the sheet metal being installed unless specified otherwise.
4. Fabricate cleats from 50 mm (2 inch) wide strip. Form end with not less than 19 mm (3/4 inch) wide loose lock to item for anchorage. Form other end of length to receive nails free of item to be anchored and end edge to be folded over and cover nail heads.

D. Edge Strips or Continuous Cleats:

1. Fabricate continuous edge strips where shown and specified to secure loose edges of the sheet metal work.
2. Except as otherwise specified, fabricate edge strips of minimum 1.25 mm (0.050 inch) thick aluminum.
3. Use material compatible with sheet metal to be secured by the edge strip.
4. Fabricate in 3000 mm (10 feet) maximum lengths with not less than 19 mm (3/4 inch) loose lock into metal secured by edge strip.
5. Fabricate Strips for fascia anchorage to extend below the supporting wood construction to form a drip and to allow the flashing to be hooked over the lower edge at least 19 mm (3/4-inch).
6. Fabricate anchor edge maximum width of 75 mm (3 inches) or of sufficient width to provide adequate bearing area to insure a rigid installation using 1.6 mm (0.0625 inch) thick aluminum.

E. Drips:

1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

F. Edges:

1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC, current edition.

G. Metal Options:

1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.
3. Where copper gravel stops, copings and flashings will carry water onto cast stone, stone, or architectural concrete, or stainless steel.

## 2.5 FINISHES

- A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.
- B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.
- C. Finish exposed metal surfaces as follows, unless specified otherwise:
  1. Copper: Mill finish.
  2. Stainless Steel: Finish No. 2B or 2D.
  3. Aluminum:
    - a. Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1 Architectural, 18 mm (0.7 mils) thick.
    - b. Colored Finish: Dark bronze to match existing. AA-C22A42 (anodized) or AA-C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1 Architectural, 18 mm (0.7 mils) thick. Dyes will not be accepted.
    - c. Fluorocarbon Finish: AAMA 620, high performance organic coating.
    - d. Mill finish.
  4. Steel and Galvanized Steel:
    - a. Finish painted under Section 09 91 00, PAINTING unless specified as prefinished item.
    - b. Manufacturer's finish:
      - 1) Baked on prime coat over a phosphate coating.
      - 2) Baked-on prime and finish coat over a phosphate coating.
      - 3) Fluorocarbon Finish: AAMA 621, high performance organic coating.

## 2.6 THROUGH-WALL FLASHINGS

- A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.
1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
  2. Fabricate so keying nests at overlaps.
- B. For Masonry Work When Concealed Except for Drip:
1. Either copper, stainless steel, or copper clad stainless steel.
  2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
  3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.
- C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:
1. Use same metal and thickness as counter flashing.
  2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
  3. Form exposed portion as snap lock receiver for counter flashing upper edge.
- D. For Flashing at Architectural Precast Concrete Panels or Stone Panels.
1. Use plan flat sheet of stainless steel.
  2. Form exposed portions with drip as specified or receiver.
- E. Window Sill Flashing and Lintel Flashing:
1. Use either copper, stainless steel, copper clad stainless steel plane flat sheet, or nonreinforced elastomeric sheeting, bituminous coated copper, copper covered paper, or polyethylene coated copper.
  2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
  3. Turn up back edge as shown.
  4. Form exposed portion with drip as specified or receiver.
- F. Door Sill Flashing:
1. Where concealed, use either 0.5 Kg (20 oz) copper, 0.5 mm (0.018 inch) thick stainless steel, or 0.5 mm (0.018 inch) thick copper clad stainless steel.
  2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use either 0.6 Kg (24 ounce) copper, 0.6 mm (0.024 inch) stainless steel, or 0.6 mm (0.024 inch) thick stainless steel.

3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

## 2.7 BASE FLASHING

- A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
  1. Use either copper, or stainless steel, thickness specified unless specified otherwise.
  2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use either 0.5 Kg (20 oz) copper or 0.5 mm (0.018 inch) stainless steel.
  3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.
  4. Use either copper, or stainless steel at pipe flashings.
- B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).
- C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.
- D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.
- E. Pipe Flashing: (Other than engine exhaust or flue stack)
  1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
  2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
  3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
    - a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
    - b. Allow for loose fit around and into the pipe.
  4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
    - a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
    - b. Allow for loose fit around pipe.

## 2.8 COUNTERFLASHING (CAP FLASHING OR HOODS)

- A. Either copper or stainless steel, unless specified otherwise.
- B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:
  1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.

2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
  3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
  4. Manufactured assemblies may be used.
  5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.
  6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.
- C. One-piece Counterflashing:
1. Back edge turned up and fabricate to lock into reglet in concrete.
  2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).
- D. Two-Piece Counterflashing:
1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
  2. Counterflashing upper edge designed to snap lock into receiver.
- E. Surface Mounted Counterflashing; one or two piece:
1. Use at existing or new surfaces where flashing can not be inserted in vertical surface.
  2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
  3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.
- F. Pipe Counterflashing:
1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
  2. Fabricate 100 mm (4 inch) over lap at end.
  3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.



4. Use stainless steel bolt on draw band tightening assembly.
  5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.
- G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.
- C. Formed (Corrugated Sheet) Sheet Metal Gravel Stops and Fascia:
1. Fabricate as shown of 0.8 mm (0.032 inch) thick aluminum.
  2. Sheets shall have 2 mm (1/16 inch) deep corrugations either transversely or diagonally rolled into the sheet. Crimped sheets are not acceptable.
  3. Factory fabricate prepackaged system, complete with fastenings.
  4. Provide concealed flashing splice plate at joints not less than 150 mm (6 inches) long and continuous edge strip at lower edge of fascia made from same metal.
  5. Fabricate as two-piece fascia when fascia depth exceeds 175 mm (7 inches).

#### 2.12 ENGINE EXHAUST PIPE OR FLUE OR STACK FLASHING

- A. Flashing at penetrations through roofing shall consist of a metal collar, sheet metal flashing sleeve and hood.
- B. Fabricate collar with roof flange of 1.2 mm (0.047 inch) minimum thick black iron or galvanized steel sheet.
1. Fabricate inside diameter of collar 100 mm (4 inches) larger than the outside diameter of the item penetration the roofing.
  2. Extend collar height from structural roof deck to not less than 350 mm (14 inches) above roof surface.
  3. Fabricate collar roof flange not less than 100 mm (4 inches) wide.
  4. Option: Collar may be of steel tubing 3 mm (0.125 inch) minimum wall thickness, with not less than four, 50 mm x 100 mm x 3 mm (2 inch by 4 inch by 0.125 inch) thick tabs bottom edge evenly spaced around tube in lieu of continuous roof flange. Full butt weld joints of collar.
- C. Fabricate sleeve base flashing with roof flange of either copper, stainless steel, or copper clad stainless steel.
1. Fabricate sleeve roof flange not less than 100 mm (4 inches) wide.
  2. Extend sleeve around collar up to top of collar.

3. Flange bottom of sleeve out not less than 13 mm (1/24 inch) and soldered to 100 mm (4 inch) wide flange to make watertight.
  4. Fabricate interior diameter 50 mm (2 inch) greater than collar.
- D. Fabricate hood counter flashing from same material and thickness as sleeve.
1. Fabricate the same as pipe counter flashing except allow not less than 100 mm (4 inch) lap below top of sleeve and to form vent space minimum of 100 mm (4 inch) wide.
  2. Hem bottom edge of hood 13 mm (1/2 inch).
  3. Provide a 50 mm (2 inch) deep drawband.
- E. Fabricate insect screen closure between sleeve and hood. Secure screen to sleeve with sheet metal screws.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. General:

1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.
7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a

- staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.
  10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
  11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
  12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
  13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
  14. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
    - a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
    - b. Paint dissimilar metal with a coat of bituminous paint.
    - c. Apply an approved caulking material between aluminum and dissimilar metal.
  15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
  16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
  17. Bitumen Stops:
    - a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
    - b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

### 3.2 THROUGH-WALL FLASHING

#### A. General:

1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches) and use thickness of metal as specified for exposed locations.

3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
  4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
  5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
  6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
  7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
  8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
  9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
  10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
  11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
  12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
  13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
  14. Continue flashing around columns:
    - a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
    - b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).
- B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed. Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.

- C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).
- D. Flashing at Cavity Wall Construction: Where flashing occurs in cavity walls turn vertical portion up against backup under waterproofing, if any, into mortar joint. Turn up over insulation, if any, and horizontally through insulation into mortar joint.
- E. Flashing at Veneer Walls:
1. Install near line of finish floors over shelf angles or where shown.
  2. Turn up against sheathing.
  3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
  4. At concrete backing, extend flashing into reglet as specified.
  5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.
- F. Lintel Flashing when not part of shelf angle flashing:
1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
  2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.
  3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.
- G. Window Sill Flashing:
1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
  2. Turn back edge up to terminate under window frame.
  3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.
- H. Door Sill Flashing:
1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.
  2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.
  3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.
- I. Flashing at Masonry, Stone, or Precast Concrete Copings:

1. Install flashing with drips on both wall faces unless shown otherwise.
2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

### 3.3 BASE FLASHING

- A. Install where roof membrane type base flashing is not used and where shown.
1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
  2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
  3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.
  4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.
- B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.
- C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

### 3.4 COUNTERFLASHING (CAP FLASHING OR HOODS)

- A. General:
1. Install counterflashing over and in conjunction with installation of base flashings, except as otherwise specified or shown.
  2. Install counterflashing to lap base flashings not less than 100 mm (4 inch).
  3. Install upper edge or top of counterflashing not less than 225 mm (9 inch) above top of the roofing.
  4. Lap joints not less than 100 mm (4 inch). Stagger joints with relation to metal base flashing joints.
  5. Use surface applied counterflashing on existing surfaces and new work where not possible to integrate into item.

6. When fastening to concrete or masonry, use screws driven in expansion shields set in concrete or masonry. Use screws to wood and sheet metal. Set fasteners in mortar joints of masonry work.
- B. One Piece Counterflashing:
1. Where flashing is installed at new masonry, coordinate to insure proper height, embed in mortar, and end lap.
  2. Where flashing is installed in reglet in concrete insert upper edge into reglet. Hold flashing in place with lead wedges spaced not more than 200 mm (8 inch) apart. Fill joint with sealant.
  3. Where flashing is surface mounted on flat surfaces.
    - a. When top edge is double folded anchor flat portion below sealant "V" joint with fasteners spaced not over 400 mm (16 inch) on center:
      - 1) Locate fasteners in masonry mortar joints.
      - 2) Use screws to sheet metal or wood.
    - b. Fill joint at top with sealant.
  4. Where flashing or hood is mounted on pipe.
    - a. Secure with draw band tight against pipe.
    - b. Set hood and secure to pipe with a one by 25 mm x 3 mm (1 x 1/8 inch) bolt on stainless steel draw band type clamp, or a stainless worm gear type clamp.
    - c. Completely fill joint at top with sealant.
- C. Two-Piece Counterflashing:
1. Where receiver is installed at new masonry coordinate to insure proper height, embed in mortar, and lap.
  2. Surface applied type receiver:
    - a. Secure to face construction in accordance, with manufacturer's instructions.
    - b. Completely fill space at the top edge of receiver with sealant.
  3. Insert counter flashing in receiver in accordance with fabricator or manufacturer's instructions and to fit tight against base flashing.
- D. Where vented edge occur install so lower edge of counterflashing is against base flashing.
- E. When counter flashing is a component of other flashing install as shown.  
to discharge water into conductor head.

### 3.5 COPINGS

- A. General:

1. On walls topped with a wood plank, install a continuous edge strip on the front and rear edge of the plank. Lock the coping to the edge strip with a 19 mm (3/4 inch) loose lock seam.
2. Where shown turn down roof side of coping and extend down over base flashing as specified for counter-flashing. Secure counter-flashing to lock strip in coping at continuous cleat.
3. Install ends adjoining existing construction so as to form space for installation of sealants. Sealant is specified in Section 07 92 00, JOINT SEALANTS.

B. Aluminum Coping:

1. Install with 6 mm (1/4 inch) joint between ends of coping sections.
2. Install joint covers, centered at each joint, and securely lock in place.

THE END OF SECTION 076000



## **SECTION 077119 MANUFACTURED ROOF EDGE**

### **PART 1 - GENERAL**

#### **1.1 GENERAL PROVISIONS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Carefully review and examine all other Contract Documents for requirements therein affecting the work of this Section. Furthermore, coordinate and sequence the work of this Section with all other trades affected.

#### **1.2 SUMMARY**

- A. Furnish and install factory fabricated and finished roof edging, and pertinent accessories.

#### **1.3 RELATED WORK**

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:
  - 1. Division 6 Section "Misc. Rough Carpentry": for misc. wood blocking, nailers, etc.
  - 2. Division 7 Section "Sheet Metal Flashing and Trim": for custom formed sheet metal flashing and trim where required for the Project.
  - 3. Division 7 Section "Joint Sealants": Sealant and backing material not specified herein.
  - 4. Division 8 Section "Fiberglass Sandwich Panel Skylight System" Roof system specified.

#### **1.4 REFERENCES**

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Division 1 Section "REFERENCES". Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. Factory Mutual Research Corporation (FMRC), PO Box 9102, Norwood, MA 02082, 617-762-4300.
  - 2. SPRI Sheet Membrane & Component Suppliers to the Commercial Roofing Industry, 175 Highland Ave., Needham, MA 02194, 617-444-0242, fax: 617-444-6111.

## 1.5 SUBMITTALS

- A. Submit the following:
1. Product Data: Provide manufacturer's product and complete installation data for all materials in this specification.
  2. Shop Drawings: Show profiles, joining method, location of accessory items, anchorage and flashing details, adjacent construction interface, and dimensions.
  3. Samples: Available on request; size to adequately represent material.
  4. Installation Guide: The product manufacturer shall provide a written installation guide.

## 1.6 QUALITY ASSURANCE:

- A. High performance roof edge system shall be CERTIFIED by the manufacturer to comply with ANSI/SPRI Standard ES-1. Roof edge shall meet performance design criteria according to the following test standards: [select, if applicable]:
1. ANSI/SPRI ES-1 Test Method RE-1 Test for Roof Edge Termination of Single-Ply Roofing Membranes: The fascia system shall be tested to secure the membrane to minimum of 100 lbs/ft in accord with the ANSI/SPRI ES-1 Test Method RE -1. Use the current edition of *ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems*.
  2. ANSI/SPRI ES-1 Test Method RE-2 Pull-Off Test for Fascia: The fascia system shall be tested in accord with the ANSI/SPRI ES-1 Test Method RE -2. Use the current edition of *ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems*.
- B. The fascia product shall be listed in current *Factory Mutual Research Corporation Approval Guide* approved for [FM-1-645].
- C. The fascia product shall be approved for use in Miami-Dade County and has been designed to comply with Florida Building Code, including the High Velocity Hurricane Zone. Miami-Dade County NOA No. 08-0604.02 Expiration Date 12/11/13.

## 1.7 PRODUCT HANDLING

- A. All material shall arrive in the manufacturer's original sealed, labeled containers.
- B. Store materials in a dry, protected, well-vented area. The contractor shall report damaged material immediately to the delivering carrier and note such damage on the carrier's freight bill of lading.
- C. Remove protective plastic surface film immediately before installation.

## 1.8 JOB CONDITIONS

- A. Verify that other trades are complete before installing the roof edging.
- B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
- C. Refer to the construction documents, shop drawings and manufacturer's installation instructions.
- D. Coordinate installation with roof membrane manufacturer's installation instructions.
- E. Observe all appropriate OSHA safety guidelines for this work.

#### 1.9 WARRANTY

- A. Provide a lifetime warranty for the roof edge system, when installed per manufacturer's instructions, covering blow-off from winds up to 170 mph. The warranty is not to exceed the life of the roof membrane on which the product was originally installed.
- B. Provide a lifetime warranty for manufacturer approved 70% Kynar colors for the painted finish covering color fade, chalk, and film integrity. The warranty is not to exceed the life of the roof membrane on which the product was originally installed.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURER:

- A. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
  - 1. Metal-Era, Inc., Waukesha, WI.
  - 2. Pac-Clad – Petersen Aluminum Corp., Elk Grove Village, IL.
  - 3. Carlisle SynTec, Carlisle, PA.
  - 4. Or equal as approved by Architect.

#### 2.2 ROOF EDGING AND SCUPPER

- A. Roof Edging: shall be equivalent to "Anchor-Tite Standard Fascia" as manufactured by Metal-Era, Inc., Waukesha, WI; or equal as approved by Architect.
  - 1. Model(s) shall be AF-40, AF-55, AF-70, AF-85, standard and/or custom sizes as indicated. The rise above the nailer for all models is 1-1/4". Fascia model number denote inches; (i.e. AF-55 has a 5-1/2" face height).
- B. Gutter: shall be of the same manufacturer with matching material and Pre-finished, engineered to be integrated into the roof edging system and Fiber glass Sandwich Panel Skylight System.
  - a. 5" x 5" of lengths indicated, .050" aluminum factory welded construction.

- b. Provide wall brackets, riveted elbows, transitions and other pertinent matching accessories.
  
- C. Rain Chain: 100% Copper Double Ring rain chain shall be a classic and simple double link design consisting of links measuring 10'-6" feet in length ( Cut as required to suit actual length). Each chain shall be 2" wide and 2" long and equipped with stainless steel hanger and attachment piece allowing for connection to aluminum scupper and collection box.
  - 1. Classic Gutter Systems, Kalamazoo, MI.
  - 2. Oregon Garden Art, Coos Bay, OR.
  - 3. Rain Chains Direct, 1-855-THE-RAIN (855-843-7246).
  - 4. Or equal as approved by Architect.

## 2.3 PERFORMANCE CHARACTERISTICS

- A. Decorative metal fascia with continuous extruded aluminum bar. To terminate adhered or mechanically attached single-ply roofing at perimeter. The system shall be watertight with no exposed fasteners.
  - 1. Extruded bar shall lock membrane, prevent wind pullback.
  - 2. Injection molded EPDM splices to allow thermal expansion of extruded aluminum anchor bar.
  - 3. Fascia shall freely thermal cycle on extruded bar, preventing periodic maintenance.
  - 4. Fascia may be factory modified for true radius application.
- B. Fascia metal gauge: .040" thick formed aluminum.
- C. Fascia: standard 12'-0" (3.65 m) lengths.
- D. Extruded bar: Shall be continuous 6063-T6 alloy aluminum at 12'-0" (3.65 m) standard lengths. All bar miters are welded.
- E. Fasteners: #9 x 2" stainless steel fasteners provided with drivers. No exposed fasteners permitted.

## 2.4 ACCESSORIES

- A. Welded base assembly shall be used to maintain watertight integrity.
- B. Provide matching miter, wall cap, extenders, or other standard and/or special shape fabrications as detailed or as required.
- C. Sealant: where required to be used within the edging system shall be exterior grade, waterproof type as recommended by roof edging manufacturer.

## 2.5 FINISH

- A. All exposed surfaces shall receive a factory applied Architectural Class I anodized finish in conformance with Aluminum Association Standard SSA-46 or AAMA 611.

### PART 3 - EXECUTION

#### 3.1 INSPECTION:

- A. Filed verify all conditions and dimensions prior to fabrication. Check as-built conditions and verify the manufacturer's coping details for accuracy to fit the wall assembly prior to fabrication.
- B. Verify that coping installation will not disrupt other trades.
- C. Verify that substrate is dry, clean, free of foreign matter and ready to receive the coping installation. Report and correct defects prior to any installation.

#### 3.2 INSTALLATION OF ROOF EDGING SYSTEM:

- A. The installer shall comply with the roof edging manufacturer's installation guide when setting edging.
- B. Installer shall use provided fasteners consistent with manufacturer's instructions, suitable for the substrate to which it is being installed.
- C. Install water cut-off, as recommended by the membrane manufacturer, under the anchor bar.

END OF SECTION 077119

## **SECTION 079200 JOINT SEALANTS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION:**

Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

#### **1.2 RELATED WORK:**

- A. Sealing of site work concrete paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.
- B. Masonry control and expansion joint: Section 04 20 00, UNIT MASONRY.
- C. Glazing: Section 08 80 00, GLAZING.
- D. Sound rated gypsum partitions/sound sealants: Section 09 29 00, GYPSUM BOARD.
- E. Mechanical Work: Section 21 05 11 COMMON WORK RESULTS FOR FIRE SUPPRESSION, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

#### **1.3 QUALITY CONTROL:**

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
  - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
  - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
  - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
  - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

- D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer's recommendations:
1. Locate test joints where indicated or, if not indicated, as directed by Contracting Officer.
  2. Conduct field tests for each application indicated below:
    - a. Each type of elastomeric sealant and joint substrate indicated.
    - b. Each type of non-elastomeric sealant and joint substrate indicated.
  3. Notify the COTR 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.
- E. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's installation instructions for each product used.
- C. Cured samples of exposed sealants for each color where required to match adjacent material.
- D. Manufacturer's Literature and Data:
  1. Caulking compound
  2. Primers
  3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.5 PROJECT CONDITIONS:

- A. Environmental Limitations:
  1. Do not proceed with installation of joint sealants under following conditions:
    - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
    - b. When joint substrates are wet.
- B. Joint-Width Conditions:
  1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions:
  1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 DELIVERY, HANDLING, AND STORAGE:

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 5° C (40° F) or less than 32° C (90° F).

1.7 DEFINITIONS:

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Back-up Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up rod.

1.8 WARRANTY:

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to two years.
- B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

1.9 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C509-06 .....Elastomeric Cellular Preformed Gasket and Sealing Material.
  - C612-04 .....Mineral Fiber Block and Board Thermal Insulation.
  - C717-07 .....Standard Terminology of Building Seals and Sealants.
  - C834-05 .....Latex Sealants.
  - C919-02. ....Use of Sealants in Acoustical Applications.
  - C920-05 .....Elastomeric Joint Sealants.
  - C1021-08 .....Laboratories Engaged in Testing of Building Sealants.
  - C1193-05 .....Standard Guide for Use of Joint Sealants.
  - C1330-02 (R2007) .....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.



D1056-07 .....Specification for Flexible Cellular Materials—Sponge or  
Expanded Rubber.

E84-08.....Surface Burning Characteristics of Building Materials.

- C. Sealant, Waterproofing and Restoration Institute (SWRI).  
The Professionals' Guide

## PART 2 - PRODUCTS

### 2.1 SEALANTS:

A. S-1:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 20-40

B. S-2:

1. ASTM C920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade P.
5. Shore A hardness of 25-40.

C. S-3:

1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-25.
6. Minimum elongation of 700 percent.

D. S-4:

1. ASTM C920 polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade NS.

- 5. Shore A hardness of 25-40.
  - E. S-5: Not used.
  - F. S-6:
    - 1. ASTM C920, silicone, neutral cure.
    - 2. Type S.
    - 3. Class: Joint movement range of plus 100 percent to minus 50 percent.
    - 4. Grade NS.
    - 5. Shore A hardness of 15-20.
    - 6. Minimum elongation of 1200 percent.
  - G. S-7: Not used.
  - H. S-8: Not used.
  - I. S-9:
    - 1. ASTM C920 silicone.
    - 2. Type S.
    - 3. Class 25.
    - 4. Grade NS.
    - 5. Shore A hardness of 25-30.
    - 6. Non-yellowing, mildew resistant.
  - J. S-10: Not used.
  - K. S-11: Not used.
  - L. S-12: Not used.
- 2.2 CAULKING COMPOUND:
- A. C-1: ASTM C834, acrylic latex.
  - B. C-2: One component acoustical caulking, non drying, non hardening, synthetic rubber.
- 2.3 COLOR:
- A. Sealants used with exposed masonry shall match color of mortar joints.
  - B. Sealants used with unpainted concrete shall match color of adjacent concrete.
  - C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.
  - D. Caulking shall be light gray or white, unless specified otherwise.
- 2.4 JOINT SEALANT BACKING:
- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
  - 1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C (minus 26° F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. 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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

#### 2.5 FILLER:

- A. Mineral fiber board: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

#### 2.6 PRIMER:

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

#### 2.7 CLEANERS-NON POUROUS SURFACES:

Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

### PART 3 - EXECUTION

#### 3.1 INSPECTION:

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

### 3.2 PREPARATIONS:

- A. Prepare joints in accordance with manufacturer's instructions and SWRI.
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
  - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
  - 2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
  - 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.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
  - 1. Apply primer prior to installation of back-up rod or bond breaker tape.
  - 2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

### 3.3 BACKING INSTALLATION:

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.
- E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

### 3.4 SEALANT DEPTHS AND GEOMETRY:

- A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.
- B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

### 3.5 INSTALLATION:

- A. General:
  - 1. Apply sealants and caulking only when ambient temperature is between 5° C and 38° C (40° and 100° F).
  - 2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
  - 3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
  - 4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
  - 5. Avoid dropping or smearing compound on adjacent surfaces.
  - 6. Fill joints solidly with compound and finish compound smooth.
  - 7. Tool joints to concave surface unless shown or specified otherwise.
  - 8. Finish paving or floor joints flush unless joint is otherwise detailed.
  - 9. Apply compounds with nozzle size to fit joint width.
  - 10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.
- B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.

- C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
  2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
  3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
  4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
  5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

### 3.6 FIELD QUALITY CONTROL:

- A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer:
1. Extent of Testing: Test completed elastomeric sealant joints as follows:
    - a. Perform 5 tests for first 300 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
- B. Inspect tested joints and report on following:
1. 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 type of product and joint substrate.
  2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
  3. Whether sealants filled joint cavities and are free from voids.
  4. Whether sealant dimensions and configurations comply with specified requirements.
- C. 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 fill, sealant configuration, and sealant dimensions.

- D. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- E. Evaluation of Field-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.

### 3.7 CLEANING:

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.
- B. After filling and finishing joints, remove masking tape.
- C. Leave adjacent surfaces in a clean and unstained condition.

### 3.8 LOCATIONS:

- A. Exterior Building Joints, Horizontal and Vertical:
  - 1. Metal to Metal: Type S-1, S-2
  - 2. Metal to Masonry or Stone: Type S-1
  - 3. Masonry to Masonry or Stone: Type S-1
  - 4. Threshold Setting Bed: Type S-1, S-3, S-4
  - 5. Masonry Expansion and Control Joints: Type S-6
- B. Metal Reglets and Flashings:
  - 1. Flashings to Wall: Type S-6
  - 2. Metal to Metal: Type S-6
- C. Sanitary Joints:
  - 1. Walls to Plumbing Fixtures: Type S-9
  - 2. Pipe Penetrations: Type S-9
- F. Interior Caulking:
  - 1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1, C-2.
  - 2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1, C-2.
  - 3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1, C-2.
  - 4. Perimeter of Gypsum Wallboard Walls: Types C-1, C-2.

5. Exposed Isolation Joints at Top of Full Height Walls: Types C-1, C-2.
6. Exposed Acoustical Joint at Sound Rated Partitions Type C-2.
7. Concealed Acoustic Sealant Type S-4, C-1, C-2.

THE END OF SECTION 079200



## SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

### PART 1 GENERAL

#### 1.1 RELATED SECTIONS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. See Section 08705 - Hardware for hardware preparation.
- C. See Section 06100 - Rough Carpentry for additional installation specifications.

#### 1.2 DESCRIPTION OF WORK

- A. Provide all labor, equipment, materials and services necessary for the complete installation of steel doors and frame systems. Work includes but is not limited to:
  - 1. Doors and Frames
  - 2. Accessories
  - 3. Finishes

#### 1.3 SUBMITTALS

- A. Shop Drawings: Indicate door and frame elevations, internal reinforcement, wall tie system, stiles, rails, and finish.
- B. Product Data: Indicate door and frame configurations, location of cut-outs for hardware reinforcement.

#### 1.4 QUALITY ASSURANCE

- A. Conform to the following:
  - 1. SDI-100 - Standard Steel Doors and Frames.
  - 2. DHI - Door Hardware Institute - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
  - 3. Fire Rated Door, Panel and Frame Construction: ASTM E152, NFPA 252 UL 10B, NFPA 80.
  - 4. Handicapped: ANSI A117.1, ADA Guidelines.

## PART 2 PRODUCTS

### 2.1 DOORS AND FRAMES

- A. Manufacturers:
  - 1. Pioneer Industries or approved equal
- B. Exterior Doors: SDI 100 Grade II, 18 gauge, galvanized, thermal insulated, flush doors. All doors shall have top and bottom fillers built in. Doors shall have seamless one-piece face and be fiberglass filled, equal to the Imperial series.
- C. Exterior Frames and Frames Embedded in Masonry: 16 gauge thick material, core thickness, galvanized, welded corners. All frames shall be made with 2" face and of the widths indicated. Frames shall be rigid type with welded corners. All welds shall be ground smooth.
  - 1. Wall Anchors: Provide metal anchors of shapes and sizes required for the adjoining type of wall construction. Fabricate jamb anchors of steel, not lighter than the gauge used from frame. Locate anchors on jambs near the top and bottom of each frame and at intermediate points not over 24" apart.
  - 2. Floor Anchors: Provide floor clips of not less than 16 gauge steel and fasten to bottom of each jamb member for anchoring frame to floor construction.
  - 3. Extension Clips: Where floor fill occurs, the bottom of frames shall terminate at the indicated finished floor levels and be supported by an adjustable extension clip angle resting on and anchored to the structural slab.
  - 4. All metal doors, door frames, and window frames shall be properly mortised, reinforced, and drilled and tapped at the factory for all hardware. Hardware and fastening locations shall be determined by templates supplied by the hardware manufacturer.
- D. Thermal Insulated Door:
  - 1. Polyurethane core with minimum R value of 11.1.
  - 2. Polystyrene core with minimum R value of 7.7.
- E. Fire Ratings: Provide labeled fire doors as indicated which have been tested in accordance with ASTM E-152 and ANSI A2.2, UL-10 and NFPA 252. See door schedule for class/hourly ratings for specific doors. Comply with rate of rise requirements for all rated doors.
- F. Stile and Rails: 16 gauge tubular steel, 1 3/4" thick. Stiles extend full height of door. Rails mechanically fastened to stiles to form neat seams on faces.

## 2.2 ACCESSORIES

- A. Silencers: Resilient rubber.
- B. Bituminous Coating: Fibered asphalt emulsion.
- C. Primer: Zinc chromate iron phosphate type.
- D. Rain Drip: Provide rain drip on head of all exterior door frames.

## 2.3 FINISH

- A. Steel Sheet: Galvanized to ASTM A525, G60, A60 for exterior application.
- B. Primer: Baked for interior applications.
- C. Coat inside of exterior profiles with bituminous coating.

## PART 3 EXECUTION

### 3.1 FABRICATION - DOORS

- A. Fabricate doors with hardware reinforcement welded in place.
- B. Attach fire rated label to each door unit.
- C. Close top and bottom edge of exterior doors with inverted steel channel closure. Seal joints watertight.
- D. Configure exterior doors with special profile to receive recessed weatherstripping.

### 3.2 FABRICATION - FRAMES

- A. Fabricate frames as welded unit. Provide the appropriate anchor for masonry and stud application.
- B. Fabricate frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.
- C. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.
- D. Prepare frame for silencers and install.
- E. Fabricate frames to suit masonry wall coursing as indicated.

### 3.3 INSTALLATION

- A. Install doors and frames in accordance with ANSI/SDI-100.
- B. Coordinate installation of doors and frames with installation of hardware specified in Section 08705.
- C. Install door louvers, plumb and level.
- D. Set frames in position, plumb, align and brace securely until permanent anchors are set. Anchor bottom of frames to floors with expansion bolts or with powder driven fasteners. Build wall anchors into walls or secure to adjoining construction as indicated or specified. Where frames require ceiling struts or other structural overhead bracing, they shall be anchored securely to ceilings or structural framing above, as indicated. Fill behind door frames in all masonry walls solid, with mortar.
- E. All frames and doors shall be installed in strict accordance with the manufacturer's printed recommendations and directions.
- F. All frames and doors shall be installed straight, plumb and true with no play, warp or rack.

### 3.4 COORDINATION WITH OTHER ACTIVITIES

- A. The installation of doors, door frames and window frames shall be carefully coordinated and/or built-in with all connected and adjacent work.

### 3.5 CLEANING

- A. Upon completion, metal surfaces of doors and door frames shall be thoroughly cleaned and touched up.

### 3.6 DELIVERY, STORAGE AND HANDLING

- A. Metal doors and frames shall be delivered, stored, handled and installed so as not to be damaged or deformed; abraded, scarred or rusty areas shall be cleaned and painted immediately upon detection. Doors and frames stored at the site before erection shall be stacked on platforms or pallets and covered with tarpaulins or other suitable covering to provide weathertight enclosure with affording proper air circulation.

### 3.7 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

END OF SECTION

## SECTION 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS

### PART 1 – GENERAL

#### 1.01 SUMMARY

A. Section Includes: Kawneer Architectural Aluminum Curtain Wall Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of curtain wall framing.

1. Types of Kawneer Aluminum Curtain Wall include:

a. 1600 Wall System<sup>®1</sup> – 2-1/2" x 6 3/4" outside glazed pressure plate format.

B. Related Sections:

1. Division 08 80 00 "Glazing"

#### 1.02 REFERENCES (Industry Standards)

#### 1.03 SYSTEM DESCRIPTION

A. Curtain Wall System Performance Requirements:

1. Wind loads: Provide Curtain Wall system to withstand dead loads and live loads cause by positive and negative wind loads acting normal to plane of wall as calculated in accordance with all applicable codes.

2. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft<sup>2</sup> (0.3 l/s · m<sup>2</sup>) at a static air pressure differential of 6.24 psf (300 Pa).

3. Water Resistance, (static): The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a static air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.

4. Water Resistance, (dynamic): The test specimen shall be tested in accordance with AAMA 501.1. There shall be no leakage at an air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.

5. Uniform Load: A static air design load of 40 psf (1915 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member at design load. At structural test load equal to 1.5

- times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
6. Seismic: When tested to AAMA 501.4, system must meet design displacement of 0.010 x the story height and ultimate displacement of 1.5 x the design displacement.
  7. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than: 0.66 (clear) or per AAMA 507 and /or NFRC 100 standards.
  8. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 66<sub>frame</sub> and 60<sub>glass</sub> (clear), or Condensation Index (I): when tested to CSA-A440-00, the Condensation Index shall not be less than 68<sub>frame</sub> and 54<sub>glass</sub> (clear).
  9. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 71<sub>frame</sub> and 71<sub>glass</sub> (HP glass).
  10. Sound Transmission Loss: When tested to ASTM E90 and ASTM E1425, the Sound Transmission Class (STC) and Outdoor/Indoor Transmission Class (OITC) shall not be less than: STC 31 or OITC 26 based upon 1" insulating glass (1/4", 1/2" AS, 1/4"), STC 37 or OITC 30 based upon 1" laminated glass (1/4" laminated, 1/2" AS, 1/4" laminated).

#### 1.04 SUBMITTALS

- A. General: Prepare, review, approve, and submit specified submittals in accordance with "Conditions of the Contract" and Submittals Sections. Product data, shop drawings, samples, and similar submittals are defined in "Conditions of the Contract."
- B. Quality Assurance/Control Submittals:
  1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics.

#### 1.05 WARRANTY

- A. Project Warranty: Refer to "Conditions of the Contract" for project warranty provisions.
- B. Manufacturer's Product Warranty: Submit, for Owner's acceptance, manufacturer's warranty for curtain wall system as follows:
  1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by Kawneer.

1.06 QUALITY ASSURANCE

A. Qualifications:

1. Installer Qualifications: Installer experienced (as determined by contractor) to perform work of this section who has specialized in the installation of work similar to that required for this project and who is acceptable to product manufacturer.
  2. Manufacturer Qualifications: Manufacturer capable of providing structural calculations, applicable independent product test reports, installation instructions, a review of the application method, customer approval and periodic field service representation during construction.
- B. Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirement.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. Packing, Shipping, Handling, and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle material and components to avoid damage. Protect curtain wall material against damage from elements, construction activities, and other hazards before, during and after curtain wall installation.

PART 2 – PRODUCTS

2.01 MANUFACTURES (Acceptable Manufacturers/Products)

A. ACCEPTABLE MANUFACTURES:

1. Address: Kawneer Company, Inc.  
555 Guthridge Court,  
Technology Park/Atlanta,  
Norcross, GA 30092  
Telephone: 770 449 5555  
Fax: 770 734 1560

2. Proprietary Product(s)/System(s): Kawneer Aluminum Curtain Wall
  - a. Series: 1600 Wall System<sup>®1</sup>
  - b. Finish/Color: (See 2.06 Finishes)
  
- B. SUBSTITUTIONS:
  1. General: Refer to Substitutions Section for procedures and submission requirements.
    - a. Pre-Contract (Bidding Period) Substitutions: Submit written requests ten (10) days prior to bid date.
    - b. Post-Contract (Construction Period) Substitutions: Submit written request in order to avoid curtain wall installation and construction delays.
  2. Substitution Documentation
    - a. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.
    - b. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for curtain wall system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum curtain wall for a period of not less than ten (10) years. (Company Name)
    - c. Test Reports: Submit test reports verifying compliance with each test requirement for curtain wall required by the project.
    - d. Product Sample and Finish: Submit product sample, representative of curtain wall for the project, with specified finish and color.
  3. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

## 2.02 MATERIALS

- A. Aluminum (Curtain Wall and Components):
  1. Material Standard: Extruded Aluminum, ASTM B 221, 6063-T6 alloy and temper.
  2. Member Wall Thickness: Each framing member shall have a wall thickness sufficient to meet the specified structural requirements.
  3. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.



## 2.03 ACCESSORIES

- A. Fasteners: Where exposed, shall be Stainless Steel.
- B. Gaskets: Glazing gaskets shall comply with ASTM C 864 and be extruded of a silicone compatible EPDM rubber that provides for silicone adhesion.
- C. Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- D. Thermal Barrier: Thermal separator shall be extruded of a silicone compatible elastomer that provides for silicone adhesion.
- E. 1600 PowerShade®: An aluminum sunshade consisting of strut anchors and strut arms and three louvers per bay with integral amorphous silicon (photovoltaic or P.V.) panels which produce nominal 45 watts of electrical generation per bay at peak performance. Optional aluminum panels are also available, if selected, in lieu of the P.V. panels. Strut anchors and strut arms shall be painted (Select from Kawneer's standard paints and colors. Custom colors are available upon request.). Louvers shall be painted or anodized (Select from Kawneer's standard paints and colors, custom colors are available upon request, or Kawneer's anodized finishes.).
- F. 1600 SunShade™: An aluminum sunshade (consisting of outriggers, louvers, and fascia which may be selected from standard configurations, modified configurations, or customized) that is anchored directly to the vertical curtain wall mullions. Outriggers shall be painted (Select from Kawneer's standard paints and colors. Custom colors are available upon request.). Louvers and fascia shall be painted or anodized (Select from Kawneer's standard paints and colors, custom colors are available upon request, or Kawneer's anodized finishes.).
- G. InLighten™ (light shelf): aluminum light shelf system consisting of anchor channels, support beams, fascia trims and Aluminum Composite Material (ACM) panels that is anchored directly to the Curtain Wall intermediate horizontal members.
  - 1. Light shelf location shall be as detailed on the architectural drawings.  
Specifier to choose light shelf end treatment as described below:
    - a. "Wall to Wall" light shelf end treatment; recommended for wall to wall applications (with open-end assembly) or
    - b. "End Caps" light shelf end treatment; recommended for punched opening applications (with closed-end assembly).  
Specifier to choose light shelf model as described below:
  - 2. Standard designs shall be "Fascia Cap" or "Continuous Panel" models.

- a. Fascia Cap model: Consists of top and bottom ACM panel surfaces with separate interior extruded aluminum fascia trim as selected from standard profiles, (custom profiles are available on request).
- b. Continuous Panel model: Consists of a single ACM panel formed to create the overall shelf profile.
3. Light shelf assembly dimensions shall be as follows:
  - a. Overall light shelf assembly nominal thickness shall be 2-1/2" (63.5)
  - b. Overall projection depth shall be as detailed on the architectural drawings, maximum depth is 30" (762).
  - c. ACM panels shall be 3mm or 4mm thick.
4. Anchor channels and fascia trims shall be painted or anodized.
  - a. Select from Kawneer standard paint colors or anodized finishes.
  - b. Custom paint colors are available on request.
5. Aluminum Composite Material (ACM) panels shall be painted.
  - a. Top panel of Fascia Cap model and Continuous Panel model shall be painted white.
  - b. Bottom panel of Fascia Cap model shall be painted as specified.
6. Panel Joint Trim for Fascia Cap model.
7. Select color for top and bottom trim: Black, Gray or White.

#### 2.04 RELATED MATERIALS

- A. Sealants: Refer to Joint Treatment (Sealants) Section.
- B. Glass: Refer to Glass and Glazing Section.

#### 2.05 FABRICATION

- A. GENERAL:
  1. Fabricate components per manufacturer's installation instructions and with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
  2. Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.
  3. Prepare components to receive anchor devices. Fabricate anchors.
  4. Arrange fasteners and attachments to conceal from view.

#### 2.06 FINISHES

A. SHOP FINISHING:

1. Kawneer Permanodic® AA-M12C22A44, AAMA 611, Architectural Class I Color Anodic Coating. Color to be determined by Architect.

2.07 SOURCE QUALITY CONTROL

- A. Source Quality: Provide aluminum curtain walls specified herein from a single source.
1. Building Enclosure System: When aluminum curtain wall are part of a building enclosure system, including entrances, entrance hardware, windows, storefront framing and related products, provide building enclosure system products from a single source manufacturer.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive curtain wall system and sill plate is level in accordance with manufacturer's acceptable tolerances.
1. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

3.02 INSTALLATION

- A. General: Install curtain wall systems plumb, level, and true to line, without warp or rack of frames with manufacturer's prescribed tolerances and installation instructions. Provide support and anchor in place.
1. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
  2. Glazing: Glass shall be outside glazed and held in place with extruded aluminum pressure plates anchored to the mullion using stainless steel fasteners spaced no greater than 9" on center.
  3. Water Drainage: Each light of glass shall be compartmentalized using joint plugs and silicone sealant to divert water to the horizontal weep locations. Weep holes shall be located in the horizontal pressure plates and covers to divert water to the exterior of the building.

- B. Related Products Installation Requirements:
  - 1. Sealants (Perimeter): Refer to Joint Treatment (Sealants) Section.
  - 2. Glass: Refer to Glass and Glazing Section.
    - a. Reference: ANSI Z97.1, CPSC 16 CFR 1201 and GANA Glazing Manual.

### 3.03 FIELD QUALITY AND CONTROL

- A. Field Tests: Architect shall select curtain wall units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.
  - 1. Testing: Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.
    - a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft<sup>2</sup>, which ever is greater.
    - b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 psf (383 Pa).
- B. Manufacturer's Field Services: Upon Owner's written request, provide periodic site visit by manufacturer's field service representative.

### 3.04 PROTECTION AND CLEANING

- A. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum curtain wall system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.
- B. Cleaning: Repair or replace damaged installed products at no cost to the owner. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 08 44 13

**SECTION 084532 – 2-3/4” INSULATED TRANSLUCENT FIBERGLASS SANDWICH PANEL SKYLIGHT SYSTEM**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes the insulated translucent sandwich panel skylight system and accessories as shown and specified. Work includes providing and installing:
  - a) Factory prefabricated structural insulated translucent sandwich panels
  - b) Aluminum installation system
  - c) Aluminum flashing attached to skylights

**1.3 SUBMITTALS**

- A. Submit manufacturer's product data. Include construction details, material descriptions, profiles and finishes of skylight components.
- B. Submit shop drawings. Include elevations and details.
- C. Submit manufacturer's color charts showing the full range of colors available for factory-finished aluminum.
- D. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below. If finishes involve normal color variations, include sample sets consisting of two or more units showing the full range of variations expected.
- E. Sandwich panels: 14" x 28" units
- F. Factory finished aluminum: 5" long sections
- G. Submit manufacturer's product data. Include construction details, material descriptions, profiles and finishes of skylight components.
- H. Submit shop drawings. Include elevations and details.
- I. Submit manufacturer's color charts showing the full range of colors available for factory-finished aluminum.

- J. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below. If finishes involve normal color variations, include sample sets consisting of two or more units showing the full range of variations expected.
- K. Sandwich panels: 14" x 28" units
- L. Factory finished aluminum: 5" long sections

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications.
- B. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of those materials being satisfactorily used on at least six projects of similar size, scope and location. At least three of the projects shall have been in successful use for ten years or longer.
- C. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural and water infiltration testing of sandwich panel systems by an accredited agency.
- D. Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with AC177 "Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems" as issued by the ICC-ES.
- E. Installer's Qualifications: Installation shall be by an experienced installer, which has been in the business of installing specified skylight systems for at least two consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. The manufacturer shall be responsible for the configuration and fabrication of the complete skylight panel system.

- B. When requested, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Standard skylight system shall have less than 0.01 cfm/ft<sup>2</sup> air leakage by ASTM E 283 at 6.24 PSF (50 mph) and no water penetration by ASTM E 331 at 15 PSF; and structural testing by ASTM E 330.
- D. Structural Loads; Provide skylight system capable of handling the following loads:

#### 1.6 DELIVERY STORAGE AND HANDLING

- A. Deliver panel system, components and materials in manufacturer's standard protective packaging.
- B. Store panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer's storage and handling instructions.

#### 1.7 WARRANTY

- A. Submit manufacturer's and installer's written warranty agreeing to repair or replace panel system work, which fails in materials or workmanship within one year of the date of delivery.
- B. Failure of materials or workmanship shall include leakage, excessive deflection, deterioration of finish on metal in excess of normal weathering and defects in accessories, insulated translucent sandwich panels and other components of the work

### PART 2 - PRODUCTS

#### A. MANUFACTURER

1. The basis for this specification is for products manufactured by Kalwall Corporation. Other manufacturers may bid this project provided they comply with all of the performance requirements of this specification and submit evidence thereof. Listing other manufacturers' names in this specification does not constitute approval of their products or relieve them of compliance with all the performance requirements contained herein.
  - a. Kalwall Corporation, Tel: (800) 258-9777 – Fax: (603) 627-7905 – Email: [info@kalwall.com](mailto:info@kalwall.com)
2. Or Approved Equal.

#### B. PANEL COMPONENTS

1. FACE SHEETS

- a. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.
- b. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.
- c. Face sheets shall not deform, deflect or drip when subjected to fire or flame.

2. INTERIOR FACE SHEETS:

- a. Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than and smoke developed no greater than 250 when tested in accordance with UL 723.
- b. Burn extent by ASTM D 635 shall be no greater than 1”.

3. EXTERIOR FACE SHEETS:

- a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after ears outdoor South Florida weathering at 5° facing south, determined by the average of at least three white samples with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.
- b. Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of t. lbs. without fracture or tear when impacted by a 3-1/4” diameter, 5 lb. free-falling ball per UL 972.

4. APPEARANCE :

- a. Exterior face sheets: Smooth,
- b. Interior face sheets: Smooth,
- c. Face sheets shall not vary more than  $\pm 10\%$  in thickness and be uniform in color.

5. GRID CORE

- a. I-beam grid core shall be of 6063-T6 or 6005-T5 alloy and temper with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16”.
- b. I-beam Thermal break: Minimum 1”, thermoset fiberglass composite.

6. LAMINATE ADHESIVE

- a. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council “Acceptance Criteria for Sandwich Panel Adhesives”.



- b. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.
- c. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:
  - i. 50% Relative Humidity at 68° F: 540 PSI
  - ii. 182° F: 100 PSI
  - iii. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI
  - iv. Accelerated Aging by ASTM D 1037 at 182° F: 250 PSI

7. PANEL CONSTRUCTION:

- A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.
- B. Thickness: 2-3/4"
  - 1. Standard panels shall deflect no more than 1.9" at 30 PSF in 10' 0" span without a supporting frame by ASTM E 72.
  - 2. Standard panels shall withstand 1200° F fire for minimum one hour without collapse or exterior flaming.
  - 3. Thermally broken panels: Minimum Condensation Resistance Factor of 80 by AAMA 1503 measured on the bond line.

8. SKYLIGHT SYSTEM:

- A. Skylight System shall meet the fall through requirements of OSHA 1910.23 as demonstrated by testing in accordance with ASTM E661, thereby not requiring supplemental screens or railings.

9. BATTENS AND PERIMETER CLOSURE SYSTEM

- A. Closure system:
  - a. Extruded aluminum 6063-T6 and 6063-T5 alloy and temper clamp-tite screw type closure system.
  - b. Curved closure system may be roll formed.
  - c. Skylight perimeter closures at curbs shall be factory sealed to panels.
  - d. Sealing tape: Manufacturer's standard, pre-applied to closure system at the factory under controlled conditions.
  - e. Fasteners: 300 series stainless steel screws for aluminum closures, excluding final fasteners to the building.

B. Finish:

- a. Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604.
- b. Color to be Mill (optional)

PART 3 - EXECUTION

1. EXAMINATION

- A. Installer shall examine substrates, supporting structure and installation conditions.
- B. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

2. PREPARATION

A. Metal Protection:

- B. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- C. Where aluminum will contact concrete, masonry or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.

3. INSTALLATION

- A. Install the skylight system in accordance with the manufacturer's installation recommendations and approved shop drawings.
- B. Anchor component parts securely in place by permanent mechanical attachment system. Accommodate thermal and mechanical movements. Set perimeter framing in a full bed of sealant compound, or with joint fillers or gaskets to provide weather-tight construction.
- C. Install joint sealants at perimeter joints and within the panel system in accordance with manufacturer's installation instructions.

4. FIELD QUALITY CONTROL

- A. Water Test: Installer to test skylights according to procedures in AAMA 501.2.
- B. Repair or replace work that does not pass testing or that is damaged by testing and retest work.

5. CLEANING

- A. Clean the skylight system inside and outside, immediately after installation.

B. Refer to manufacturer's written recommendations.

THE END OF SECTION 08 45 23

## SECTION 087100 - DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Exit Devices:
    - a. Standard and Heavy Duty Surface Vertical Rod Exit Devices.
    - b. Standard and Heavy Duty Rim Exit Devices.
- B. Related Sections:
  - 1. Section **08 11 00 - Metal Doors and Frames.**
  - 2. Section **08 44 13 - Glazed Aluminum Curtain Wall.**

#### 1.2 REFERENCES

- A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
  - 1. ANSI/BHMA A156.3 Exit Devices.
  - 2. ANSI/BHMA A156.18 Materials & Finishes.
- B. Underwriters Laboratories, Inc. (UL):
  - 1. UL 10B Fire Tests of Door Assemblies.
  - 2. UL 10C/UBC 7-2 Positive Pressure Fire Tests of Door Assemblies.
  - 3. UL 305 Panic Hardware.

#### 1.3 ACTION SUBMITTALS

- A. General: Submit listed submittals in accordance with Contract Conditions.
- B. Product Data: Submit for specified hardware items manufacturer's complete product literature, detailed installation diagrams and instructions, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Manufacturer's SPEC-DATA product sheet.
- C. Samples:
  - 1. Submit samples upon request.
  - 2. Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
  - 3. After approval, samples will be returned for incorporation into work.

- D. Templates: Submit templates detailing installation procedures, including layout, dimensions and placement of hardware.

#### 1.4 INFORMATION SUBMITTALS

- A. Quality Assurance:

- 1. Test Reports: Certified test reports issued by nationally recognized testing laboratory showing product compliance with specified performance characteristics and physical requirements.
- 2. Certificate of Compliance: Manufacturer's certification that products furnished meet specified performance characteristics and physical requirements.
- 3. Manufacturer's Instructions: Manufacturer's installation instructions; manufacturer's instruction sheets.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Closeout Submittals: Submit following:

- 1. Warranty: Warranty documents specified.
- 2. Maintenance Data: Maintenance data for installed products to include:
  - a. Methods for maintaining installed products.

#### 1.6 QUALITY ASSURANCE

- A. Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
- B. Preinstallation Meetings: Conduct preinstallation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

#### 1.7 DELIVERY, STORAGE & HANDLING

- A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. Delivery, Storage and Protection:
  - 1. Deliver, store and handle in accordance with manufacturer's written instructions.
  - 2. Deliver in original packaging with labels and identification intact.
  - 3. Ship hardware items in lots coordinated with openings, as numbered in opening schedule.
  - 4. Inspect hardware items upon delivery to ensure that specified products have been received.
  - 5. Store hardware items in secure dry location, protected from weather until ready for installation.

#### 1.8 PROJECT CONDITIONS

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

1.9 WARRANTY

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Ensure manufacturer has minimum **5** years experience in manufacturing.
- B. Manufacturer: S Parker to match the existing Brookside Entry Keys
1. **S. PARKER HARDWARE MFG CORP**  
Parker Drive, P.O. Box 9882, Englewood, NJ 07631  
NJ (201) 569-1600 | NYC (212) 925-6300 | 1-800-S-PARKER  
FAX (201) 569-1082 | 1-877-636-5712EXIT DEVICES
- C. Underlook
1. Door Size 48"
  1. S Parker C8161D26DIC Grade 1 Storeroom Leverset:
    2. Cover: **Stainless steel**.
    3. End Caps: **Stainless steel**.
    4. Chassis: **[Steel plated] [Stainless steel]**.
    5. Trim: Compatible with surface rod exit device, finished **[to match] [\_\_\_\_\_]**.
      - a. Acceptable Material: Hager Companies trim item numbers **[47CE] [47BE] [47NL] [47DT] [47RN] [47RD] [Pull x Rim Cylinder NL function]**.
  6. Door Size: **[36 inches (915 mm), field sizable to 32 inches (813 mm)] [48 inches (1220 mm), field sizable to 38 inches (965 mm)]**.
  7. Door Thickness: 1 3/4 inches (45 mm).
  8. Latches and Strikes:
    - a. Latchbolt: 1/2 inch (12.7 mm) throw, stainless steel with Dead Latch.
    - b. Strikes: **[Stainless steel with plated rollers] [Surface applied to frame with slotted holes]**.
    - c. Finish: To **[\_\_\_\_\_]**.
  9. Acceptable Material: Hager Companies Surface Vertical Rod Exit Devices Series 4700 standard duty.
- D. Surface Vertical Rod Exit Devices Heavy Duty:
1. Cover: **[Brass] [Bronze]**.
  2. End Caps: **[Brass] [Bronze]**.
  3. Chassis: **[Aluminum]**.
  4. Listing: UL/ULC to 3 hours, UL10C/UBC 7-2 Positive Pressure Rated, UL10B Neutral Pressure Rated, UL305 Certified.
  5. Fasteners: **[Wood screws] [Machine screws] [Through-bolts] [\_\_\_\_\_]**.
  6. Trim: Compatible with surface rod exit device, finished **[to match] [\_\_\_\_\_]**.

- a. Acceptable Material: Hager Companies trim item numbers [47CE] [47BE] [47NL] [47DT] [47RN] [47RD] [Pull x Rim Cylinder NL function].
7. Door Size: [36 inches (915 mm), field sizable to 32 inches (813 mm)] [48 inches (1220 mm), field sizable to 38 inches (965 mm)].
8. Door Thickness: [1 3/4 inches (45 mm)] [\_\_\_\_\_].
9. Latches and Strikes:
  - a. Latchbolt: 1/2 inch (12.7 mm) throw, stainless steel with Dead Latch.
  - b. Strikes: [Solid steel, fire rated] [Surface applied to frame with slotted holes].
  - c. Finish: [US3] [US4] [US10] [US10B] [US26] [US26D].
10. Acceptable Material: Hager Companies Surface Vertical Rod Exit Devices, Series 4500 Heavy Duty Commercial, Grade 1.

### PART 3 - EXECUTION

#### 3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and Hager Companies SPEC-DATA sheets for exit devices.
- B. Furnish door and frame manufacturers with complete instructions and templates for preparation of their work to receive exit devices.
- C. Furnish manufacturer's instructions for proper installation of each exit device component.

#### 3.2 EXAMINATION

- A. Site Verification of Conditions: Verify that substrate conditions are acceptable for product installation in accordance with manufacturer's instructions.

#### 3.3 INSTALLATION

- A. Install exit devices to standard hardware location dimensions in accordance with Hager Companies Standard Hardware Locations Chart.
- B. Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

#### 3.4 ADJUSTING

- A. Adjust exit devices for optimum, smooth operating condition.
- B. Lubricate where directed by manufacturer.

3.5 CLEANUP

- A. Clean exit devices with damp rag and approved nonabrasive cleaner, and polish exit devices in accordance with manufacturer's instructions.
- B. Remove protective material from exit devices where present.
- C. Upon completion and verification of performance of installation, remove surplus materials, rubbish, tools and equipment.

END OF SECTION



## **SECTION 08 80 00 GLAZING**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies glass, plastic, related glazing materials and accessories. Glazing products specified apply to factory or field glazed items.

#### **1.2 RELATED WORK**

A. Factory glazed by manufacturer in following units:

1. Section 08 44 13. ALUMINUM CURTAIN WALL SYSTEM

#### **1.3 LABELS**

A. Temporary labels:

1. Provide temporary label on each light of glass identifying manufacturer or brand and glass type, quality and nominal thickness.
2. Label in accordance with NFRC (National Fenestration Rating Council) label requirements.
3. Temporary labels shall remain intact until glass is approved by the M-NCPPC Construction Manager .

B. Permanent labels:

1. Locate in corner for each pane.
2. Label in accordance with ANSI Z97.1 and SGCC (Safety Glass Certification Council) label requirements.
  - a. Tempered glass.
  - b. Laminated glass or have certificate for panes without permanent label.
  - c. Organic coated glass.
3. Bullet resistance glass or plastic assemblies:
  - a. Bullet resistance glass or plastic assemblies in accordance with UL 752 requirements for power rating specified.
  - b. Identify each security glazing permanently with glazing manufacturer's name, date of manufacture, product number, and DOS Code number inconspicuously located in lower corner on protective side and visible after glazing is framed.
  - c. The "attack (threat) side" shall be identified in bold lettering on each side of glazing with removable label.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Building Enclosure Vapor Retarder and Air Barrier:
  - 1. Utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
  - 2. Maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- B. Glass Thickness:
  - 1. Select thickness of exterior glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with applicable code.
  - 2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
  - 3. Test in accordance with ASTM E 330.
  - 4. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.

#### 1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Certificates:
  - 1. Certificates stating that wire glass, meets requirements for safety glazing material as specified in ANSI Z97.1.
  - 2. Certificate on shading coefficient.
  - 3. Certificate on "R" value when value is specified.
  - 4. Certificate test reports confirming compliance's with specified bullet resistive rating.
- C. Warranty: Submit written guaranty, conforming to General Condition requirements, and to "Warranty of Construction" Article in this Section.
- D. Manufacturer's Literature and Data:
  - 1. Glass, each kind required.
  - 2. Insulating glass units.
  - 3. Glazing cushion.
  - 4. Sealing compound.
- E. Samples:
  - 1. Size: 150 mm by 150 mm (6 inches by 6 inches).
  - 2. Tinted glass.
  - 3. Reflective glass.

- F. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer's test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.
- B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.
- C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.

1.7 PROJECT CONDITIONS

Field Measurements: Field measure openings before ordering tempered glass products. Be responsible for proper fit of field measured products.

1.8 WARRANTY

- A. Warranty: Conform to terms of "Warranty of Construction", FAR clause 52.246-21, except extend warranty period for the following:
  - 1. Bullet resistive plastic material to remain visibly clear without discoloration for 10 years.
  - 2. Insulating glass units to remain sealed for 10 years.
  - 3. Laminated glass units to remain laminated for 5 years.
  - 4. Polycarbonate to remain clear and ultraviolet light stabilized for 5 years.
  - 5. Insulating plastic to not have more than 6 percent decrease in light transmission and be ultraviolet light stabilized for 10 years.

1.9 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American National Standards Institute (ANSI):
  - Z97.1-04.....Safety Glazing Material Used in Building - Safety Performance Specifications and Methods of Test.
- C. American Society for Testing and Materials (ASTM):
  - C1363-05 ..... Thermal Performance of Building Assemblies, by Means of A Hot Box Apparatus
  - C542-05 ..... Lock-Strip Gaskets.

- C716-06 .....Installing Lock-Strip Gaskets and Infill Glazing Materials.
- C794-06 .....Adhesion-in-Peel of Elastomeric Joint Sealants.
- C864-05 .....Dense Elastomeric Compression Seal Gaskets, Setting Blocks,  
and Spacers.
- C920-08 .....Elastomeric Joint Sealants.
- C964-07 .....Standard Guide for Lock-Strip Gasket Glazing.
- C1036-06 .....Flat Glass.
- C1048-04 .....Heat-Treated Flat Glass-Kind HS, Kind FT Coated and  
Uncoated Glass.
- C1172-09 .....Laminated Architectural Flat Glass.
- C1376-10 .....Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
- D635-06 .....Rate of Burning and/or Extent and Time of Burning of  
Self-Supporting Plastic in a Horizontal Position.
- D4802-02 .....Poly (Methyl Methacrylate) Acrylic Plastic Sheet.
- E84-09.....Surface Burning Characteristics of Building Materials.
- E330-02.....Structural Performance of Exterior Windows, Curtain Walls, and  
Doors by Uniform Static Air Pressure Difference.
- E2190-08.....Insulating Glass Unit
- D. Commercial Item Description (CID):
  - A-A-59502 .....Plastic Sheet, Polycarbonate
- E. Code of Federal Regulations (CFR):
  - 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; 1977, with 1984 Revision.
- F. National Fire Protection Association (NFPA):
  - 80-08 .....Fire Doors and Windows.
- G. National Fenestration Rating Council (NFRC)
- H. Safety Glazing Certification Council (SGCC)2009:
  - Certified Products Directory (Issued Semi-Annually).
- I. Underwriters Laboratories, Inc. (UL):
  - 752-06 .....Bullet-Resisting Equipment.
- J. Unified Facilities Criteria (UFC):
  - 4-010-01-2007 .....DOD Minimum Antiterrorism Standards for Buildings
- K. Glass Association of North America (GANA):
  - Glazing Manual (Latest Edition)

Sealant Manual (2008)

- L. American Society of Civil Engineers (ASCE):  
ASCE 7-10..... Wind Load Provisions

## PART 2 - PRODUCT

### 2.1 GLASS

- A. Use thickness stated unless specified otherwise in assemblies.
- B. Clear Glass:
  - 1. ASTM C1036, Type I, Class 1, Quality q3.
  - 2. Thickness, 6 mm (1/4 inch).
- C. Patterned and Wired Flat Glass:
  - 1. ASTM C1036, Type II, Class 1, Q5, Mesh m1.
  - 2. Thickness, 6 mm (1/4 inch).

### 2.2 INSULATING GLASS UNITS

- A. Provide factory fabricated, hermetically sealed glass unit consisting of two panes of glass separated by a dehydrated air space and comply with ASTM E2190.
- B. Sealed Edge Units (SEU):
  - 1. Insulating Glass Unit Makeup
    - a. Outboard Lite
      - 1. Glass type: Float
      - 2. Glass Tint: PPG Solarban 60 or equal
      - 3. Nominal Thickness: 1/4"
      - 4. Glass Strength: Tempered
      - 5. Coating Orientation: N/A
    - b. Spacer
      - 1. Nominal Thickness: 1/2"
      - 2. Gas Fill: Air
    - c. Inboard Lite
      - 1. Glass Type: Float
      - 2. Glass Tint: PPG SolarBan 60 (3) clear or equal
      - 3. Nominal Thickness: 1/4"
      - 4. Glass Strength: Tempered
      - 5. Coating Orientation: (Surface #3)

2. Performance Characteristics (Center of Glass)

- a. Visible Transmittance: 42%
  - b. Visible Reflectance: 7%
  - c. Winter U-factor (U-value): .29
  - d. Shading Coefficient (SC): .36
  - e. Solar heat Gain Coefficient (SHGC): .31
3. Glass shall be annealed, heat strengthened or tempered as required by codes, or as required to meet thermal stress and wind loads.
  4. Glass heat-treated by horizontal (roller hearth) process with inherent roller wave distortion parallel to the bottom edge of the glass as installed when specified.

2.3 GLAZING ACCESSORIES

- A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work shall have a finish that will not corrode or stain while in service.
- B. Setting Blocks: ASTM C864:
  1. Channel shape; having 6 mm (1/4 inch) internal depth.
  2. Shore a hardness of 80 to 90 Durometer.
  3. Block lengths: 50 mm (two inches) except 100 to 150 mm (four to six inches) for insulating glass.
  4. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
  5. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.
- C. Spacers: ASTM C864:
  1. Channel shape having a 6 mm (1/4 inch) internal depth.
  2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
  3. Lengths: One to 25 to 76 mm (one to three inches).
  4. Shore a hardness of 40 to 50 Durometer.
- D. Sealing Tapes:
  1. Semi-solid polymeric based material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
  2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.
- E. Glazing Sealants: ASTM C920, silicone neutral cure:
  1. Type S.

2. Class 25
  3. Grade NS.
  4. Shore A hardness of 25 to 30 Durometer.
- F. Color:
1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames shall match color of the finished aluminum and be nonstaining.
  2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted shall be black, gray, or neutral color.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions:
1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
  2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer's approved shop drawings.
- B. Advise Contractor of conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation: Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units to prevent damage to glass and glazing units by cleaning materials.

#### 3.2 PREPARATION

- A. For sealant glazing, prepare glazing surfaces in accordance with GANA-02 Sealant Manual.
- B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.
- C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.
- D. Verify that components used are compatible.
- E. Clean and dry glazing surfaces.
- F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

### 3.3 INSTALLATION - GENERAL

- A. Install in accordance with GANA-01 Glazing Manual and GANA-02 Sealant Manual unless specified otherwise.
- B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.
- C. Set glazing without bending, twisting, or forcing of units.
- D. Do not allow glass to rest on or contact any framing member.
- E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.
- F. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.
- G. Insulating Glass Units:
  - 1. Glaze in compliance with glass manufacturer's written instructions.
  - 2. When glazing gaskets are used, they shall be of sufficient size and depth to cover glass seal or metal channel frame completely.
  - 3. Do not use putty or glazing compounds.
  - 4. Do not grind, nip, cut, or otherwise alter edges and corners of fused glass units after shipping from factory.
  - 5. Install with tape or gunnable sealant in wood sash.
- H. Fire Resistant Glass:
  - 1. Wire glass: Glaze in accordance with NFPA 80.
  - 2. Other fire resistant glass: Glaze in accordance with UL design requirements.

### 3.4 INSTALLATION - WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

- A. Cut glazing tape to length and set against permanent stops, 5 mm (3/16 inch) below sight line. Seal corners by butting tape and dabbing with butyl sealant.
- B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- C. Place setting blocks at 1/3 points with edge block no more than 150 mm (6 inches) from corners.
- D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to achieve full contact at perimeter of pane or glass unit.
- E. Install removable stops, with spacer strips inserted between glazing and applied stops, 6 mm (1/4 inch) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.



- F. Fill gap between glazing and stop with silicone type sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line.
- G. Apply cap bead of silicone type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

### 3.5 INSTALLATION - WET METHOD (SEALANT AND SEALANT)

- A. Place setting blocks at 1/3 points and install glazing pane or unit.
- B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- C. Fill gaps between glazing and stops with silicone type sealant to depth of bite on glazing, but not more than 9 mm (3/8 inch) below sight line to ensure full contact with glazing and continue the air and vapor seal.
- D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

### 3.6 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)

- A. Cut glazing tape to length and install against permanent stops, projecting 1.6 mm (1/16 inch) above sight line.
- B. Place setting blocks at 1/3 points with edge block no more than 150 mm (6 inches) from corners.
- C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
- D. Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.
- E. Fill gaps between pane and applied stop with silicone type sealant to depth equal to bite on glazing, to uniform and level line.
- F. Trim protruding tape edge.

### 3.7 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND)

- A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 600 mm (24 inch) centers, kept 6 mm (1/4 inch) below sight line.
- B. Locate and secure glazing pane using glazers' clips.
- C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

### 3.8 REPLACEMENT AND CLEANING

- A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by the COTR.

- B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.
- C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

### 3.9 PROTECTION

Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

### 3.10 GLAZING SCHEDULE

#### A. Fire Resistant Glass:

- 1. Install clear wire glass in interior fire rated or labeled doors and windows.
- 2. Install clear wire glass in exterior windows and doors indicated to receive wire glass.

#### B. Tempered Glass:

- 1. Install in full and half glazed doors unless indicated otherwise.
- 2. Install in storefront, windows, and door sidelights adjacent to doors.
- 3. Use clear tempered glass on interior side lights and doors, and on exterior doors and sidelights unless otherwise indicated or specified.
- 4. Use SEU tinted tempered and clear tempered glass on storefront and sidelights. PPG Solar Ban 60 series or equal.

#### C. Clear Glass:

- 1. Interior observation windows not specified otherwise.
- 2. Interior pane of dual glazed windows not receiving tempered, laminated or organic coated glass, or other special glass indicated or specified.

#### D. Tinted Glass: Exterior pane of dual glazed windows not receiving tinted tempered glass.

#### E. Insulating Glass:

- 1. Install SEU tinted tempered and clear tempered glass in storefronts, adjacent to entrances or walks.

THE END OF SECTION 088000

## **SECTION 088113 - DECORATIVE GLASS GLAZING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section includes the following decorative glass:
  - 1. Patterned.
  - 2. Glass with decorative film sandwiched within laminated glass.
- B. Related Sections:
  - 1. Section 088000 "Glazing" for standard glass products.

#### **1.3 DEFINITION**

- A. Glass Thickness: Indicated by thickness designations in millimeters according to ASTM C 1036.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. General Performance: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Design glass installed adjacent to walking surfaces, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
  - 1. Differential deflection of adjacent unsupported edges shall not exceed glass thickness when subjected to 50 lbf/ft. applied horizontally to one panel at any point up to 42 inches above the adjacent walking surface.
  - 2. Base design on thickness at thinnest part of the glass.

## 1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
  2. Submit no fewer than eight Samples of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
  3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.
  5. Testing will not be required if data based on previous testing of current sealant products and glazing materials match those submitted.

## 1.6 ACTION SUBMITTALS

- A. Product Data: For each decorative-glass and glazing product indicated.
- B. LEED Submittals:
1. Product Data for Credit IEQ 4.1: For glazing sealants used inside the weatherproofing system, documentation including printed statement of VOC content.
  2. Laboratory Test Reports for Credit IEQ 4: For glazing sealants used inside the weatherproofing system, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Shop Drawings: For decorative glass. Show fabrication and installation details. Include the following:
1. Size and location of penetrations.
  2. Glazing method.
  3. Mounting method.
  4. Attachments to other work.
  5. Full-size details of edge-finished profiles.
- D. Glass Samples: For the following products, 12 inches square:
1. Each type of decorative glass.
  2. Each edge treatment on type of decorative glass.
  3. Each decorative film overlay on type of decorative glass.
  4. Each applied coating on type of decorative glass.
- E. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths.
- F. Product Schedule: For decorative glass. ( See Architectural Drawings ).

- G. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer, fabricator, and sealant testing agency.
- B. Product Certificates: For each type of decorative glass, from manufacturer.
- C. Preconstruction Adhesion and Compatibility Test Reports: Based on evaluation and comprehensive tests performed by a qualified testing agency.
- D. Warranty: Sample of special warranty.

#### 1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of decorative glass and each decorative film overlay and each applied coating to include in maintenance manuals.

#### 1.9 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under NGA's Certified Glass Installer Program.
- B. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- C. Source Limitations for Glass: Obtain each type of decorative glass from single source from single manufacturer.
- D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer, for each product and installation method.
- E. Glazing Publications: Comply with published recommendations in GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual" unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
- F. Safety Glazing: Where safety glazing is indicated, comply with testing requirements in 16 CFR 1201 for Category II materials.
  - 1. Labeling: Permanently mark glazing with certification label of manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard that glass complies with.
- G. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. Preinstallation Conference: Conduct conference at Project site.

#### 1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect decorative glass and glazing materials according to manufacturer's written instructions and as needed to prevent damage to surfaces and edges.
- B. Retain packaging and sequencing numbers for decorative-glass units.

#### 1.11 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install decorative glass until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of openings and construction contiguous with decorative glass by field measurements before fabrication.

#### 1.12 WARRANTY

- A. Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
  1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Warranty on Back Painted Decorative Glass: Manufacturer's standard form in which back painted glass manufacturer agrees to replace back painted glass units that deteriorate within specified warranty period. Deterioration of back painted glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning contrary to manufacturer's written instructions.
  1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with requirements indicated. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with requirements indicated. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- C. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
  - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- D. Back painted decorative glass: ASTM C 1036, Type I, Quality-Q3, Class I (ultraclear float).
  - 1. Fabrication Process: By curtain head production line to assure uniform paint coverage using an adhesion promoter to ensure paint adhesion to the glass. Back painted decorative glass must have a secondary protective grey backing paint to protect colored paint surface.

### 2.2 DECORATIVE GLASS TYPES

- A. Decorative Glass - Patterned glass; fully tempered, Type II, Form 3; Quality-Q 6, Finish (patterned both sides).
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provided by one of the following:
    - a. Bendheim Corporation.
    - b. Guardian Industries Corp
    - c. Pilkington North America.
    - d. PPG Industries, Inc..
    - e. SCHOTT Corporation.
    - f. Or approved Equal and by Architect.
  - 2. Glass Thickness: 1/2"
  - 3. Pattern: To be selected by Architect.
  - 4. Type: Ultraclear float.
- B. Decorative Glass - Glass with decorative film sandwiched within laminated glass. Use translucent, dimensionally stable, cast PVC film, 2-mil- (0.05-mm-) minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.

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. Avery Dennison, Graphics; Etchmark A5861-S.
  - b. FDC Graphic Films, Inc.; Intermediate Frosted Crystal Vinyl Film Series 3804, to be selected by Architect.
  - c. FDC Graphic Films, Inc.; Premium Frosted Etched Glass Vinyl Film Series 3500.
  - d. 3M; Scotchcal Dusted Crystal.
  - e. 3M; Scotchcal Frosted Crystal, To be selected by M-NCPPC Construction Manager and Architect.
  - f. Or approved Equal and by M-NCPPC Construction Manager.
2. Glass Type: Clear fully tempered, float glass.
3. Glass Thickness: ½"
4. Comply with requirements for safety glazing.
5. Use: Suitable for exterior and interior applications.
6. Outdoor Durability: Not less than five years.
7. Patterns: As selected by M-NCPPC Construction Manager and Architect from manufacturer's full range

## 2.3 SEALANTS

- A. Glazing Gaskets, Sealants, Tapes, and Miscellaneous Glazing Materials: As specified in Section 088000 "Glazing."
  1. Elastomeric Glazing Sealants: ASTM C 920, and per manufactures recommendations
    - a. Color: As selected by M-NCPPC Construction Manager and Architect from manufacturer's full range.
- B. Joint Sealants: As specified in Section 079200 "Joint Sealants."

## 2.4 HARDWARE FOR GLASS INSTALLATION

- A. Hardware: Per manufacturer's recommendations.
  1. Products: Subject to compliance with requirements,
  2. Dimensions: see architectural drawings.
  3. Material and Finish: As selected by M-NCPPC Construction Manager and Architect.
- B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- C. Gaskets and Wedges: Manufacturer's standard, compatible with decorative glass type indicated.



- D. Anchors and Inserts: Provide devices as required for hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide stainless-steel anchors and inserts for applications on inside face of exterior walls and where indicated.

## 2.5 DECORATIVE-GLASS FABRICATION

- A. Fabricate decorative glass and provide other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written recommendations of product manufacturer and with referenced glazing standard.
- B. Edge Finishing: Fabricate finished edges to produce smooth, polished edges without chips, scratches, or warps.
  - 1. Finished Edge: Flat polishes edges as indicated on drawings.
  - 2. Edge-Finished Glass Adhesive: Clear, non-yellowing, as recommended by manufacturer.
- C. Lite Treatment: as indicated on Drawings with smooth, uniform edge.
- D. Decorative Film Overlay: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, the back face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.
- E. Pattern: Manufacturer's custom design. Pattern to match architect's approved sample.
- F. Color. Manufacturer's custom color to match architect's approved sample.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine decorative-glass framing members, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Minimum required face or edge clearances.
  - 3. Effective sealing between joints of decorative-glass framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

- B. Examine glazing units to locate orientation of outer surfaces per indicated on Drawings. Label or mark units as needed so that surface orientation is readily identifiable. Do not use materials that leave visible marks in the completed Work.

### 3.3 INSTALLATION

- A. Set decorative-glass units in each series true in line with uniform orientation, pattern, draw, bow, and similar characteristics.
- B. Set glass lites with proper orientation so that each outer surface faces the direction per indicated on Drawings.
- C. Set decorative glass in locations indicated on Drawings. Install glass with hardware and accessories according to hardware manufacturer's written instructions. Attach hardware securely to mounting surfaces.
- D. Set decorative glass in locations indicated on Drawings.

### 3.4 GLAZING, GENERAL

- A. Decorative Glass: Install glazing as specified in Section 088000 "Glazing."
- B. Comply with combined written instructions of manufacturers of gaskets, glass, sealants, tapes, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- C. Adjust glazing channel dimensions during installation as required by Project conditions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- D. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- E. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- F. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- G. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- H. Provide spacers for glass lites where length plus width is more than 50 inches.
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and

glazing tapes are used that have demonstrated ability to maintain required face clearances, and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

- I. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

### 3.5 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels and between glass-to-glass joints to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants smooth.

### 3.6 CLEANING AND PROTECTION

- A. Protect decorative glass from damage immediately after installation by attaching crossed streamers to framing and held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088113

## **SECTION 09 22 16 NON-STRUCTURAL METAL FRAMING**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies steel studs wall systems, shaft wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board, plaster bases or other building boards.

#### **1.2 RELATED WORK**

##### **A. METAL FABRICATIONS – SECTION 05000**

#### **1.3 TERMINOLOGY**

- A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.
- C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Studs, runners and accessories.
  - 2. Hanger inserts.
  - 3. Channels (Rolled steel).
  - 4. Furring channels.
  - 5. Screws, clips and other fasteners.
- C. Shop Drawings:
  - 1. Typical ceiling suspension system.
  - 2. Typical metal stud and furring construction system including details around openings and corner details.
  - 3. Typical shaft wall assembly

4. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.

D. Test Results: Fire rating test designation, each fire rating required for each assembly.

#### 1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C754.

#### 1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society For Testing And Materials (ASTM)
  - A123-09 .....Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products
  - A653/A653M-09.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
  - A641-09 .....Zinc-Coated (Galvanized) Carbon Steel Wire
  - C11-10 .....Terminology Relating to Gypsum and Related Building Materials and Systems
  - C635-07 .....Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings
  - C636-06 .....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
  - C645-09 .....Non-Structural Steel Framing Members
  - C754-09 .....Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
  - C841-03(R2008) .....Installation of Interior Lathing and Furring
  - C954-07 .....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
  - C1002-07 .....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  - E580-09.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

## PART 2 - PRODUCTS

### 2.1 PROTECTIVE COATING

Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G-60 minimum, per ASTM 123.

### 2.2 STEEL STUDS AND RUNNERS (TRACK)

- A. ASTM C645, modified for thickness specified and sizes as shown.
  - 1. Use ASTM A525 steel, 0.8 mm (0.0329-inch) thick bare metal (33 mil).
  - 2. Runners same thickness as studs.
- B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
- C. Doubled studs for openings and studs for supporting concrete backer-board.
- D. Studs 3600 mm (12 feet) or less in length shall be in one piece.

### 2.3 FURRING CHANNELS

- A. Rigid furring channels (hat shape): ASTM C645.
- B. Resilient furring channels:
  - 1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
  - 2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.
- C. "Z" Furring Channels:
  - 1. Not less than 0.45 mm (0.0179-inch)-thick bare metal, with 32 mm (1-1/4 inch) and 19 mm (3/4-inch) flanges.
  - 2. Web furring depth to suit thickness of insulation with slotted perforations.
- D. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

### 2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

- A. ASTM C754, except as otherwise specified.
- B. For fire rated construction: Type and size same as used in fire rating test.
- C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.

- D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.
- E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.
- F. Tie Wire and Hanger Wire:
  - 1. ASTM A641, soft temper, Class 1 coating.
  - 2. Gage (diameter) as specified in ASTM C754 or ASTM C841.
- G. Attachments for Wall Furring:
  - 1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
  - 2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.
- H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

## 2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD

- A. Conform to ASTM C635, heavy duty, with not less than 35 mm (1-3/8 inch) wide knurled capped flange face designed for screw attachment of gypsum board.
- B. Wall track channel with 35 mm (1-3/8 inch) wide flange.

## PART 3 - EXECUTION

### 3.1 INSTALLATION CRITERIA

- A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.
- B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

### 3.2 INSTALLING STUDS

- A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.
- B. Space studs not more than 610 mm (24 inches) on center.
- C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.

- D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.
  - E. Extend studs to underside of structure overhead for fire, rated partitions, smoke partitions, shafts, and sound rated partitions and insulated exterior wall furring.
  - F. At existing plaster ceilings and where shown, studs may terminate at ceiling as shown.
  - G. Openings:
    - 1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
    - 2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
    - 3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.
  - H. Fastening Studs:
    - 1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
    - 2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.
  - I. Chase Wall Partitions:
    - 1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
    - 2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).
  - J. Form building seismic or expansion joints with double studs back to back spaced 75 mm (three inches) apart plus the width of the seismic or expansion joint.
  - K. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.
- 3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY
- A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.
  - B. Wall furring-Stud System:
    - 1. Framed with 63 mm (2-1/2 inch) or narrower studs, 600 mm (24 inches) on center.
    - 2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.
    - 3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.



- C. Direct attachment to masonry or concrete; rigid channels or "Z" channels:
1. Install rigid (hat section) furring channels at 600 mm (24 inches) on center, horizontally or vertically.
  2. Install "Z" furring channels vertically spaced not more than 600 mm (24 inches) on center.
  3. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
  4. Ends of spliced furring channels shall be nested not less than 200 mm (8 inches).
  5. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide two fasteners in each flange.
  6. Locate furring channels at interior and exterior corners in accordance with wall finish material manufacturers printed erection instructions. Locate "Z" channels within 100 mm (4 inches) of corner.
- D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

### 3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES

- A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.
- B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

### 3.5 TOLERANCES

- A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.
- B. Plumb and align vertical members within 3 mm (1/8-inch.)
- C. Level or align ceilings within 3 mm (1/8-inch.)

END OF SECTION 092216

## **SECTION 09 29 00 GYPSUM BOARD**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies installation and finishing of gypsum board.

#### **1.2 RELATED WORK**

- A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- B. Sound deadening board: Section 07 21 13, THERMAL INSULATION.
- C. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.

#### **1.3 TERMINOLOGY**

- A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.
- B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.
- C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Cornerbead and edge trim.
  - 2. Finishing materials.
  - 3. Laminating adhesive.
  - 4. Gypsum board, each type.
- C. Shop Drawings:
  - 1. Typical gypsum board installation, showing corner details, edge trim details and the like.
  - 2. Typical sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
  - 3. Typical shaft wall assembly.

4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.

D. Samples:

1. Cornerbead.
2. Edge trim.
3. Control joints.

E. Test Results:

1. Fire rating test, each fire rating required for each assembly.
2. Sound rating test.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing And Materials (ASTM):

- C11-08 ..... Terminology Relating to Gypsum and Related Building  
Materials and Systems
- C475-02 ..... Joint Compound and Joint Tape for Finishing Gypsum Board
- C840-08 ..... Application and Finishing of Gypsum Board
- C919-08 ..... Sealants in Acoustical Applications
- C954-07 ..... Steel Drill Screws for the Application of Gypsum Board or  
Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to  
0.112 in. (2.84mm) in thickness
- C1002-07 ..... Steel Self-Piercing Tapping Screws for the Application of  
Gypsum Panel Products or Metal Plaster Bases to Wood Studs  
or Steel Studs
- C1047-05 ..... Accessories for Gypsum Wallboard and Gypsum Veneer Base
- C1177-06 ..... Glass Mat Gypsum Substrate for Use as Sheathing
- C1658-06 ..... Glass Mat Gypsum Panels
- C1396-06 ..... Gypsum Board
- E84-08..... Surface Burning Characteristics of Building Materials

- C. Underwriters Laboratories Inc. (UL):  
Latest Edition.....Fire Resistance Directory
- D. Inchcape Testing Services (ITS):  
Latest Editions .....Certification Listings

## PART 2 - PRODUCTS

### 2.1 GYPSUM BOARD

- A. Gypsum Board: ASTM C1396, NON- FIRE RATED, 16 mm (5/8 inch) thick unless shown otherwise. Shall contain a minimum of 20 percent recycled gypsum.
- B. Gypsum cores shall contain maximum percentage of post industrial recycled gypsum content available in the area (a minimum of 95 percent post industrial recycled gypsum content). Paper facings shall contain 100 percent post-consumer recycled paper content.

### 2.2 GYPSUM SHEATHING BOARD

- A. ASTM C1396, water-resistant core, 16 mm (5/8 inch) thick.
- B. ASTM C1177,

### 2.3 ACCESSORIES

- A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.
- B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

### 2.4 FASTENERS

- A. ASTM C1002 and ASTM C840, except as otherwise specified.
- B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).
- C. Select screws of size and type recommended by the manufacturer of the material being fastened.
- E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

### 2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE

ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

## PART 3 - EXECUTION

### 3.1 GYPSUM BOARD HEIGHTS

- A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:
  - 1. Two sides of partitions:
    - d. Full height partitions shown (FHP).
  - 2. One side of partitions or furring:
    - a. Inside of exterior wall furring or stud construction.
    - b. Room side of room without suspended ceilings.
    - c. Furring for pipes and duct shafts, except where fire rated shaft wall construction is shown.
  - 3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.
- B. In locations other than those specified, extend gypsum board from floor to heights as follows:
  - 1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.
  - 2. At ceiling of suspended gypsum board ceilings.
  - 3. At existing ceilings.

### 3.2 INSTALLING GYPSUM BOARD

- A. Coordinate installation of gypsum board with other trades and related work.
- B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.
- C. Moisture and Mold-Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.
- D. Use gypsum boards in maximum practical lengths to minimize number of end joints.
- E. Bring gypsum board into contact, but do not force into place.
- F.
- G. Walls (Except Shaft Walls):
  - 1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
  - 2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
  - 3. Stagger screws on abutting edges or ends.

4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.
  5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
  6. For three-ply gypsum board assemblies, apply plies in same manner as for two-ply assemblies, except that heads of fasteners need only be driven flush with surface for first and second plies. Apply third ply of wallboard in same manner as second ply of two-ply assembly, except use fasteners of sufficient length enough to have the same penetration into framing members as required for two-ply assemblies.
  7. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
  8. Installing Two Layer Assembly Over Sound Deadening Board:
    - a. Apply face layer of wallboard vertically with joints staggered from joints in sound deadening board over framing members.
    - b. Fasten face layer with screw, of sufficient length to secure to framing, spaced 300 mm (12 inches) on center around perimeter, and 400 mm (16 inches) on center in the field.
  9. Control Joints ASTM C840 and as follows:
    - a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
    - b. Not required for wall lengths less than 9000 mm (30 feet).
    - c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.
- H. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
  2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
  3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.

I. Electrical and Telecommunications Boxes:

1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.

J. Accessories:

1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
2. Install in one piece, without the limits of the longest commercially available lengths.
3. Corner Beads:
  - a. Install at all vertical and horizontal external corners and where shown.
  - b. Use screws only. Do not use crimping tool.
4. Edge Trim (casings Beads):
  - a. At both sides of expansion and control joints unless shown otherwise.
  - b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
  - c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
  - d. Where shown.

3.3 INSTALLING GYPSUM SHEATHING

- A. Install in accordance with ASTM C840, except as otherwise specified or shown.
- B. Use screws of sufficient length to secure sheathing to framing.
- C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.
- D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.
- E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.

3.5 FINISHING OF GYPSUM BOARD

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for all finished areas open to public view.
- B. Before proceeding with installation of finishing materials, assure the following:
  1. Gypsum board is fastened and held close to framing or furring.

2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.
- C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non decorated fire rated and sound rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the fire rated and sound rated construction/ Sanding is not required of non decorated surfaces.

### 3.6 REPAIRS

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.
- B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.
- C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.
- D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction.

END OF SECTION 092900



## **SECTION 09 91 00 - PAINTING**

### **PART 1 - GENERAL**

#### **1.1 SECTION REQUIREMENTS**

- A. Summary: Paint exposed surfaces, new and existing, unless otherwise indicated.
  - 1. Paint the back side of access panels.
  - 2. Do not paint prefinished items, items with an integral finish, operating parts, and labels unless otherwise indicated.
- B. Submittals:
  - 1. Product Data. Include printout of "MPI Approved Products List" with product highlighted. Use same designations indicated on drawings and in schedules.
  - 2. Samples.
- C. MPI Standards:
  - 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
  - 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
- D. Extra Materials: Deliver to Owner 1 gal. (3.8 L) of each color and type of finish coat paint used on Project, from the same product run, in containers, properly labeled and sealed.

### **PART 2 - PRODUCTS**

#### **2.1 PAINT**

- A. Products: Subject to compliance with requirements, provide products by one of the following:
  - 1. Benjamin Moore & Co.
  - 2. Glidden.
  - 3. PPG Architectural Finishes, Inc.
  - 4. Pratt & Lambert.
  - 5. Sherwin-Williams Company.
- B. Material Compatibility: Provide materials that are compatible with one another and with substrates.
  - 1. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

- C. Colors: As scheduled.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Remove hardware, lighting fixtures, and similar items that are not to be painted. Mask items that cannot be removed. Reinstall items in each area after painting is complete.
- B. Clean and prepare surfaces in an area before beginning painting in that area. Schedule painting so cleaning operations will not damage newly painted surfaces.

#### 3.2 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
  - 1. Use brushes only for exterior painting and where the use of other applicators is not practical.
  - 2. Use rollers for finish coat on interior walls and ceilings.
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
  - 1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply stains and transparent finishes to produce surface films without color irregularity, cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other imperfections. Use multiple coats to produce a smooth surface film of even luster.

#### 3.3 INTERIOR PAINT APPLICATION SCHEDULE

- A. Galvanized Metal:
  - 1. Semigloss High Performance Architectural Latex: Two coats over waterborne galvanized-metal primer: MPI INT 5.3N.
- B. Dressed Lumber: Including architectural woodwork.
  - 1. Satin Polyurethane: Two coats over stain: MPI INT 6.3E.
- C. Gypsum Board:
  - 1. Satin Latex: Two coats over primer/sealer: MPI INT 9.2A.

3.4 PAINT COLOR SCHEDULE

- A. Color schedule refers to basis of design color. Provide paints from one of the specified manufacturers that match the colors referenced in this schedule.

END OF SECTION 09 91 00

## **SECTION 101200 –PREFABRICATED COMPOSTING TOILET**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

**A. Section Includes:**

1. This specification covers the construction permitting and installation of the Clivus Multrum M54 Trailhead Foam Flushing Composting toilet and structure or approved equal
2. Composting toilet will be delivered to the site without siding, soffit, fascia, or green roof. These will be applied to the structure at the site
3. Walls will be poured to hold back the soil around the fiberglass tank. These will be completed by the general contractor
4. Coordinate all elements of the structure and design with the different disciplines

#### **1.2 RELATED SECTIONS**

- A. Section 32 95 00 – Vegetated Roof Assemblies**
- B. Section 07 46 23 – Wood Siding, Soffits, Fascia**

#### **1.3 DESIGN CRITERIA**

**A. Design criteria include provisions of the 2012 IBC Code.**

1. Roof Snow Load: 30 pounds per square foot snow load.
2. Green Roof Load: 50 pounds per square foot
3. Floor Load: 100 pounds per square foot floor load.
4. Wind Load: 105 mile per hour

**B. Submittals**

1. Construction Documents for the structure and composting toilet signed and sealed by a professional Architect or Engineer Licensed to practice in the state of Maryland
2. Drawings are to be submitted for approval by the M-NCPPC Construction Manager

### **PART 2 - MATERIALS**

- 2.1** The composter base is designed to be placed below grade and to support a handicapped accessible building structure without the need for a separate foundation or footings. The composter is comprised of separate chambers for the composting of solid material and the storage of compost liquid. The compost liquid storage chamber has a capacity

equivalent to approximately 7500 uses. The compost system is designed so that all maintenance access points are on top of the compost system.

- A. The composter base is manufactured of rotationally molded polyethylene and conforms to the following specifications:
1. Length: 118" Width: 65.5" Height: 48"
  2. Capacity for daily use at average temp.  $\geq 65^{\circ}$  F. 60 visits
  3. Annual use at average temp  $\geq 65^{\circ}$  F. 22,000 visits
  4. Constructed of high density linear polyethylene
    - a. Density (ASTM 4883) 0.942 TG/CM<sup>3</sup>
    - b. Tensile strength at yield (ASTM D638) 2700 PSI
    - c. Dart Impact @  $-40^{\circ}$  C, 250 mils: 175 ft-lbs.
    - d. Evnt. stress crack resistance (ASTM D1693) > 400 hrs.
    - e. Solids storage capacity: 604 gallons
    - f. Liquid storage capacity: 300 gallons

## 2.2 Walls and Roof:

- A. Expanded Polystyrene (EPS) panel core:
1. Expanded Poly Styrene (EPS) core, thickness to support the required dead and live loads, complies with Type 1 requirements of ASTM C 578
- B. Exterior Wall Panel Facing:
1. 7/16" OSB plywood
- C. Interior Wall Panel Facing:
1. .060 smooth FRP
  2. Interior color: white
- D. Exterior Wall Surface:
1. Unfinished
- E. Roof Surface:
1. Green Roof, see section 32 95 00 – Vegetated Roof Assemblies
- F. Finish exterior siding soffits and fascia, see section 07 46 23 – Wood Siding, Soffits, Fascia

## 2.3 Floor Panel:

- A. Expanded Poly Styrene (EPS) panel core
1. 5/16" Expanded polystyrene core with characteristics as above
- B. Top Face:
1. Top face is 1/2" plywood with .08" vulcanized rubber non-slip coating
- C. Bottom Face:
1. Bottom surface is 1/2" plywood with .060 embossed aluminum skin

- D. Maintenance Hatch:
    - 1. Hatch construction same as floor but with aluminum diamond plate top surface for wear. Size: length 30"; width 67"
  
  - E. Steel Doors
    - 1. Doors will be flush panel type 1-3/4" thick, minimum 16 gauge prime coated steel panels with minimum 12 gauge internal bracing channels with polystyrene core. Door size to be 3068 single door.
    - 2. Door frames will be knockdown or welded type, single rabbet, minimum 16-gauge prime coated steel, width to suit wall thickness. Three (3) rubber door silencers will be provided on latch side of frame.
    - 3. Door Hinges
      - a. Door hinges will be 3 per door with dull chrome plating 4-1/2"x 4 1/2" adjustable tension, automatic-closing for each door.
    - 4. Color: Powder Coated Gray to match the weathered color of the wood. Final selection from the Manufacturers full range of colors as selected by the M-NCPPC Construction Manager
  
  - F. Lockset
    - 1. Lockset will meet ANSI A156.2 Series 4000, Grade 1 cylindrical lockset for exterior door.
    - 2. Lever handle both inside and out.
    - 3. Deadbolt will be a Schlage standard model with a single cylinder, 2 3/4" backset, and 626 finish. The cylinder will be a standard B661P Schlage.
- 2.4 VII. Ventilation Tube:
- A. Length: 10' Diameter: 4"
  - B. Color: black
  - C. Constructed from Schedule 40 ABS plastic
- 2.5 VIII. Fan:
- A. 100 CFM
  - B. Nominal voltage 12vDC
  - C. Power input 17w
  - D. Ball bearing motor
  - E. Life expectancy at 40° C 77,500 hrs.

2.6 Solar Components:

A. Solar Panel:

1. Large enough to support the fan and lighting

B. Battery:

1. Maintenance-free, valve regulated, sealed lead acid battery, designed for deep cycle photovoltaic applications

C. Charger:

1. Negative-ground switching shunt regulator housed in an anodized aluminum chassis and encapsulated in a hard epoxy resin
2. 1 - 16 amp charging
3. 100% solid state
4. Blocking diode
5. Charger mounted in a NEMA box

2.7 Finishings:

A. Handicapped toilet:

1. Seat 18" above floor
2. Toilet stool is constructed of impervious reinforced fiberglass with an industrial grade gel-coat
3. Seat and lid are molded from ABS plastic
4. Liner is rotationally molded from polypropylene
5. Connecting chute is 14" dia. and 10" high, polyethylene as above

B. Grab Bars:

1. 1 1/4" stainless steel with white vinyl powder coat
2. length: 42" each (2); 18" (1)
3. ADA approved

C. Toilet Paper Dispenser:

1. Made of stainless steel
2. Two roll capacity
3. Supplied with security lock

D. Windows

1. Window frames shall be cast in and constructed of steel. Window glazing will be 1/4" thick clear Lexan polycarbonate.

2.8 FINISHING AND FABRICATION

- A. Shop fabricate the structure and composting toilet components finishing the inside and outside of the structure so that all components are plumb, true and in full working order.

- B. Seal Coat: After fabricating and surfacing each unit, apply a saturation coat of penetrating sealer on surfaces of each unit except for treated wood where the treatment included a water repellent.

## 2.9 INSTALLATION

- A. Scope of Work
  - 1. Work specified under this Section includes excavation, backfill and placement of composting toilet.
- B. Excavation
  - 1. The hole dug to accommodate the fill for the base must be large enough to be workable and allow the floor of the building to fit on the fill for the base when placed.
- C. Compacting
  - 1. The bottom of the area must be compacted after it has been dug out. After the base has been placed, it must be compacted as well. The bearing of the soil and base should be a minimum of 1,500 pounds per square foot.
- D. Base
  - 1. After compacting the bottom of the area, a minimum of 6" of a compacted, CR-# 57 stone with a 2" level of #8 leveling stone compacted to 95 percent proctor.

## PART 3 - WARRANTY

Provide a 1 year full warranty on all products and work

END OF SECTION 133424



## SECTION 12 36 61.19 – QUARTZ COUNTERTOPS

### PART 1 – GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Quartz countertops.
2. Setting materials and accessories.

##### B. Related Sections:

1. Division 01: Administrative, procedural, and temporary work requirements.
2. Section 06 10 00 – Rough Carpentry
3. Section 07 92 00 – Joint sealers.

#### 1.2 REFERENCES

##### A. American National Standards Institute (ANSI):

1. A108.5 – Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
2. A118.4 – Latex-Portland Cement Mortar.

##### B. ASTM International (ASTM):

1. C97 – Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
2. C99 – Standard Test Method for Modulus of Rupture of Dimension Stone.
3. C170 – Standard Test Method for Compressive Strength of Dimension Stone.
4. C241 – Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic.
5. C482 – Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement.
6. C484 – Standard Test Method for Thermal Shock Resistance of Glazed Ceramic Tile.
7. C531 – Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
8. C648 – Standard Test Method for Breaking Strength of Ceramic Tile.
9. C650 – Standard Test Method for Resistance of Ceramic Tile to Chemical Substances.
10. C672/C672M – Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
11. C880 – Standard Test Method for Flexural Strength of Dimension Stone.
12. C1026 – Standard Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling.
13. C1028 – Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
14. E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

#### 1.3 SUBMITTALS

A. Shop Drawings: Include countertop layout, dimensions, materials, finishes, cutouts, and attachments.

##### B. Samples:

1. 3" x 3" inch quartz samples showing available colors.
2. Joint sealer samples showing available colors.

#### 1.4 QUALITY ASSURANCE

A. Fabricator and Installer Qualifications: Minimum 2 years documented experience in work of this Section.

B. Mockup:

1. Construct countertop mockup, 6 feet wide, full depth or size that may remain as part of the work.
2. Approved mockup may remain as part of the Work.

#### 1.5 WARRANTY

A. Provide manufacturer's 10 year warranty against defects in materials and workmanship.

### PART 2 – PRODUCTS

#### 2.1 MANUFACTURERS

A. DuPont

B. Or Approved Equal

#### 2.2 MATERIALS

A. Quartz Sheet:

1. Product: Silestone.
2. Composition: Quartz aggregate, resin, and color pigments formed into flat slabs.
3. Anti-microbial protection: Microban by Microban International, Inc., integral to sheet.
4. Color: To be selected from manufacturer's full color range.
5. Thickness: ½" Solid Surface Counter.
5. Edge: Add a continuous Skirt to hide sub-structure ( ¾" thick ). Edge profile to be selected by Architect.
6. Physical characteristics:
  - a. Static coefficient of friction: 1.02 dry, 0.51 wet, tested to ASTM C1028.
  - b. Water absorption: Maximum 0.03 percent, tested to ASTM C97.
  - c. Compressive strength: Minimum 29,000 psi, tested to ASTM C170.
  - d. Bond strength: Minimum 210 psi, tested to ASTM C482.
  - e. Modulus of rupture: Minimum 6300 psi, tested to ASTM C99.
  - f. Flexural strength: Minimum 5800 psi, tested to ASTM C880.
  - g. Breaking strength: Minimum 480 lbf, tested to ASTM C648.
  - h. Stain resistance: Not affected by 10 percent hydrochloric acid or 10 percent KOH, tested to ASTM C650.
  - i. Thermal shock resistance: Pass 5 cycles, tested to ASTM C484.
  - j. Abrasive index: 65-Ha = 25, tested to ASTM C241.
  - k. Thermal expansion:  $1.670 \times 10^{-5}$  in/in/deg F, tested to ASTM C531.
  - l. Deicing resistance: Rating of 0, tested to ASTM C672/C672M.
  - m. Freeze/thaw resistance: 0 tiles at 15 cycles, tested to ASTM C1026.
  - n. Flame spread rating: Class 1, tested to ASTM E84.

#### 2.3 ACCESSORIES

A. Adhesive: Type recommended by quartz manufacturer.

B. Joint Sealer:

1. Type: Recommended by Quartz manufacturer.
2. Color: To be selected from manufacturer's full color range.

2.4 FABRICATION

- A. Cut quartz panels accurately to required shapes and dimensions.
- B. Radius exposed edges.
- C. Fabricate with hairline joints.

PART 3 – EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive countertops; remove loose and foreign matter than could interfere with adhesion.

3.2 INSTALLATION

- A. Install countertops in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Adhere countertops to supports with continuous beads of adhesive.

\*\*\*\* OR \*\*\*\*

- C. Adhesive type to be recommended by Quartz manufacturer.
- D. Set plumb and level. Align adjacent pieces in same plane.
- E. Install with hairline joints.
- F. Fill joints between countertops and adjacent construction with joint sealer; finish smooth and flush.

3.3 INSTALLATION TOLERANCES

- A. Maximum variation from level and plumb: 1/8 inch in 10 feet, noncumulative.
- B. Maximum variation in plane between adjacent pieces at joint: Plus or minus 1/16 inch.

3.4 CLEANING

- A. Clean countertops in accordance with manufacturer's instructions.

3.5 PROTECTION

- A. Protect installed countertops with nonstaining sheet coverings.

End of Section 12 36 61.19

## **SECTION 125083 – CUSTOM WOOD BENCHES & WHEEL STOP**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Work of this Section consists
  - 1. Custom benches made from black locust lumber:
  - 2. Custom Wheel Stop

#### **1.2 RELATED SECTIONS**

- A. Section 055000 Metal Fabrications

#### **1.3 REFERENCES**

- A. Architectural Woodwork Standards, latest edition, published jointly by the Architectural Woodwork Institute, the Architectural Woodwork Manufacturer Association of Canada, and the Woodwork Institute.
- B. American Architectural Manufacturers Association (AAMA) Specifications for Paint and Architectural Powder Coat
- C. American National Standards Institute ANSI/HPVA Type I water resistance specification

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of wood, metal brackets, and fasteners.
- B. Samples for each type of product listed
- C. Shop Drawings: Submit, sketches, plans, elevations, and details indicating materials, dimensions, joinery, finishes, hardware, cutouts and if provided, holes, power, cabling, wiring, and built-in appliances and equipment.
- D. Closeout Submittals: Operation and Maintenance Data, Bonds, Executed Warranty Documentation, and Record Documents.
- E. Evaluation Reports: For the following, from ICC-ES:
  - 1. Adhesives.
  - 2. Expansion anchors.

1.5 QUALITY ASSURANCE

- A. Qualifications: Minimum 5 (5) years experience for Fabricator/Woodworker
- B. Examples: 3 (3) examples of similar products including location of installation & client contact information

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

- A. Provide Black Locust Lumber for the benches from the following provider:  
Black Locust Lumber Inc. or approved equal  
PO Box 685 | Pittstown, NJ | 08867  
tel: 908-735-8871 | fax: 908-735-6893
- B. Certified Wood: Wood decking shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

2.2 SOLID-SAWN WOOD

- A. Wood Species:
  - 1. Black Locust :
- B. Wood for Benches: Premium Grade
  - 1. Based on the "Gree-Dex" Grade Specifications A product innovated by Black Locust Lumber Inc. or approved equal. This product comes from the "Best of the Best" Black Locust grown in the Eastern USA. Each individual piece is carefully inspected to insure premiere, quality, durability, and appearance. The most beautiful knots, 3" in diameter and less are admitted to show the real beauty of this species. Minor mineral streaks and small bark insertions are also admitted, giving you the satisfied feeling of natural characteristics. Checks less than 1/12th of the board length are also admitted. Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated.
  - 2. Surfaced smooth on four sides with eased edges; kiln dried, free of knots, solid stock of species indicated.
- C. Wood for Wheel Stop
  - 1. #1 Grade: Timber carefully inspected to insure quality and durability. All sound knots are admitted in this grade. All other characteristics that do not affect the duration of this product are also admitted. Small grub holes are admitted.

## 2.3 METAL ANCHORING BRACKETS

- A. Provide metal brackets in accordance with Section 055000 Metal Fabrications
- B. Metal Finishes
  - 1. Powder coated in accordance with AAMA 2605.
  - 2. Color: Black.

## 2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. Wood attachments:
    - a. Provide Type 304 stainless steel bolts washers and thread-all for all
  - 2. Anchor bolts:
    - a. HILTI HIT-Z anchor bolt or approved equal
  - 3. Wheel stop attachment to concrete:
    - a. Provide Type 304 stainless steel rod as indicated in the construction detail

## 2.5 WOOD ADHESIVES

- A. ANSI Type I “Waterproof” wood glue
  - 1. Match color to the weathered appearance of the benches

## PART 3 - EXECUTION

### 3.1 ASSEMBLY

- A. Assembly / Fabrication:
  - 1. Shop assemble each unit of furniture to dimensions, profiles, and details indicated by approved Shop Drawings.
  - 2. Bend or Cut wood to create a smooth arcs for benches with a radius
  - 3. Sand all sides and ease all edges a minimum of 1/16” unless otherwise noted
  - 4. Fit each component together to allow for wood expansion and contraction movement.
  - 5. Locate hardware accurately using templates or roughing-in diagrams to produce accurately sized and shaped letting of integral hardware.
- B. Metal Fabrication
  - 1. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.
  - 2. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At

exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

3. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
4. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.
5. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

### 3.2 EXAMINATION

- A. Examine areas to receive benches.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

### 3.3 INSTALLATION

- A. Install all work in conformance with the “*Architectural Woodwork Standards*,” latest edition.
- B. Install benches and wheel stop in accordance with the drawings and manufacturer’s instructions at locations indicated on the Drawings.
- C. Install benches and wheel stops level.
- D. Anchor benches securely in place.

### 3.4 ADJUSTING

- A. Finish Damage: Repair minor damages to finish in accordance with manufacturer’s instructions and as approved by M-NCPPC Construction Manager.
- B. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by M-NCPPC Construction Manager.

### 3.5 CLEANING

- A. Clean benches promptly after installation in accordance with manufacturer’s instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.



3.6 PROTECTION

- A. Protect installed benches to ensure that, except for normal weathering, benches will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 125083

## SECTION 129300 - SITE FURNISHINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes Bicycle Racks, Drinking Fountains, Contemporary Wood Bollards, Depressible Bollards

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.
- C. Shop Drawings: For each type of product
- D. Fastening technique and bolts

#### 1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

### PART 2 - PRODUCTS

#### 2.1 BICYCLE RACKS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings by the following or approved equal:
  - 1. Technique Architectural Products  
815 Penn Avenue  
Pittsburgh, PA 15221  
Tel. 412.241.1644  
Fax. 412.241.1645  
[info@techniqueap.com](mailto:info@techniqueap.com)  
(or approved equal)
- B. INSTALLATION
  - 1. Install bollard base plum and level during the concrete pour as shown on the construction documents.
  - 2. Protect bases from concrete splatters during the pour
  - 3. Any bollard bases that are installed incorrectly will require the entire replacement of the concrete up to the closest control joint at no additional cost to the Owner.
    - a. Saw cutting and replacing concrete around the bollard is not permitted

4. Complete field assembly of site furnishings where required.
5. Bolts:
  - a. Tamper resistant
  - b. Stainless steel Button head that is bolted through the decking and blocking with a locking washer and locking bolt (see detail)
  - c. Color:
    - 1) As selected by the M-NCPPC Construction Manager from the manufactures full line of colors

2.2 CONTEMPORARY WOODEN BOLLARD Details 2,3,4 - Drawing LD9.1

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or approved equal by one of the following:
  1. Columbia Cascade Company.
  2. Landscape Forms.
  3. Victor Stanley, Inc.
  4. or approved equal
- B. Steel and Iron: Free of surface blemishes and complying with the following:
  1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
  2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53/A 53M, or electric-resistance-welded pipe complying with ASTM A 135/A 135M.
  3. Tubing: Cold-formed steel tubing complying with ASTM A 500/A 500M.
  4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513, or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500/A 500M; zinc coated internally and externally.
  5. Sheet: Commercial steel sheet complying with ASTM A 1011/A 1011M.
  6. Perforated Metal: As shown in drawings
  7. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F 1267.
- C. Wood: Surfaced smooth on four sides with eased edges solid stock of species indicated.
  1. Wood Species:
    - a. Black Locust : Premium Grade  
Based on the "Gree-Dex" Grade Specifications A product innovated by Black Locust Lumber Inc. or approved equal. This product comes from the "Best of the Best" Black Locust grown in the Eastern USA. Each individual piece is carefully inspected to insure premiere, quality, durability, and appearance. The most beautiful knots, 3" in diameter and less are admitted to show the real beauty of this species. Minor mineral streaks and small bark insertions are also admitted, giving you the satisfied feeling of natural characteristics. Checks less than 1/12th of the board length are also admitted.
- D. FABRICATION
  1. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

2. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.
3. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
4. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.
5. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

E. STEEL FINISHES

1. Steel parts shall be coated with a tough, opaque, UV resistant exterior grade polyester powder coating applied to a minimum thickness of 6 mils. *Liquid, epoxy or lead-containing powder coatings are not acceptable.*
2. Preparation of the mild steel substrate shall incorporate the phosphate system. Substrate preparation shall consist first of mechanical cleaning to remove heavy mill scale, rust, varnish, grease, etc., with surfaces uniformly abraded to promote quality of finish coating. Chemical cleaning in accordance with TT-C-490C, Methods I and III shall remove impurities from the surfaces.
3. After the two-step cleaning process, the metal substrate shall receive a corrosion-inhibiting iron phosphate pre-coating in accordance with TT-C-490C, Type II, prior to the application of the powder color coat. The color coating shall be applied by the electrostatic method and then oven-cured at 400 degrees Fahrenheit to chemically bond the coating to the substrate and to render the coated metal resistant to abrasion, impact, chipping, weathering, and rusting.
4. Color:
  - a. Selection by the M-NCPPC Construction Manager from the full range of Manufacturer's standard colors

F. INSTALLATION

1. Install bollard base plum and level during the concrete pour as shown on the construction documents.
2. Protect bases from concrete splatters during the pour
3. Any bollard bases that are installed incorrectly will require the entire replacement of the concrete up to the closest control joint at no additional cost to the Owner.
  - a. Saw cutting and replacing concrete around the bollard is not permitted
4. Complete field assembly of site furnishings where required.
5. Bolts:
  - a. Tamper resistant
  - b. Button head
  - c. Color:
    - 1) Powder Coated to match final color of the bollards

2.3 DRINKING FOUNTAIN:

- A. PRODUCTS: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Most Dependable Fountains, Inc., Pedestal Bottle Filler (Model 10135 SMSS).
- B. SPECIFICATIONS:
1. Frost resistant
  2. ADA Accessible
  3. Standard Pedestal: Stainless steel.
    - a. Grade: 304 schedule 10
  4. Receptor Bowl: Stainless steel.
    - a. Gauge: 18GA, electro-polished.
  5. Bubbler Head: Stainless steel, anti-squirt head.
  6. Push Bar: Stainless steel.
    - a. Grade: 304 with circumference exceeding 8.6".
  7. Finish: Oven baked powder coat.
    - a. Color:
      - 1) Selection by the M-NCPPC Construction Manager from the full range of Manufacturer's standard colors
- C. INSTALLATION:
1. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
  2. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
  3. Install site furnishings level, plumb, true, and securely anchored at locations indicated on
  4. All bolts Drawings.
  5. Surface mount; anchor atop existing surface with anchor bolts through mounting plate that is welded to the fountain.
  6. Bolts:
    - a. Tamper resistant
    - b. Button head
    - c. Color to match final color of the fountain

2.4 RETRACTABLE BOLLARDS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or approved equal by one of the following:
- Reliance Foundry Co. Ltd., phone 604-592-4333 or 888-735-5680, fax 604-590-8875, website [www.reliance-foundry.com](http://www.reliance-foundry.com), email [info@reliance-foundry.com](mailto:info@reliance-foundry.com).
- B. Retractable Bollard:
1. Model: Reliance Foundry; R-8422
  2. Size: 36 inches high x 4.5 inches diameter base.
  3. Design: Fixed cylinder with flat top.
  4. Material:

- a. Stainless Steel: ASTM A312, Grade TP 304.
5. Color Coating:
  - a. Type: Polyester powder coat over epoxy primer.
  - b. Color: Bengal Stainless.
6. Installation:
  - a. Retractable, New Concrete:
  - b. Receiver: Included with bollard.
  - c. Footing: 3000 psi minimum concrete or mortar. Concrete.
  - d. Fill: # 57Aggregate.

C. EXECUTION

1. Examination
  - a. Examine paving or other substrates for compliance with manufacturer's requirements for placement and location of embedded items, condition of substrate, and other conditions affecting installation of bollards.
  - b. Proceed with installation only after unsatisfactory conditions have been corrected.
2. Installation
  - a. General: Comply with manufacturer's installation instructions and setting drawings.
  - b. Damaged, cracked, chipped, deformed or marred bollards are not acceptable. Field touch-up minor imperfections in accordance with manufacturer's instructions.
3. Cleaning and protection
  - a. Protect bollards against damage.
  - b. Immediately prior to Substantial Completion, clean bollards in accordance with manufacturer's instructions to remove dust, dirt, adhesives, and other foreign materials.
  - c. Touch up damaged finishes according to manufacturer's instructions.
4. Closeout activities
  - a. Provide executed warranty and maintenance information.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Install site furnishings level, plumb, true, and securely anchored at locations indicated.

END OF SECTION 129300

## **SECTION 131200 - FOUNTAINS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Provide and install fountain equipment mechanical and electrical package in accordance with the Contract Documents. Furnish all labor, materials, apparatus, tools, equipment, transportation, temporary construction, and special or occasional services as required to make a complete working fountain installation, as shown on the drawings, shop drawings, and described in these specifications. The work of this Section shall include, but not be limited to the following:
  - 1. Fountain Display System including pumps, valves, piping and specialties (nozzles, pool fittings, etc.) as hereinafter described, listed and shown on the drawings.
  - 2. Fountain Electrical Control System including control panel, water level controller, time switches, relays, grounding system, and other circuits and accessories as required, U.L. 508 Listed.
  - 3. Filtration and Water Treatment System, media, accessories, and controls.
  - 4. All special tools for proper operation and maintenance of equipment provided under this section.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 04 43 00 - stone masonry for surrounding stone work
- B. Section 057500.10 - Decorative Metal Basins for fountain basins
- C. Section 33 16 20 - Rainwater Harvesting for Cistern
- D. Section 32 84 00 - Planting Irrigation for water makeup

#### **1.3 QUALITY ASSURANCE**

- A. At a minimum, any subcontractors for the water feature and fabrication of copper and stainless steel basins must provide written evidence (through references) of ten (10) years prior experience as detailed in the specifications. Selected Contractor must also provide five (5) examples of relevant projects located in the DC Metro Area over the past 2 years with photographs of the above projects.
- B. All workmanship and materials shall conform and comply with the requirements of building ordinances, codes, rules and regulations of all departments of Federal, State county and city having lawful jurisdiction over the work in this section.
- C. When these specifications and/or drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above mentioned rules and regulations, the provisions of these specifications and/or drawings shall take precedence over the requirements of said rules and regulations.

- D. The contractor shall furnish, without extra charge, any additional material and/or labor required for compliance with these rules and regulations although not mentioned in these specifications or indicated on the drawings.
- E. All materials shall be new and shall conform to applicable standards in every case where such standards have been established for the particular material in question.
- F. All work shall be executed by workmen skilled in craft to which they are assigned.
- G. Adequate supervision shall be provided to maintain high quality workmanship.

#### 1.4 SUBMITTALS

- A. Approval is required for submittals by the M-NCPPC Construction Manager. Submit the following in accordance with SUBMITTAL PROCEDURES.
- B. Shop drawings shall be provided for the fountain, which include plans, elevations, sections, details and connections/attachment to other work.
- C. Product Data shall include descriptive literature, detailed specifications, performance data, electrical diagrams, and warranty information. They shall be submitted for the following items.
  - 1. Granite
  - 2. Pumps
  - 3. Tanks
  - 4. Fountain Equipment
  - 5. Fountain Display System
  - 6. Fountain Electrical Control System
  - 7. Fountain Submersible Lighting System
  - 8. Filtration and Water Treatment System

#### 1.5 SUBSTITUTES

- A. Any proposal for substitution of materials or equipment shall be submitted 10 calendar days prior to the final bid date; otherwise, no substitutions shall be permitted. Submittal for equivalent or comparable items shall, where applicable, including the following data which are not necessarily required for specified items:
  - 1. Performance Characteristics and hydraulic and electrical load data.
  - 2. Materials of construction, fabrication, and manufacture.
  - 3. Certification of Conformance with specific codes, standards and specifications.
- B. Submittal of substituted equipment may be rejected if the component alters the design in a manner that affects other trades or if it impairs accessibility or critical clearances.
- C. No substitutions shall be made unless authorized in writing by the Contracting Officer or Designated Representative. Should a substitution be accepted, and should the substitute material prove to be defective or otherwise unsatisfactory for the service intended within the guarantee period, the Contractor shall replace this material or equipment with material or equipment specified, at its own expense, and to the satisfaction of the Contracting Officer or Designated Representative.



- D. Contractors submitting bids proposing to use substitute materials and equipment must also submit a bid on the “as specified” materials and equipment.
- E. Contractors submitting bids on proposed substitute materials and equipment must also provide written performance guarantee certifying that the substitute materials and equipment will produce the specified water effects.
- F. Proposed substitutions in the list of equipment included in this section may be made by the Equipment Supplier only if the equipment is of better quality and more effective than that listed, improves the design and performance or delivery times, and only if the changes are thoroughly documented and approved in writing by the Contracting Officer or Designated Representative prior to procurement.

#### 1.6 PERFORMANCE GUARANTEE

- A. The Equipment Supplier shall guarantee the fountain to perform to the designed water heights and spray patterns, provided that installation of the equipment is in strict accordance with supplier’s recommendations, instructions, details, and approved drawings.
- B. The Equipment Supplier shall accept complete Fountain System Design responsibility for the hydraulic and electrical system, provided that all equipment required for the fountain installation is procured from the specified equipment Manufacturer as itemized in its proposals and materials list on the final, approved installation drawings.
- C. The Contractor shall be responsible for installation of all equipment required for the fountain installation in accordance with fountain supplier’s drawings and instructions.

#### 1.7 WARRANTY

- A. All materials and component parts, excluding lamps, supplied by the Manufacturer, shall be guaranteed to be free from defects of materials and/or workmanship for a period of one year from date of substantial completion or 18 months from shipment, whichever comes first. Provide sample warranty form from Equipment and Material supplier.
- B. Contractor shall warrant all material found defective within (1) year of final acceptance and shall be removed and replaced with new material at no cost to the owner including labor to remove and re-install any defective materials.
- C. The warranty shall not extend to damage incurred through incorrect or improper operation and maintenance by the owner. The owner shall assume full responsibility for proper operation and maintenance upon final acceptance of installation form Contractor.
- D. In case of Manufacturer’s guarantees being limited, or expiring within the specified guarantee period, the contractor shall be responsible for purchasing and providing service contracts and additional warranty coverage to extend through the warranty period as may be required by the owner.

1.8 PERMITS AND FEES

- A. The Contractor shall secure and pay for all permits, inspections, and certificates of inspection of any governmental and inspection body having jurisdiction over all or any part of the work included under this section and/or such inspections etc. required by these specifications.
- B. The Contractor shall secure and pay for all fees and assessments in connection with the work under contract and shall include this cost in its bid and contract price.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Contractor shall be responsible for purchasing all specialized fountain mechanical and electrical materials and tools for the fountain and shall then furnish electrical fountain components to the electrical contractor for installation and connection.
- B. Materials not listed within these specifications or on drawings as furnished by the Equipment supplier, but required for the complete installation of the fountain mechanical and/or electrical systems, shall be furnished by the Contractor.
- C. Materials shown on the drawings, but not specified herein, shall be provided in accordance with information shown on the drawings and the general provisions of this part of the specification.

2.2 SPECIALIZED FOUNTAIN MATERIAL MANUFACTURER/SUPPLIER

- A. All fountain equipment specified and supplied to the Contractor shall be supplied by a single fountain Equipment Supplier/Manufacturer with the exceptions of the copper and metal basins. In this package the equipment item numbers are from Fountain Craft Mfg. Co. Equals are accepted. Equals are only supplied by a manufacturer that is currently in the business of supply fountain equipment for a minimum of twenty (20) years and shall have previously supplied fountain systems design, drawing and equipment, similar in size and complexity to this specified project.

2.3 FOUNTAIN COMPONENTS

- A. South Terrace Water Feature

Item	QTY	Description
1	1	PPSPES99-II No. S90-11, 1 HP SF1.0, 60 Hz, PSC, 230/208/115V, 6.0/12.0, B228SE/EB8228
2	1	CFSPACF180 NO. ACF180, Cartridge Filter 180 Square Feet with Pressure Gauge and 1-1/2" Quick Disconnect Unions
3	1	CHFCF1100 NO. 1100, Copper Silver Ionization Sterilizer for Small Ponds

4	1	CTLFC-900 Master Control Panel in Hoffman Nema 4 Panel with Hinged Lockable Door Including HOA Door Switches with Controller Lights, Timers. Circuit Breaker Panel with GFCI Circuit Breakers for All Equipment Including Pumps. Easy Terminal Strip Included.
5	2	FIFCWS200 2" Brass Water Stop with Flange.
6	2	FIPTPG20 2" NPT Brass Threaded Plug
7	1	WLB671CA4A No. 67C1CA4A, Warrick Duplex Pump Controller with High and Low Alarm Capability. Input from Suresite Switches. Input Power 120VAC, Built into the Control Box
8	1	5" Thick Poured Concrete Pad with a Hot Box Standard #PG4000 Pump Guard (or Approved Equal); Color: Beige.
9	1	750 Gallon 5' x 5' x 4' Deep Fiberglass Vault with Dual Spring Opening Assisted Doors. Doors with Concrete Tray Tops with Materials, Finish, and Aesthetic to Match Adjacent Paving Area.
10	1	Overflow, Provide Positive Slope and Drain to MH-3 (Storm Drain)
11	1	Little Giant #8CIA Submersible Sump Pump or Approved Equal
12	1	1/2" Thick Grade A (Monumental/Sculpture Grade) Granite Basin placed perfectly level with no tolerance, milled and ground to match grades in Contract Drawings with drain holes located as shown in the Contract Drawings, and 3" deep ponding area attached to basin with granite-to-granite fasteners and Bonstone exterior epoxy or approved equal, Color to be selected by Owner
13	1	1'-8 3/4" x 1'-10" Removable 304 Stainless Steel Grate, McNichols GW100A 1" x 1/8" Grating or approved Equal
14	5	ACO Brickslot Drain or approved equal around perimeter of Basin with 4" x 2-1/2" Granite Setts between slot drain and paver bands, allow four (4) locations for access points that drain to chamber

B. Water Wall Water Feature

Item	QTY	Description
1	1	Speck Pumps, S90I, 3/4 Horse Power Pump, Service Factor 1.0. 115/230v, 60 hz. Made of recycled material. 2" Suction Line, 1.5" Discharge Line.
2	1	Speck Pumps, ACF 180 Cartridge Filter. 180 Square Foot Filtration Area. 180 Gallons Per Minute Maximum Flow Rate. 45" Height, 1.5" Inlets

3	1	Care Free Clear Water, Model 1100 Copper Silver Ionizer, Automatic Purification System
4	2	Main Suction Drain to Pump
5	1	Poolmiser, Remote Automatic Pool Fill with Overflow Drain
6	1	Fountain Craft, 1-1/2" Threaded Brass Water Stop with Bonding Screw.
7	1	PEM, Cast Bronze Adjustable Wall Overflow, 1-1/2" Threaded Connection.
8	1	Fountain Craft, 2" Threaded Brass Water Stop with Bonding Screw.
9	1	Fountain Craft 2" Threaded Brass Plug
10	1	Fountain Craft, Master Control Panel in Nema 4 Encloser. Including Door Switches with Control Lights, Timers, GFCI Breakers, and Easy Terminating Strips.
11	1	Rain Bird LC Series 1 HP Pump or approved equal
12	1	1" Schedule 40 PVC Pipe from Irrigation Line. Constant Pressure Required. Domestic Water Supply Makeup from Solenoid Valve.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Install and connect all equipment in accordance with Manufacturers' instructions and recommendations. Provide all piping, valves, and connections recommended by the Manufacturer for proper operation.
- B. Protect all pipes, equipment, and other parts of the work against injury by exposure to the weather during construction while stored or installed.
- C. Make all adjustments required for the proper operation of the mechanical system. Use manufacturer's factory technicians where adjustments cannot be accomplished by the contractor's personnel at contractor's expense

#### 3.2 COORDINATION

- A. The Contractor shall coordinate the work with all trades and appropriate sections of the construction specifications as necessary to ensure proper provisions for the work of this section.
- B. The Contractor shall be responsible for the protection of the owner's property from injury or loss due its work. All damage to existing property (building, utilities, pavement, etc.) or

planting (trees, shrubs, lawn or ground cover) caused by the Contractor during its operation or as a result of malfunction of installed work during the guarantee period shall be repaired at the Contractor's expense.

- C. The Contractor shall fully inform itself regarding any available space limitations and unusual requirements, for the installation of all materials and work furnished under this section. Although the location of equipment may be shown on the drawings in certain positions, the Contractor shall also be guided by the details and conditions at the job, correlating its work with that of the other sections and other trades, with discrepancies and interferences being brought to the attention of the Contracting Officer or Designated Representative for the resolution prior to proceeding with the work.

### 3.3 VALVE INSTALLATION

- A. Supply all piping systems with valves arranged to provide necessary isolation and give regulating control throughout the system.
- B. Butterfly valves used to isolate equipment or accessories shall be lug type installed in a manner to allow servicing without draining the system.
- C. Check valves shall close against pressure.
- D. Do not install valve stems below horizontal line.

### 3.4 PLUMBING

- A. Provide schedule 40 PVC piping with pressure fittings and unions as necessary to allow removal and reinstallation of any item, or equipment, or accessory without cutting, welding or soldering.
- B. Provide discharge piping of proper size for all filters and winter drain valves. Extend to nearest drain.
- C. Provide a readily accessible 1-1/2" hose angle valve with hose connection and hose, at all low points in the system and immediately downstream of check valves as necessary to allow the system to be completely drained.
- D. Cut pipe to measurements established at the site. Work into place without springing or forcing.
- E. Protect all openings in piping during construction to prevent entrance of foreign matter.
- F. Cut pipe and tubing ends square. Remove rough edges and burrs so that a smooth and unobstructed flow will be obtained.
- G. Arrange exposed piping straight, parallel and perpendicular to the walls of the structure unless otherwise shown on drawings.
- H. Wherever 2 or more pipes are installed in parallel, allow sufficient space for required welding, soldering, painting, and/or the application of insulation.

- I. Bevel all pipe ends with a coarse file or beveling tool.
- J. Clean surfaces to be joined of all loose dirt and moisture from the ID and OD of the pipe end and the ID of the fitting socket.
- K. Apply a coating of purple primer to the entire ID surface of the fitting socket and to an equivalent area on the OD of the pipe end.
- L. Apply heavy body gray solvent cement using an appropriate natural bristle brush as follows: apply a liberal coating of cement around the entire perimeter of the pipe end to a width slightly more than the equivalent socket depth of the fitting. Apply a light but complete coating once around the entire depth of the socket surface, avoiding excessive cement application. Apply a second liberal coating onto the pipe end.
- M. Immediately after cementing, insert the pipe into the fitting to the full socket depth while rotating the pipe or fitting  $\frac{1}{4}$  turn. Hold joint for at least 15 seconds after joining to make sure pipe does not back out of socket.
- N. Do not disturb or move the joint for at least 1 hour after joining.
- O. Discard cement when an appreciable change in viscosity takes place or if cement is lumpy or stringy. Do not thin. Cement must be used before expiration date on container.

### 3.5 PIPE PROTECTION

- A. Copper or brass piping, encased in concrete: exterior shall be wrapped with one layer of pipe wrap at half lap. Do not wrap the penetration fittings.
- B. Copper or brass piping, underground: exterior shall be coated with two coats of coal tar mastic to a total thickness of 8 to 10 mils. Allow 12 hours drying time between applications. Clean and prepare pipe exterior in accordance with manufacturer's recommendations.

### 3.6 PENETRATIONS

- A. Core drilling for pipe penetrations shall be accomplished only at locations and in a manner approved by the contracting officer or designated representative.
- B. Provide a metal or approved plastic sleeve or core drilled hole for every pipe passing through a concrete wall or floor. Provide a water stop or membrane clamp for every pipe or sleeve penetrating and exterior concrete wall or floor or the fountain wall or floor, whichever is appropriate to the waterproofing method and/or as shown on the drawings.
- C. Seal sleeves passing through interior walls with foam fireproof sealant, unless otherwise indicated on the drawings.
- D. Seal sleeves passing through exterior walls with resilient seal and foam sealant, unless otherwise indicated on the Drawings.

### 3.7 PIPING TESTS

- A. Provide all temporary piping, pumps, and gauges necessary to conduct the specified tests.
- B. Conduct all tests before concealment of work and before any coating, wrap, or insulation is applied.
- C. Replace or repair any part that leaks. Repeat test until criteria are met.
- D. Do not subject any item to a test pressure greater than the pressure rating of the item.
- E. Underground piping shall be tested as follows:
  - 1. In accordance with pipe manufacturers' recommendations and procedures, pressurize all underground piping (except for drain system) to 60 psi prior to backfilling (spot backfilling to anchor piping may be done prior to pressurizing). Piping shall remain pressurized until all backfilling, grading, planting, and concrete work in the area of the piping is completed.
  - 2. In accordance with pipe manufacturers' recommendations and procedures, pressurize all underground drain piping beneath the equipment space to 15 psi until all backfilling and concrete work in the area is completed.
- F. The completed piping system shall be tested as follows:
  - 1. Conduct each test for a minimum continuous duration of eight hours.
  - 2. Hydrostatically pressure test all storm and sanitary drain piping at 15 psi.
  - 3. Hydrostatically pressure test all other piping and equipment at 75 psi.
  - 4. Strike all solder joints with a soft face hammer while under pressure.
  - 5. Log pressure readings for all test required above at the beginning and end of each test and on every working day between. Note the location and cause of any failure and method of repair on the daily log. Submit copy of the log to the M-NCPPC Construction Manager weekly.
  - 6. Testing of the completed system, as specified above, shall be witnessed by the M-NCPPC Construction Manager.

### 3.8 FLUSHING

- A. Before the fountain system is placed in operation, flush all fountain system piping with water to remove foreign matter and debris in piping.
- B. Completely drain all piping and equipment. Re flush as necessary until water runs clear. Fill the system to the required capacity with clean water.
- C. Circulate the water throughout the system for 1 hour, using the display pump. Install start up screens as necessary to prevent equipment clogging and damage.
- D. Drain, fill, and circulate (repeat previous 3 steps above) until the water remains clear.

3.9 HOUSEKEEPING PADS

- A. All floor-mounted equipment shall be erected on reinforced concrete housekeeping pads. Pads shall be 4" high with chamfered edges except where otherwise indicated or required on drawings.

3.10 SUPPORTING DEVICES

- A. Furnish and install all required fasteners, rods, hangers, supports, bolts, nuts, washers, and plates and shapes using stainless steel hardware.
- B. Furnish and arrange for the installation of all requires inserts and anchor bolts. Provide templates where appropriate.
- C. Provide additional hangers or supports at all valves, strainers, and elsewhere where required to properly support any additional pipe loadings. Where several pipes occur at the same elevation, use trapeze type hangers. Provide copper plated hangers where hangers are in direct contact with copper piping.
- D. Equipment may not support any of the pipe loading, nor may equipment, except valves and strainers, be supported by any of the piping. Piping shall not be supported by another pipe or duct.

3.11 EQUIPMENT IDENTIFICATION

- A. Provide securely attached permanently installed nameplates for each piece of equipment containing all data required to properly identify the equipment (i.e. manufacturer, type, size, capacity, horsepower, etc.)
- B. Provide flow direction arrow pipe bands on all system piping (Seton or equal)

3.12 ADJUSTMENTS

- A. Make temporary and final adjustments for each system and equipment apparatus installed, using factory trained technicians when appropriate.
- B. Refer to the drawings and operation and maintenance manuals for system start- up and adjustment details. Contact Manufacturer/Supplier for additional assistance as necessary.

3.13 OPERATING INSTRUCTIONS

- A. At the time of completion, a period of not less than 8 hours shall be allotted by the Contractor for instruction of operating and maintenance personnel in the use of all systems. All personnel shall be instructed at one time, the contractor making at its expense, all necessary arrangements with manufacturer's technicians to provide instruction, product literature, and application guides for the user's reference



3.14 MAINTENANCE MANUEL

- A. The Equipment Supplier shall deliver to the owner the specified quantities of the Operations and Manuals, together with any additional information or manuals which would assist in the proper operation and maintenance of equipment.
- B. The Contractor shall, at its expense, arrange and provide for the technical instruction of the owner's maintenance personnel, by the Equipment Supplier's personnel, for such time as is reasonably required to acquaint them with the operation and maintenance of all equipment furnished and installed under this section.

PART 4 - END OF SECTION

## **SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For testing agency.
- B. Field quality-control reports.

#### **1.5 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

### **PART 2 - PRODUCTS**

#### **2.1 CONDUCTORS AND CABLES**

- A. 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:
  - 1. Alcan Products Corporation; Alcan Cable Division.
  - 2. Alpha Wire.
  - 3. Belden Inc.

4. Encore Wire Corporation.
5. General Cable Technologies Corporation.
6. Southwire Incorporated.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2, Type XHHW-2, and Type UF.

## 2.2 CONNECTORS AND SPLICES

A. 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:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; a brand of the EGS Electrical Group.
4. 3M; Electrical Markets Division.
5. Tyco Electronics.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## 2.3 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 NFPA 70.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Control Circuits: Copper. Stranded with crimped termination appropriate for installation. Minimum wire size shall be #14 AWG.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- B. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- C. Exposed Branch Circuits: Type THHN-THWN, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- D. Test and Inspection Reports: Prepare a written report to record the following:
  - 1. Procedures used.
  - 2. Results that comply with requirements.
  - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- E. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

## SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes methods and materials for grounding and bonding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - 1. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NFPA 70B.
    - a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
    - b. Include recommended testing intervals.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. 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:
1. Burndy; Part of Hubbell Electrical Systems.
  2. Dossert; AFL Telecommunications LLC.
  3. ERICO International Corporation.
  4. Fushi Copperweld Inc.
  5. Galvan Industries, Inc.; Electrical Products Division, LLC.
  6. Harger Lightning and Grounding.
  7. ILSCO.
  8. O-Z/Gedney; A Brand of the EGS Electrical Group.
  9. Robbins Lightning, Inc.
  10. Siemens Power Transmission & Distribution, Inc.

### 2.2 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 467 for grounding and bonding materials and equipment.

### 2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
1. Solid Conductors: ASTM B 3.
  2. Stranded Conductors: ASTM B 8.
  3. Tinned Conductors: ASTM B 33.
  4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 2 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart with insulators.

## 2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
  - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- C. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

### 3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.



### 3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.
- C. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

### 3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 24 inches below finished floor or final grade unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
  - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service

entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

### 3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
  - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
  - b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

## **SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

#### **1.3 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

#### **1.5 QUALITY ASSURANCE**

- A. Comply with NFPA 70.

#### **1.6 COORDINATION**

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
  2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated** steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Cooper B-Line, Inc.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti, Inc.
      - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.
  2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

### PART 3 - EXECUTION

#### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT and IMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

#### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and IMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  1. To Wood: Fasten with lag screws or through bolts.
  2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  4. To Existing Concrete: Expansion anchor fasteners.
  5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  6. To Light Steel: Sheet metal screws.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

END OF SECTION 260529

## **SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

#### **1.3 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

#### **1.5 QUALITY ASSURANCE**

- A. Comply with NFPA 70.

#### **1.6 COORDINATION**

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
  2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated** steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Cooper B-Line, Inc.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti, Inc.
      - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.
  2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.



3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

### PART 3 - EXECUTION

#### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT and IMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

#### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and IMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  1. To Wood: Fasten with lag screws or through bolts.
  2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  4. To Existing Concrete: Expansion anchor fasteners.
  5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  6. To Light Steel: Sheet metal screws.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

END OF SECTION 260529

## **SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Metal conduits, tubing, and fittings.
  - 2. Nonmetal conduits and fittings.
  - 3. Metal wireways and auxiliary gutters.
  - 4. Nonmetal wireways and auxiliary gutters.
  - 5. Surface raceways.
  - 6. Boxes, enclosures, and cabinets.
  - 7. Handholes and boxes for exterior underground cabling.

#### **1.3 DEFINITIONS**

- A. IMC: Intermediate metal conduit.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

### **PART 2 - PRODUCTS**

#### **2.1 METAL CONDUITS AND FITTINGS**

- A. 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:
  - 1. AFC Cable Systems, Inc.
  - 2. Allied Tube & Conduit.
  - 3. Anamet Electrical, Inc.

4. Electri-Flex Company.
5. O-Z/Gedney.
6. Picoma Industries.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company.

- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. IMC: Comply with ANSI C80.6 and UL 1242.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. FMC: Comply with UL 1; zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Fittings for EMT:
    - a. Material: Steel or die cast.
    - b. Type: Setscrew or compression.
- H. Joint Compound for IMC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. 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:
1. Lamson & Sessions; Carlon Electrical Products.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. LFNC: Comply with UL 1660.
- E. Fittings for LFNC: Comply with UL 514B.

### 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. 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:
  - 1. Cooper B-Line, Inc.
  - 2. Hoffman.
  - 3. Mono-Systems, Inc.
  - 4. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R, Type 4, or Type 12 as indicated, and sized according to NFPA 70.
  - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type with flange-and-gasket unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

### 2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. 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:
  - 1. Allied Moulded Products, Inc.
  - 2. Hoffman.
  - 3. Lamson & Sessions; Carlon Electrical Products.
  - 4. Niedax-Kleinhuis USA, Inc.
- B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

## 2.5 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
  - 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. Mono-Systems, Inc.
    - b. Panduit Corp.
    - c. Wiremold / Legrand.

## 2.6 BOXES, ENCLOSURES, AND CABINETS

- A. 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:
  - 1. Adalet.
  - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
  - 3. EGS/Appleton Electric.
  - 4. Erickson Electrical Equipment Company.
  - 5. FSR Inc.
  - 6. Hoffman.
  - 7. Hubbell Incorporated.
  - 8. Kraloy.
  - 9. Milbank Manufacturing Co.
  - 10. Mono-Systems, Inc.
  - 11. O-Z/Gedney.
  - 12. RACO; Hubbell.
  - 13. Robroy Industries.
  - 14. Spring City Electrical Manufacturing Company.
  - 15. Stahlin Non-Metallic Enclosures.
  - 16. Thomas & Betts Corporation.
  - 17. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
- J. Gangable boxes are prohibited.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, Type 3R, Type 4, or Type 12 as indicated on drawings with continuous-hinge cover with flush latch unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Fiberglass.
  - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- L. Cabinets:
  - 1. NEMA 250, Type 1, Type 3R, or Type 12 as indicated on drawings, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.
  - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
  - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
  - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Quazite: Hubbell Power System, Inc; or comparable product.
  - 2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.

3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

## 2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
  2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: IMC or Type EPC-40-PVC.
  2. Concealed Conduit, Aboveground: EMT or RNC, Type EPC-40-PVC.
  3. Underground Conduit: Type EPC-40-PVC direct buried.
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or Type 4 as indicated.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed: EMT.
  2. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  4. Damp or Wet Locations: IMC.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.



2. EMT: Use setscrew or compression steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install surface raceways only where indicated on Drawings.

### 3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches of enclosures to which attached.
- H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- J. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- K. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

- M. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- O. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- P. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where an underground service raceway enters a building or structure.
  - 3. Where otherwise required by NFPA 70.
- Q. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- R. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC in damp or wet locations not subject to severe physical damage.
- S. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- T. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- U. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- V. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

- 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. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

### 3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### 3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

**SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Direct-buried conduit, ducts, and duct accessories.
2. Concrete-encased conduit, ducts, and duct accessories.
3. Handholes and boxes.
4. Precast Concrete Handholes and Boxes.

1.3 DEFINITIONS

- A. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include duct-bank materials, including separators and miscellaneous components.
2. Include ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include accessories for manholes, handholes, boxes, and other utility structures.
4. Include warning tape.
5. Include warning planks.

- B. Shop Drawings:

1. Precast or Factory-Fabricated Underground Utility Structures:
  - a. Include plans, elevations, sections, details, attachments to other work, and accessories.
  - b. Include duct entry provisions, including locations and duct sizes.
  - c. Include reinforcement details.
  - d. Include frame and cover design and manhole frame support rings.
  - e. Include Ladder or Step details.
  - f. Include grounding details.

- g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
  - h. Include joint details.
2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
- a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
  - b. Include duct entry provisions, including locations and duct sizes.
  - c. Include cover design.
  - d. Include grounding details.
  - e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
  - 1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
  - 2. Drawings shall be signed and sealed by a qualified professional engineer.
- B. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.
- C. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.
- D. Source quality-control reports.
- E. Field quality-control reports.

#### 1.6 MAINTENANCE MATERIALS SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

#### 1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

#### 1.8 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by M-NCPPC or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify M-NCPPC no fewer than seven days in advance of proposed interruption of electrical service.
  2. Do not proceed with interruption of electrical service without M-NCPPC's written permission.
- B. Ground Water: Assume ground-water level is 36 inches below ground surface unless a higher water table is noted on Drawings.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

- A. Comply with ANSI C2.

### 2.2 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

### 2.3 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. 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:
1. ARNCO Corp.
  2. Beck Manufacturing.
  3. Cantex, Inc.
  4. CertainTeed Corporation.
  5. Condux International, Inc.
  6. ElecSys, Inc.
  7. Electri-Flex Company.
  8. IPEX Inc.
  9. Lamson & Sessions; Carlon Electrical Products.
  10. Spiraduct/AFC Cable Systems, Inc.
- B. Underground Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F 512, Type EPC-80 and Type EPC-40, with matching fittings complying with NEMA TC 3 by same manufacturer as the duct.
- C. Duct Accessories:
1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.

2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

#### 2.4 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. General Requirements for Handholes and Boxes: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
  1. Color:
    - a. Light green for applications in grass.
    - b. Light gray for applications in concrete.
    - c. Dark gray for applications in macadam.
  2. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
  3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  5. Cover Legend: Molded lettering, "ELECTRIC" or as indicated for each service.
  6. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
  7. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.
- B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
  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. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. NewBasis.
    - d. Quazite: Hubbell Power System, Inc.

#### 2.5 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  2. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.



### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.
- 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 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-80 or Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.
- B. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-80 or Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.
- C. Underground Ducts Crossing Paved Paths, Walks, and Driveways, and Roadways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

#### 3.3 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less:
  - 1. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
  - 2. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 15 structural load rating.
  - 3. Cover design load shall not exceed the design load of the handhole or box.

#### 3.4 EARTHWORK

- A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

- B. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. 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."
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to the "Cutting and Patching" Article in Section 017300 "Execution."

### 3.5 DUCT INSTALLATION

- A. Install ducts according to NEMA TCB 2.
- B. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes, to drain in both directions.
- C. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.
- D. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- E. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
  - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
  - 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than 3/4 inch.
  - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- F. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall, without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- G. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- H. Pulling Cord: Install 100-lbf-test nylon cord in empty ducts.

- I. Concrete-Encased Ducts: Support ducts on duct separators.
1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than 6 inches in nominal diameter.
  2. Width: Excavate trench 3 inches wider than duct bank on each side.
  3. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
  4. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than five spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
  5. Elbows: Use manufactured duct elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run unless otherwise indicated. Extend concrete encasement throughout length of elbow.
  6. Elbows: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
    - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
  7. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
  8. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
  9. Concrete Cover: Install a minimum of 3 inches of concrete cover at top and bottom, and a minimum of 2 inches on each side of duct bank.
  10. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
    - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.
  11. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

J. Direct-Buried Duct Banks:

1. Excavate trench bottom to provide firm and uniform support for duct bank. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.
2. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
3. Space separators close enough to prevent sagging and deforming of ducts, with not less than five spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
4. Set elevation of bottom of duct bank below frost line.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
6. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.
  - a. Place minimum 3 inches of sand as a bed for duct bank. Place sand to a minimum of 6 inches above top level of duct bank.

- K. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.

3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- B. Elevations:
1. Install handholes with bottom below frost line.
  2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
  3. Where indicated, cast handhole cover frame integrally with handhole structure.
- C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.
- D. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms as required for installation and support of cables and conductors and as indicated.
- E. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

### 3.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install handholes and boxes with bottom below frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- F. Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### 3.8 GROUNDING

- A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
  - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
  - 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch-long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
  - 3. Test handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.10 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543

## SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Identification for raceways.
  - 2. Identification of power and control cables.
  - 3. Identification for conductors.
  - 4. Underground-line warning tape.
  - 5. Warning labels and signs.
  - 6. Instruction signs.
  - 7. Equipment identification labels.
  - 8. Miscellaneous identification products.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

#### 1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

## 1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.

### 2.2 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

### 2.3 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
  - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
  - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
  - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
  - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
  - 2. Inscriptions for Red-Colored Tapes: **ELECTRIC LINE, HIGH VOLTAGE.**
  - 3. Inscriptions for Orange-Colored Tapes: **TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.**



## 2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.
- C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

## 2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade.

- H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

### 3.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
  - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
    - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
    - b. Colors for 208/120-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
    - c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- B. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
  - 1. Limit use of underground-line warning tape to direct-buried cables.
  - 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- C. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
  - 1. Comply with 29 CFR 1910.145.
  - 2. Identify system voltage with black letters on an orange background.
  - 3. Apply to exterior of door, cover, or other access.
  - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
- D. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- E. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power,

lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
  - a. Indoor Equipment: Adhesive film label with clear protective overlay or Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
  - b. Outdoor Equipment: Engraved.
  - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
  
2. Equipment to Be Labeled:
  - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, laminated acrylic or melamine label.
  - b. Enclosures and electrical cabinets.
  - c. Enclosed switches.
  - d. Enclosed circuit breakers.
  - e. Enclosed controllers.
  - f. Contactors.

END OF SECTION 260553

## SECTION 260943.23 - RELAY-BASED LIGHTING CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes: Lighting control panels using mechanically held relays for switching.
- B. Section Includes: Networked lighting control panels using control-voltage relays for switching.

#### 1.3 DEFINITIONS

- A. IP: Internet protocol.
- B. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- C. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A.

#### 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 control modules, power distribution components, relays, manual switches and plates, and conductors and cables.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For each relay panel and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail wiring partition configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of relays.
  - 5. Include diagrams for power, signal, and control wiring.
  - 6. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data

communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.
- C. Sample Warranty: For manufacturer's special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.
- B. Software and Firmware Operational Documentation:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and prepare panels for installation according to NECA 407.

### PART 2 - PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

- A. Input signal from field-mounted manual switches, or digital signal sources, shall open or close one or more lighting control relays in the lighting control panels. Any combination of inputs shall be programmable to any number of control relays.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.
- D. Comply with UL 916.

## 2.2 LIGHTING CONTROL RELAY PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Acuity Brands, Inc.; Lighting Control & Design, Inc or comparable product by one of the following:
1. Leviton Mfg. Company Inc.
  2. WattStopper; a Legrand Group brand.
- B. Description: Standalone lighting control panel using mechanically latched relays to control lighting and appliances.
- C. Lighting Control Panel:
1. A single enclosure with incoming lighting branch circuits, control circuits, switching relays, and on-board timing and control unit.
  2. A vertical barrier separating branch circuits from control wiring.
- D. Control Unit: Contain the power supply and electronic control for operating and monitoring individual relays.
1. Timing Unit:
    - a. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
    - b. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
    - c. Four independent schedules, each having 24 time periods.
    - d. Schedule periods settable to the minute.
    - e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
    - f. 10 special date periods.
  2. Sequencing Control with Override:
    - a. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
    - b. Sequencing control shall operate relays one at a time, completing the operation of all connected relays in not more than 10 seconds.
    - c. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor.
    - d. Override control "blink warning" shall warn occupants approximately five minutes before actuating the off sequence.
  3. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation, including accurate time of day and date.
- E. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 120-V tungsten, 30 A at 277-V ballast, 1.5 hp at 120 V, and 3 hp at 277 V. Short-circuit current rating shall be not less than 14 kA. Control shall be three-wire, 24-V ac.

- F. Power Supply: NFPA 70, Class 2, sized for connected equipment, plus 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and photo sensors.
- G. Operator Interface:
  - 1. Integral alphanumeric keypad and digital display, and intuitive drop-down menus to assist in programming.
  - 2. Log and display relay on-time.
  - 3. Connect relays to one or more time and sequencing schemes.

## 2.3 MANUAL SWITCHES AND PLATES

- A. Push-Button Switches: Modular, momentary contact, three wire, for operating one or more relays and to override automatic controls.
  - 1. Match color and style specified in Section 262726 "Wiring Devices."
  - 2. Integral green LED pilot light to indicate when circuit is on.
  - 3. Internal white LED locator light to illuminate when circuit is off.
- B. Wall Plates: Single and multigang plates as specified in Section 262726 "Wiring Devices."
- C. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

## 2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5e for horizontal copper cable and with Section 271500 "Communications Horizontal Cabling."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Receive, inspect, handle, and store panels according to NECA 407.
- B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

### 3.3 PANEL INSTALLATION

- A. Comply with NECA 1.
- B. Install panels and accessories according to NECA 407.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Mount top of trim 72 inches above finished floor unless otherwise indicated.
- E. Mount panel cabinet plumb and rigid without distortion of box.
- F. Install filler plates in unused spaces.

### 3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate loads served by each relay; incorporate M-NCPPC's final room designations. Obtain approval before installing. Use a PC or typewriter to create directory; handwritten directories are unacceptable.
- C. Lighting Control Panel Nameplates: Label each panel with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."



### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Acceptance Testing Preparation:
  - 1. Test continuity of each circuit.
- D. Lighting control panel will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies lighting control panels and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

### 3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Confirm correct communications wiring, initiate communications between panels, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.
  - 3. Setup and verify timeclock schedule and operational procedures with M-NCPPC.

### 3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

### 3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train M-NCPPC's maintenance personnel to adjust, operate, and maintain the control unit and operator interface.

END OF SECTION 260943.23

## SECTION 262416 - PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes lighting and appliance branch-circuit panelboards.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail bus configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 5. Include evidence of NRTL listing for series rating of installed devices.
  - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 7. Include wiring diagrams for power, signal, and control wiring.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Keys: Six spares for each type of panelboard cabinet lock.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations:
  - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F (.
    - b. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 6600 feet.

1.9 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Surface-mounted cabinets.
  - 1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1
    - b. Outdoor Locations: NEMA 250, Type 3R.
    - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
  - 3. Finishes:
    - a. Panels and Trim: Steel and galvanized 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: Same finish as panels and trim.
    - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
  - 4. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Top and bottom.
- C. 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.
- D. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- E. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

### 2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. 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:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.

- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

### 2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. 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]:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
  - 3. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
  - 4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- C. Install overcurrent protective devices and controllers not already factory installed.
- D. Install filler plates in unused spaces.
- E. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- F. Comply with NECA 1.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate M-NCPPC's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
  - E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262416

## SECTION 262726 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Weather-resistant receptacles.
  - 3. Wall-switches.
  - 4. Communications outlets.

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. UTP: Unshielded twisted pair.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.



## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
  2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  3. Leviton Mfg. Company Inc. (Leviton).
  4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

### 2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  2. Devices shall comply with the requirements in this Section.

### 2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
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. Cooper; 5351 (single), CR5362 (duplex).
    - b. Hubbell; HBL5351 (single), HBL5352 (duplex).
    - c. Leviton; 5891 (single), 5352 (duplex).
    - d. Pass & Seymour; 5361 (single), 5362 (duplex).
- B. Weather Resistant Convenience Receptacle, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. Must comply with the requirements of UL 498 for weather resistant receptacles.
  2. Receptacle must bear the "WR" letters on front of receptacle.

## 2.4 GFCI RECEPTACLES

### A. General Description:

1. Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

### B. Weather Resistant GFCI Convenience Receptacles, 125 V, 20:

1. **Products:** Subject to compliance with requirements, provide one of the following:
  - a. **Cooper:** WRVGF20W.
  - b. **Hubbell:** GFTR20W.
  - c. **Pass & Seymour:** WR5362W.
2. Comply with requirements of 2008 NEC article 406.8.
3. Must comply with the requirements of UL 498 for weather resistant receptacles.
4. Receptacle must bear the "WR" letters on front of receptacle.

## 2.5 WALL PLATES

### A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch-thick, satin-finished, Type 302 stainless steel.

### B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, cast aluminum with lockable cover.

## 2.6 FINISHES

### A. Device Color:

1. Wiring Devices Connected to Normal Power System: Ivory unless otherwise indicated or required by NFPA 70 or device listing.

### B. Wall Plate Color: For plastic covers, match device color.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

#### B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
  - a. Cut back and pigtail, or replace all damaged conductors.
  - b. Straighten conductors that remain and remove corrosion and foreign matter.
  - c. Pigtail existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 FIELD QUALITY CONTROL

- A. Tests for Convenience Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- B. Test straight-blade for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 262726

## SECTION 262729 - ELECTRIC VEHICLE CHARGING STATIONS

### PART 1 – GENERAL

#### 1.1 SUMMARY

- A. Scope: Provide design and engineering, labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for electric vehicle (EV) charging stations as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
- B. Section Includes: The work specified in this Section includes, but shall not be limited to, complete, electric vehicle charging stations as indicated on the Drawings and as specified herein.
  - 1. The extent of the electric vehicle charging infrastructure work shall be as indicated by the Drawings and by the requirements of this Section, including, but not limited to, the following:
    - a. Integral metering.
    - b. Power monitoring meters where the M-NCPPC wants to monitor the kW consumed by the charging station.
    - c. Interface for demand response signals options.
    - d. Work stations, software, and communications hardware when installing power monitoring devices.
  - 2. System installation shall include, but shall not be limited to, the following:
    - a. Wiring of branch circuit conductors.
    - b. Installation of communications conductors and associated hardware to capture energy usage.

#### 1.2 REFERENCES

- A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.
- B. American Society of Civil Engineers (ASCE):
  - 1. ASCE 7, "Minimum Design Loads for Buildings and Other Structures" (copyrighted by ASCE, ANSI approved).
- C. ASTM (ASTM):
  - 1. ASTM E 329, "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction."
- D. International Code Council (ICC):

1. ICC-ES AC156, "Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems."
  2. ICC IBC, "International Building Code."
- E. National Fire Protection Association (NFPA):
1. NFPA 70, "National Electrical Code" (copyrighted by NFPA, ANSI approved) - hereinafter referred to as NEC.
  2. NFPA 5000, "Building Construction and Safety Code."
- F. SAE International (SAE):
1. SAE J1772, "Standard for Electric Vehicle Conductive Charge Coupler."
- G. Underwriters Laboratories, Inc. (UL):
1. UL 991, "Standard for Tests for Safety Related Controls Employing Solid State Devices."
  2. UL 1998, "Standard for Software in Programmable Components."
  3. UL 2231-1, "Standard for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: General Requirements."
  4. UL 2231-2, "Standard for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems."
  5. UL 2251, "Standard for Plugs, Receptacles and Couplers for Electric Vehicles."
  6. UL 2594, "Standard for Electric Vehicle Supply Equipment."

### 1.3 SUBMITTALS

- A. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications, including, but not limited to, manufacturer's product data and installation instructions for each component and system.
- B. Shop Drawings: Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer's standard product data, including, but not limited to, list of components and equipment to be supplied, including, but not limited to, proposed locations, clearances, and power requirements.
1. One-Line Diagrams: Submit one-line diagrams of the system configuration proposed if it differs from that illustrated in the riser diagram included in these Construction Documents. Submit one-line drawings indicating location and addresses of all hardware, including, but not limited to, panelboard, circuit breaker, and charging stations.
- C. Wiring Diagrams: Submit wiring diagrams detailing power, signal, and control systems, clearly differentiating between manufacturer-installed wiring and field-installed wiring, and between components provided by the manufacturer and those provided by others.
1. Submit typical connection diagrams for all components including, but not limited to, panelboards, communications devices, and personal computers.

- D. Qualification Data: Submit qualification data for firms and persons specified in Quality Assurance Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names of architects and M-NCPPCs, and other information specified.
- E. Contract Closeout Submittals:
  - 1. Operation and Maintenance Data: Submit operation and maintenance data for electric vehicle charging stations to include in operation and maintenance manuals specified in Division 01 - GENERAL REQUIREMENTS.
  - 2. Warranty Data: Submit manufacturer's standard warranty documents.

#### 1.4 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of electric vehicle charging stations of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 2 years.
    - a. The manufacturer shall be ISO 9001 certified and shall be designed to internationally accepted standards.
    - b. Factory fax/telephone/email system support shall be available free of charge from the manufacturer during normal business hours.
  - 2. Installer Qualifications: Installer shall be a firm that shall have a minimum of two years of successful installation experience with projects utilizing electric vehicle charging stations similar in type and scope to that required for this Project and shall be approved by the manufacturer.
- B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.
- C. Standards: Comply with applicable requirements of the following standards:
  - 1. NEMA Compliance: Applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
  - 2. NEC Compliance: Applicable portions of the NEC, including, but not limited to, Article 625.
  - 3. UL Compliance: Applicable UL standards for electric vehicle supply equipment, panelboards, circuit breakers, and energy management equipment.
  - 4. FCC Emissions: Comply with FCC emissions standards.
- D. Electrical Components, Devices, and Accessories: Electrical components, devices, and accessories shall be listed and labeled as defined in NEC, Article 100, by an inspecting and testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Coordination: Coordinate the work in this Section with all of the trades covered in other sections of the Specification to provide a complete and operable system. Furnish inserts and anchors that must

be built into other work. Work closely with installers of finish materials so that units are properly aligned with adjacent materials.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

#### 1.6 WARRANTY

- A. Special Warranty: The Contractor shall warrant the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for period indicated below. This special warranty shall extend the one year period of limitations contained in the General Conditions. The special warranty shall be countersigned by the Installer and the manufacturer.
  - 1. Warranty Period: Warranty period shall be 18 months from date of Substantial Completion.
- B. Additional M-NCPPC Rights: The warranty shall not deprive the M-NCPPC of other rights the M-NCPPC 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 under requirements of the Contract Documents.

### PART 2 - PRODUCTS

#### 2.1 ELECTRIC VEHICLE SUPPLY EQUIPMENT – Level 2

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit. (Model S-B-R-3-B-X-00)
  - 2. Leviton Manufacturing Company Inc. (Public series )
  - 3. Coulomb Technologies, Inc. (Model CT2000 series)
- B. Power Specifications (Each charging unit):
  - 1. Input Power: 208 volts AC to 240 volts AC/30 amperes, single-phase, 60 hertz. 7.2kW.
  - 2. Input Power Connection: Line 1, line 2, and ground.
  - 3. Feeder Circuit Breaker: Two-pole, 40 amperes, non-GFCI type.
  - 4. Output Power: 208 volts AC to 240 volts AC, 30 amperes.
- C. Physical Specifications:
  - 1. Enclosure Type: Type 3R.



2. Enclosure Dimensions: See the Drawings.
3. Enclosure Mounting: Pedestal mounted.
4. Cable Type: SAE J1772.
5. Cable Length: 18 feet.
6. Unit Configurations: single units pedestal-mounted.

D. User Interface:

1. Display screen showing the EVSE communications.
2. LED charging status display.

E. Protection:

1. Ground fault protection integral, CCID 20 mA, auto reset.
2. Ground fault protection system test automatic at the beginning of each charge cycle.
3. There shall be an in-built auto ground fault reset functionality in the charging station that shall reset automatically after ground fault waits for 16 minutes and then shall attempt to supply power.

F. Environmental:

1. Operating Temperature: -22 °F to 122 °F.
2. Surge: 6 kV at 3000A.
3. Emissions FCC Class: Class B.

G. Standards Compliance:

1. NEC, Article 625.
2. SAE J1772.
3. UL 991, UL 1998, UL 2231-1, UL 2231-2, UL 2251, and UL 2594.

## 2.2 SOURCE QUALITY CONTROL

- A. Component Testing: Electronic component board assemblies shall be factory-tested and burned in prior to installation.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the M-NCPPC's representative, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

- B. Examine installation area to assure there is enough clearance to install EVSE.
- C. Check concrete pads for uniformity and level surface.
- D. Verify that equipment is ready to install.
- E. Verify that required utilities are available, in proper location and ready for use

### 3.2 INSTALLATION

- A. Preparation and installation shall be in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings. System installation shall be coordinated with related and adjacent work.

### 3.3 DEMONSTRATION AND TRAINING

- A. Provide the services of a factory-authorized service representative of the manufacturer to provide start-up service and to demonstrate and train the M-NCPPC's personnel.
  - 1. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
  - 2. Train the M-NCPPC's maintenance personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventive maintenance.
  - 3. Review data in operation and maintenance manuals with the M-NCPPC's personnel.
  - 4. Schedule training with the M-NCPPC representative, with at least 14 day's advanced notice.

### 3.4 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the electric vehicle charging stations shall be without damage at time of Substantial Completion.

END OF SECTION 16149

## SECTION 265100 - INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Interior lighting fixtures, lamps, and ballasts.
  - 2. Emergency lighting units.
  - 3. Lighting fixture supports.

#### 1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature.
- C. CRI: Color-rendering index.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting fixture, including ballast housing if provided.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of lighting fixture including dimensions.
  - 2. Emergency lighting units including battery and charger.
  - 3. Ballast, including BF.
  - 4. Energy-efficiency data.
  - 5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
  - 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture

type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

- a. **Manufacturer Certified Data:** Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Installation instructions.
- C. **Qualification Data:** For qualified agencies providing photometric data for lighting fixtures.
- D. **Product Certificates:** For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
- E. Field quality-control reports.
- F. **Operation and Maintenance Data:** For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. **Luminaire Photometric Data Testing Laboratory Qualifications:** Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

#### 1.7 WARRANTY

- A. **Special Warranty for Emergency Lighting Batteries:** Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
  1. **Warranty Period for Emergency Lighting Batteries:** 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

2. Warranty Period for Emergency Fluorescent Ballast Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

## 1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least two of each type.
  2. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

### 2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  1. Label shall include the following lamp and ballast characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.

- c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
- d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
- e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
- f. CCT and CRI for all luminaires.

## 2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

### A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A
5. Total Harmonic Distortion Rating: Less than [10] [20] percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.88 or higher.
10. Power Factor: 0.95 or higher.
11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

### B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.

### C. Electronic Programmed-Start Ballasts for T8 Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.

### D. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F and Higher: Electronic or electromagnetic type rated for 0 deg F starting and operating temperature with indicated lamp types.
2. Temperatures Minus 20 Deg F and Higher: Electromagnetic type designed for use with indicated lamp types.

## 2.4 EMERGENCY FLUORESCENT POWER UNIT

### A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.

2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
  - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
  - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
5. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

## 2.5 FLUORESCENT LAMPS

- A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500K, and average rated life 20,000 hours unless otherwise indicated.

## 2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

##### A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

##### B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

##### C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

##### D. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

##### E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

#### 3.2 IDENTIFICATION

##### A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

#### 3.3 FIELD QUALITY CONTROL

##### A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

##### B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.

##### C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.



3.4 STARTUP SERVICE

- A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by M-NCPPC. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

END OF SECTION 265100

## SECTION 265600 - EXTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Exterior luminaires with light emitting diodes and drivers.
  - 2. Poles and accessories.

- B. Related Sections:

- 1. Section 265100 "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

#### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. LED: Light emitting diode.
- D. LER: Luminaire efficacy rating.
- E. Luminaire: Complete lighting fixture, including ballast housing if provided.
- F. Pole: Luminaire support structure, including tower used for large area illumination.
- G. Standard: Same definition as "Pole" above.

#### 1.4 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
  - 2. Details of attaching luminaires and accessories.

3. Details of installation and construction.
  4. Luminaire materials.
  5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
    - a. **Manufacturer Certified Data:** Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
  6. Drivers, including energy-efficiency data.
  7. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
  8. Materials, dimensions, and finishes of poles.
  9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
  10. Anchor bolts for poles.
- B. **Shop Drawings:** Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. **Pole and Support Component Certificates:** Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.
- B. **Qualification Data:** For qualified agencies providing photometric data for lighting fixtures.
- C. **Field quality-control reports.**
- D. **Warranty:** Sample of special warranty.

#### 1.6 QUALITY ASSURANCE

- A. **Luminaire Photometric Data Testing Laboratory Qualifications:** Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. **Comply with IEEE C2, "National Electrical Safety Code."**
- D. **Comply with NFPA 70.**

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- C. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
  - 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
  - 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
  - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
  - 4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
  - 2. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on the Drawings.

## 2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
  - 1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
  - 2. LER Tests Fluorescent Fixtures: Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
  - 3. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.
- B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

- M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
  2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
    - a. Color: As selected from manufacturer's standard catalog of colors.
- N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
  2. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
    - a. Color: Dark bronze.
- O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp and ballast characteristics:
    - a. "USES ONLY" and include specific lamp type.
    - b. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
    - c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
    - d. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.
    - e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
    - f. CCT and CRI for all luminaires.

## 2.3 LED DRIVERS, BALLASTS, AND POWER SUPPLIES

- A. Description: Electronic solid state type.
1. Ten-year operational life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

2. Designed and tested to withstand electrostatic discharges up to 15,000
3. Electrolytic capacitors shall operate at least 20 degrees C below the capacitor's maximum temperature rating when the driver is under fully-loaded conditions and under maximum case temperature.
4. Maximum inrush current of 2 amperes for 120V and 277V drivers.
5. Withstand up to a 4,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.
6. Manufactured in a facility that employ ESD reduction practices in compliance with ANSI/ESD S20.20.
7. Inaudible in a 27 dBA ambient.
8. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
9. Total Harmonic Distortion less than 20 percent and meet ANSI C82.11 maximum allowable THD requirements.
10. Drivers shall track evenly across multiple fixtures and all light levels.
11. Constant current drivers shall provide models shall support from 200mA to 2.1Amps (in 10mA steps) to ensure a compatible driver exists and support LED arrays up to 40W.
12. Constant voltage drivers shall provide models to support from 10Volts to 40Volts (in 0.5V steps) to ensure a compatible driver exists and support LED arrays up to 40W.
13. Configuration tool shall be available to optimize light level, efficacy, and thermal performance for LED fixtures.
14. Driver shall be capable of operating from a supply voltage of 120 through 277VAC at 60Hz for 3-wire models.

#### 2.4 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4-M.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
  1. Materials: Shall not cause galvanic action at contact points.
  2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
  3. Anchor-Bolt Template: Plywood or steel.
- D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.
- E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

## 2.5 ALUMINUM POLES

- A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.
- B. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- C. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- D. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
  - 1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
  - 2. Finish: Same as luminaire.
- E. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- F. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
  - 2. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
    - a. Color: As selected by Architect from manufacturer's full range.

## 2.6 DECORATIVE POLES

- A. Pole Material:
  - 1. Cast ductile iron.
  - 2. Cast gray iron, according to ASTM A 48/A 48M, Class 30.
  - 3. Cast aluminum.
  - 4. Cast concrete.
  - 5. Spun concrete.
  - 6. Steel tube, covered with closed-cell polyurethane foam, with a polyethylene exterior.
- B. Mounting Provisions:
  - 1. Bolted to concrete foundation.
  - 2. Embedded.
- C. Fixture Brackets:



1. Cast ductile iron.
2. Cast gray iron.
3. Cast aluminum.

D. Pole Finish: Dark bronze.

## 2.7 POLE ACCESSORIES

- A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Section 262726 "Wiring Devices" for ground-fault circuit-interrupter type.
1. Surface mounted or Recessed, 12 inches above finished grade.
  2. Nonmetallic polycarbonate plastic or reinforced fiberglass, weatherproof in use, cover, color to match pole, that when mounted results in NEMA 250, Type 3R enclosure.
  3. With cord opening.
  4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.
- B. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

## PART 3 - EXECUTION

### 3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming.

### 3.2 POLE INSTALLATION

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
1. Fire Hydrants and Storm Drainage Piping: 60 inches.
  2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet
  3. Trees: 15 feet from tree trunk.

- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
  - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
  - 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
  - 3. Install base covers unless otherwise indicated.
  - 4. Use a short piece of 1/2-inch-diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Raise and set poles using web fabric slings (not chain or cable).

### 3.3 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

- A. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

### 3.4 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

### 3.5 GROUNDING

- A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."
  - 1. Install grounding electrode for each pole unless otherwise indicated.
  - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."
  - 1. Install grounding electrode for each pole.
  - 2. Install grounding conductor and conductor protector.
  - 3. Ground metallic components of pole accessories and foundations.

### 3.6 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
  - 1. Verify operation of photoelectric controls.
- C. Illumination Tests:
  - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
    - a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting Installations."
    - b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
    - c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
    - d. IESNA LM-64, "Photometric Measurements of Parking Areas."
    - e. IESNA LM-72, "Directional Positioning of Photometric Data."
- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

### 3.7 DEMONSTRATION

- A. Train M-NCPPC's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.

END OF SECTION 265600

## SECTION 316220 – PREFABRICATED FOUNDATION SYSTEM

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Work includes preparing site and soil, furnishing, preparing foundation components, aligning, leveling, plumbing and installing foundation components, setting and driving foundation pins, and capping pins.

#### 1.2 RELATED SECTIONS

- A. All of the Contract Documents, including GENERAL AND SUPPLEMENTARY CONDITIONS and DIVISION 01 GENERAL REQUIREMENTS, apply to the work of this Section and are hereby made a part of this Section.
- B. Examine all Drawings and other Sections of the Specifications for requirements therein affecting the work of this trade.

#### 1.3 REFERENCES

- A. ASTM A 53 – Standard Specification for Pipe
- B. ASTM A153 – Standard Specification for Zinc Coating on Hardware
- C. ASTM, ACI and CRSI standards for precast concrete products
- D. ASTM C1116/C1116M-10a – Standard Specification for Synthetic Fiber Re-inforcing – Type III.

#### 1.4 SUBMITTALS

- A. Cut sheets of product
- B. Latest edition of Manufacturer's Installation Instructions for public or commercial project.
- C. Manufacturer's or Engineer's evaluation of foundation system load capacities for this project to include the size of pier and pipe length for each connection

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURER

- A. Pin Foundations, Inc. 2105 34th Ave. NW, Gig Harbor, WA 98335 - (253) 858-8809 (Mailing Address: 5114 Pt Fosdick Dr NW, Bldg #E-60) or approved equal

## SYSTEM TYPE

- B. Diamond Pier – DP-200E, DP-100E, DP-75 - Precast heads to be minimum 4000 psi concrete, min 3/8" aggregate, with 5-7% total air entrainment in frost zone applications. Reinforcing to be min. 2" synthetic macro-fibers. Note: For high chlorine applications, concrete shall be minimum 5000 psi. For DP-75, min 5500 psi concrete, min 3/8" aggregate, with 5-7% total air entrainment, with no fibers may be substituted.

### 2.2 Pins/Capacity

- A. Four pins per pier. Capacity relative to length, diameter, and driving angle in site specific soils. Stamped capacities shall rely on stamped local geotechnical evaluations and complete project loading and site information. All Pins to be minimum Schedule 40 galvanized steel pipe (UNO) with butt cut driving ends (UNO). DP-200E to use 2" nominal pipe – 2.375" actual OD. DP-100E to use 1-1/2" nominal pipe – 1.9" actual OD. DP-75 to use 1-1/4" nominal pipe - 1.67" actual OD. Pins to be capped with UV resistant vinyl caps, sealed with 50 year adhesive caulk (UNO).

### 2.3 Connections/Posts/Beams

- A. Diamond Pier connection to be galvanized steel post base attached to Pier with single galvanized anchor bolt, UNO. Anchor bolt for DP-75, & DP-100E to be 5/8" galvanized, ASTM A 307 grade A bolt. For DP-200, anchor bolt to be 3/4" galvanized, ASTM A 307, Grade A.
- B. Four-Bolt configuration (4B) bolt diameters to be 1/2", 5/8" and 3/4" for the DP-75-4B, DP-100E-4B, and DP-200E-4B, respectively.
- C. Pressure treated posts to have factory treated ends at bracket interface.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify site conditions and utility locations
- B. Verify superstructure layout, spans and resulting loads for consistency with the manufacturer's or engineer's evaluated capacities, and report any inconsistencies to the M-NCPPC Construction Manager prior to installation.

### 3.2 PREPARATION

- A. Use an installation method to avoid compaction, erosion and will not cause damage to nearby structures and tree roots.
- B. Place mulch matting as directed by the M-NCPPC Construction Manager to minimize impacts to the existing tree roots.

3.3 INSTALLATION

- A. Remove the minimum amount of earth to install the foundation
- B. Install foundation as detailed on the drawings and in accordance with the manufacturer's written specifications and requirements.
- C. Install the foundation plumb and true to insure the designed alignment and elevation of the boardwalk
- D. Pins to be full length as specified before driving. No coupled or welded pins are to be used.
- E. Follow Manufacture's Installation Instructions for Pier Placement and Pin Driving
- F. Pins may be cut off in a partially driven position if it they meet substantial resistance in the soil. See Manufacturer's Installation Instructions.

END OF SECTION 316216.11

## SECTION 321243 – FLEXIBLE POROUS PAVEMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This specification provides requirements for the construction of flexible porous paving.
  - 1. In case the requirements of this specification conflict with the contract documents, this document shall govern.

#### 1.2 RELATED SECTIONS

- A. Subgrade preparation under Section 200: Excavation, Filling and Grading.
- B. Utilities and subsurface drainage under Section 322: Storm Drainage and Stormwater Management, as needed.

#### 1.3 DEFINITIONS

- A. Exposure Condition, Moderate: Exposure to a climate where the paving will not be in a saturated condition when exposed to freezing and will not be exposed to deicing agents or other aggressive chemicals.
- B. Exposure Condition, Severe: Exposure to deicing chemicals or other aggressive agents or where the paving can become saturated by continual contact with moisture or free water before freezing.
- C. Base Reinforcement: The use of a geosynthetic within the aggregate base course to enhance the performance of a paving.
- D. Geogrid: Biaxial or triaxial woven polypropylene material for base course reinforcement and confinement, and subgrade stabilization and increased subgrade load capacity.
- E. Panel: An individual paving slab bordered by joints or slab edges.
- F. Porous/Pervious Paving: A paving comprising material with sufficient continuous voids to allow water to pass from the surface to the underlying layers.
- G. Porous/Pervious: The property of a material which permits movement of water through it under ordinary hydrostatic pressure.
- H. Flexible Porous Paving: Paving system comprised of three components: recycled passenger car tires, aggregate, and urethane binder that provides a strong, pervious, yet flexible paving.

- I. Subbase: A layer in a paving system between the subgrade and the base course, or between the subgrade and a flexible pervious paving.
- J. Subgrade: The soil prepared and compacted to support a structure or paving system.

#### 1.4 REFERENCED STANDARDS

- A. ASTM standards: ASTM C 666/C 666M-03, "Standard Test Method for Resistance of Concrete to Freezing and Thawing, Procedure A – freezing and Thawing in Water." Samples shall indicate only minimal mass change results after 300 nominal freeze-thaw cycles, and visual examination of the test specimens shall indicate no cracks or breaks.
  - 1. D 3385-03 Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer.
  - 2. D 3665-06 Standard Practice for Random Sampling of Construction Materials E 329-06a Specification for Agencies Engaged in Construction Inspection and/or Testing.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Flexible Porous Paving installer shall be currently certified by the Manufacturer, K.B. Industries, Inc. or approved equal and have successfully installed a minimum of 10,000 square feet within a 50 mile radius of the project location within the last year.
  - 2. Flexible Porous Paving installer shall employ no less than two Manufacturer-certified Flexible Porous Paving technicians on staff who directly oversee or perform the installations during all Flexible Porous Paving placement, unless otherwise specified.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockups of full-thickness sections of flexible porous pavement to demonstrate typical joints; surface color, and texture; curing; and standard of workmanship.
    - a. If the mockup is not adequate, the contractor will continue to build mockups at no additional cost to the Owner until a mockup is satisfactorily accepted
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless M-NCPPC Inspector specifically approves such deviations in writing.
  - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.6 SUBMITTALS

- A. Qualification Data for Porous Paving Installer:
  - 1. Provide a list of successfully installed Flexible Porous Paving projects, as required herein, including the address, square footage, and photographs for each project.
  - 2. Manufacturer's Certifications.



- B. Proposed Mix Design.
- C. Samples for Verification: Provide two 6" diameter samples, full thickness.

#### 1.7 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for pedestrian traffic as required for other construction activities.
- B. Schedule placements to minimize exposure to wind and heat before curing materials are applied.
- C. Avoid placing porous paving if rain, snow, or frost is forecast within 24 hours unless measures are taken as described later. Always protect fresh paving from moisture and freezing.

### PART 2 - PRODUCTS

#### 2.1 SUBBASE

- A. Base aggregates shall be #57 coarse aggregate with no fines and shall meet the durability requirements of ASTM C 33.

#### 2.2 FLEXIBLE POROUS PAVING

- 1. Subject to compliance with requirements, provide KBI Flexi-Stone PS2000 flexible porous paving for Vehicular Surfaces from Flexi-Pave or approved equal

Capitol Flexi-Pave, LLC  
37 Pidgeon Hill Dr  
Suite 278  
Sterling, VA 20165

- B. Color: River Rock
- C. Bonding: Have the capacity to bind with: wood; steel; concrete; aluminum; compacted aggregate; enamel tile, or; fiberglass.
- D. Resistance to degradation: Resistant to: chlorine; ozone; bromine; muriatic acid; salt water; oil; transmission oil, and; hydraulic oil.
- E. Aggregate:
  - 1. Stone: Triple-washed coarse chipped granite aggregate (3/8 to 1/2 inch) per ASTM C 33. Bagged and labeled as tested and certified by Flexible Porous Paving Manufacturer, K.B. Industries, Inc. (or approved equal)
    - a. Nominal maximum aggregate size shall not exceed 1/3 of the specified paving thickness.

- F. Rubber: Recycled passenger tires ground to 3/8" nominal with the wire remnants removed. Colorizing performed at the factory as tested and certified by Flexible Porous Paving Manufacturer, K. B. Industries, Inc. (or approved equal)
- G. Binding agent: urethane liquid prepolymer based upon Diphenylmethane-Diisocyanate as tested and certified by Flexible Porous Paving Manufacturer, K. B. Industries, Inc. (or approved equal)
- H. Air Entraining Agents: Prohibited.
- I. Mix Design: Using materials acceptable to the Manufacturer design a tentative mix and test for the consistency intended for use on the work and specified.
- J. The volume by weight of aggregate per cu. yd. shall be 50% of the total dry mix.
- K. The volume by weight of the rubber product per cu. yd. shall be 50% of the total dry mix.
- L. Permeability: Pervious infiltration rate of 2,000 gallons/square foot/hour.

## 2.3 FORMS

- A. Make forms with steel, wood, or other material that is sufficiently rigid to maintain specified tolerances, and capable of supporting concrete and mechanical concrete placing equipment.
- B. Forms shall be clean and free of debris of any kind, rust, and hardened concrete.
- C. Form release: Bio-diesel or vegetable oil coating.

## PART 3 - EXECUTION

### 3.1 SUBGRADE PREPARATION

- A. Prepare subgrade as specified in the contract documents.
- B. Construct subgrade to ensure that the required paving thickness is obtained in all locations.
- C. Keep all traffic off of the subgrade during construction to the maximum extent practical. Regrade subgrade disturbed by delivery vehicles or other construction traffic, as needed.
- D. Compact the material added to obtain final subgrade elevation.
- E. Determine subgrade permeability in accordance with ASTM D3385 before porous paving placement. Confirm that subgrade permeability meets requirements of Contract Documents.

### 3.2 SUBBASE

- A. Prepare subbase over a Geotextile Mirafi 140N and Tensar Triax TX140 Geogrid.

### 3.3 SETTING FORMWORK

- A. Set, align, and brace forms so that the hardened paving meets the tolerances specified herein.
- B. Apply form release agent to the form face which will be in contact with porous paving, immediately before placing paving.
- C. The vertical face of previously placed concrete may be used as a form.
  - 1. Protect previously placed paving from damage.
  - 2. Do not apply form release agent to previously placed concrete.
  - 3. Apply liquid urethane bonding agent to face of surfaces when adhesion is desired.
- D. Placement width shall be as specified in Contract Documents.

### 3.4 BATCHING, MIXING, AND DELIVERY

- A. Batch and mix on site in compliance with Manufacturer's written specifications, except that discharge shall be completed within 5 minutes of the introduction of urethane to the dry products.

### 3.5 PLACING AND FINISHING PAVING

- A. Do not place porous paving on frozen or wet subgrade or subbase.
- B. Deposit porous paving either directly onto the subgrade or subbase by wheelbarrow or by material handler onto the subgrade or subbase, unless otherwise specified.
- C. Deposit porous paving between the forms to an approximately uniform height.
- D. Spread the porous paving using a come-along, short-handle, square-ended shovel or rake.
- E. Use steel trowels to finish to the elevations and thickness specified in Contract Documents.

### 3.6 FINAL SURFACE TEXTURE

- A. Final surface of porous paving shall be smoothed with bull float and magnesium trowels.

### 3.7 EDGING

- A. When forms are not used, bevel the edge of the top surface to a 45° slope.

### 3.8 CURING

- A. Begin curing within 20 minutes of paving discharge, unless longer working time is accepted by the Manufacturer.

- B. Completely cover the paving surface with a minimum 4 mil thick polyethylene sheet only if rain or sprinklers are imminent within 20 minutes. Cut sheeting to a minimum of a full placement width.
  - 1. Cover all exposed edges of paving with polyethylene sheet.
  - 2. Secure curing cover material without using dirt.
- C. Cure paving for a minimum of 24 uninterrupted hours, unless otherwise specified.

### 3.9 HOT- AND COLD-WEATHER CONSTRUCTION

- A. When hot weather is anticipated up to 95 degrees Fahrenheit, no special procedures are necessary.
- B. In cold weather when temperatures may fall below freezing just after an installation, utilize a fan to maintain airflow over porous paving during the curing process.

### 3.10 OPENING TO TRAFFIC

- A. Do not open the paving to light vehicular traffic until the porous paving has cured for at least 24 hours during warm weather, and 48 hours during very cold temperatures at or near freezing and not until the porous paving is accepted by the Owner for opening to traffic. Paving should be checked and verified to be sufficiently hardened after the curing period as relative humidity can alter the curing time in some regions.

END OF SECTION 321243

## SECTION 321316 – CONCRETE & DECORATIVE CONCRETE PAVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes integral colored and blasting finish concrete paving.
- B. Related Sections:
  - 1. 200 Excavation, Filling & Grading
  - 2. Section 212R, Stone Base
  - 3. Section 033300 "Architectural Concrete" for general building applications of specially finished formed concrete.
  - 4. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within decorative concrete paving and in joints between decorative concrete paving and asphalt paving or adjacent construction.

#### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color, pattern, or texture selection.
- C. Samples for Verification: For each type of exposed color, pattern, or texture indicated.
- D. Other Action Submittals:
  - 1. Design Mixtures: For each decorative concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer, ready-mix concrete manufacturer and, testing agency.
- B. Material Certificates: For the following, from manufacturer:
  - 1. Cementitious materials.
  - 2. Steel reinforcement and reinforcement accessories.
  - 3. Admixtures.
  - 4. Curing compounds.
  - 5. Blasting finish materials and equipment.
  - 6. Bonding agent or epoxy adhesive.
  - 7. Joint fillers.
- C. Material Test Reports: For each of the following:
  - 1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- D. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.
- B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from same manufacturer's plant, and obtain each aggregate from single source.
- E. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- F. ACI Publications: Comply with ACI 301 unless otherwise indicated.

- G. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build a minimum of three (3) mockups of full-thickness sections of decorative concrete paving to demonstrate typical joints; surface color, and texture; curing; and standard of workmanship.
    - a. If the first three mockups are not adequate, the contractor will continue to build mockups at no additional cost to the Owner until a mockup is satisfactorily accepted
  2. Build mockups of decorative concrete paving in the location and of the size and directed by the M-NCPPC Construction Manager and not less than 96 inches by 96 inches .
  3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless M-NCPPC Construction Manager specifically approves such deviations in writing.
  4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- H. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to decorative concrete paving, including but not limited to, the following:
    - a. Concrete mixture design.
    - b. Quality control of concrete materials and decorative concrete paving construction practices.
    - c. Location of Mockups.
  2. Require representatives of each entity directly concerned with decorative concrete paving to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Decorative concrete paving Installer.

## 1.7 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

## PART 2 - PRODUCTS

### 2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves of a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

## 2.2 STEEL REINFORCEMENT

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

D. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

E. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

F. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.

G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

## 2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, gray portland cement Type I Supplement with the following:

a. Fly Ash: ASTM C 618, Class C or F.

b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.



1. Maximum Aggregate Size: 1/2 inches nominal.
  2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: Potable and complying with ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A, colored.
  2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D, colored.
  3. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
- F. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Davis Colors.
    - b. Scofield, L. M. Company.

#### 2.4 ABRASIVE BLASTING AGENT

- A. Sand or grit for abrasive blast cleaning shall be non-siliceous.

#### 2.5 CURING MATERIALS

- A. Curing Paper: Nonstaining, waterproof paper, consisting of two layers of kraft paper cemented together and reinforced with fiber, and complying with ASTM C 171.
- B. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Axim Italcementi Group, Inc.; Caltexol CIMFILM.
    - b. BASF Construction Chemicals, LLC; Confilm.
    - c. Bon Tool Co.; #32-301 Evaporation Retarder.
    - d. Brickform; Evaporation Retarder.
    - e. ChemMasters; Spray-Film.
    - f. Conspec by Dayton Superior; Aquafilm.
    - g. Dayton Superior Corporation; Sure Film (J-74).
    - h. Edoco by Dayton Superior; BurkeFilm.
    - i. Euclid Chemical Company (The), an RPM company; Eucobar.
    - j. Kaufman Products, Inc.; VaporAid.

- k. Lambert Corporation; LAMBCO Skin.
- l. L&M Construction Chemicals, Inc.; E-CON.
- m. Meadows, W. R., Inc.; EVAPRE.
- n. Metalcrete Industries; Waterhold.
- o. Nox-Crete Products Group; MONOFILM.
- p. Sika Corporation, Inc.; SikaFilm.
- q. SpecChem, LLC; Spec Film.
- r. Symons by Dayton Superior; Finishing Aid.
- s. TK Products, division of Sierra Corporation; TK-2120 TRI-FILM.
- t. Unitex; PRO-FILM.
- u. Vexcon Chemicals Inc.; Certi-Vex EnvioAssist.

- C. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B, manufactured for colored concrete.
- 1. For integrally colored concrete, curing compound shall be pigmented type approved by coloring admixture manufacturer.
  - 2. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

## 2.6 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1752, cork or self-expanding cork in preformed strips.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Polyethylene Film: ASTM D 4397, 1 mil thick, clear.

## 2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
  - 1. Compressive Strength (28 Days): 3500 psi.

2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
  3. Slump Limit: 4 inches, plus or minus 1 inch.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
1. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.
  2. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
  3. Air Content: 5 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing and accelerating admixture in concrete as required for placement and workability.
  2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
- G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

## 2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

- B. Proof-roll prepared subbase surface below decorative concrete paving to identify soft pockets and areas of excess yielding.
  - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
  - 2. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.
- B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

### 3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

### 3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

### 3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
  2. Butt Joints: Use epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  3. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
  4. Dowelled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
  2. Extend joint fillers full width and depth of joint.
  3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
  4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
  5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
  6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks. All score joints shall be saw cut and chased at a 45 degree bevel with approved tools.
    - a. Tolerance: Ensure that sawed joints are within 3 inches in both directions from center of dowels.

2. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Score Joints: Provide score joints on concrete slabs in patterns indicated on Drawings or as specified. Score joints shall be perpendicular to wall surfaces and centered on columns, corners or breaks in surfaces unless indicated otherwise. Scored joints shall extend 1/4 the depth of the slab and shall be placed at intervals not to exceed 10 feet. Joint shallower than 1/4 the depth of the slab shall be justification for rejection of the work. All score joints shall be saw cut and chased at a 45 degree bevel with approved tools.

### 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
  1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
  2. Do not use frozen materials or materials containing ice or snow.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- K. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

### 3.7 FLOAT FINISHING

- A. Apply as indicated on the drawings
- B. General: Do not add water to concrete surfaces during finishing operations.
- C. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
  1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  1. Apply a trowel finish to surfaces exposed to view.

### 3.8 ABRASIVE BLASTING FINISH

- A. Apply as indicated on the drawings
- B. Precautions
  1. When carrying out any abrasive blasting operation the Contractor shall take suitable protective measures to ensure that no damage occurs to any other surface.

2. All blast cleaning work shall be undertaken in accordance with relevant requirements of the EPA Environmental Code and OSHA.
    - a. Use of water to reduce or eliminate dust particularly in urban areas where dry blasting is inappropriate
    - b. Control of waste water and noise attenuation
    - c. Compliance with OHS requirements for respiratory protective devices and clothing.
  - C. Blasting Operations and Requirements :
    1. Apply sandblasted finish to exposed concrete surfaces where indicated
    2. After the concrete has cured for 72 hours, apply abrasive blasting finish.
    3. Using the same nozzle, nozzle pressure and blasting technique required to match the control sample.
    4. Abrasive blast corners and edge of patterns carefully, using back-up boards to maintain uniform corner or edge line
  - D. Depths of Cut: Use an abrasive grit of proper type and gradation to expose aggregate and surrounding matrix surface to match the control samples
    1. Brush Sandblast Finish: Remove cement matrix to exposed face of fine aggregate; no reveal
    2. Light Sandblast Finish: Expose fine aggregate with occasional exposure of coarse aggregate; maximum 1/16-inch reveal
    3. Medium Sandblast Finish: Generally expose coarse aggregate; 1/16-inch to 1/8-inch
  - E. Surface Continuity: Perform abrasive blasting finish in as continuous an operation as possible utilizing the same work crew to maintain continuity of finish of each surface or area of work. Maintain patterns of variances in depths of cuts.
  - F. Upon completion of the abrasive blasting of a section the blasted surface and adjacent areas shall be washed down with a high pressure water jet to remove loose sand and blasting debris.
- 3.9 BROOM FINISH
- A. Apply as indicated on the drawings
  - B. Trowel and Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
    1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- 3.10 CONCRETE PROTECTION AND CURING
- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
  - B. Comply with ACI 306.1 for cold-weather protection.



- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Compound: Apply curing compound immediately after final finishing. Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after application. Maintain continuity of coating, and repair damage during curing period.
  - 1. Cure integrally colored concrete with a pigmented curing compound.

### 3.11 PAVING TOLERANCES

- A. The Contractor is responsible for insuring that all elements are constructed in accordance with design documents and contract conditions including the 2010 ADA Standards for Accessibility, Design. If the contractor observes that portions of the project are non-compliant with the ADA, they shall notify the Construction Manager so that a field adjustment can be made to insure compliance. Grade tolerances shall be measured with a 2-foot level.
- B. Grades associated with water features shall not vary.
- C. Comply with tolerances in ACI 117 and as follows:
  - 1. Elevation: 1/4 inch.
  - 2. Thickness: Plus 3/8 inch , minus 1/4 inch.
  - 3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/2 inch
    - a. The Contractor is responsible for insuring that all elements are constructed in accordance with design documents and contract conditions including the 2010 ADA Standards for Accessibility, Design. See construction documents for additional requirements.
    - b. In locations noted on the plans, the concrete work is not allowed to vary
  - 4. Lateral Alignment and Spacing of Dowels: 1 inch.
  - 5. Vertical Alignment of Dowels: 1/4 inch.
  - 6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
  - 7. Joint Spacing: 3 inches.
  - 8. Contraction Joint Depth: Plus 1/4 inch, no minus.
  - 9. Joint Width: Plus 1/8 inch, no minus.

### 3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 50 cu. yd. or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
  5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
  6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
    - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 100 psi
- D. Test results shall be reported in writing to M-NCPPC Construction Manager , concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by M-NCPPC Construction Manager but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by M-NCPPC Construction Manager .
- G. Decorative concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

- I. Prepare test and inspection reports.

3.13 REPAIRS AND PROTECTION

- A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by M-NCPPC Construction Manager.
- B. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321316

## **SECTION 321373 - CONCRETE PAVING JOINT SEALANTS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Cold-applied joint sealants.
  - 2. Hot-applied joint sealants

#### **1.3 PRECONSTRUCTION TESTING**

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, samples of materials that will contact or affect joint sealants. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

#### **1.4 SUBMITTALS**

- A. Product Data: For each joint-sealant product indicated.
- B. Samples: For each kind and color of joint sealant required.
- C. Product certificates.
- D. Product test reports.
- E. Preconstruction compatibility and adhesion test reports.

#### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.

- C. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021.
- D. Preinstallation Conference: Conduct conference at project site.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

#### 1.7 PROJECT 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 or covered with frost.
  - 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.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

#### 2.2 MATERIALS

- A. Compatibility: Provide joint sealants, backing materials, 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 indicated by manufacturer's designations.

#### 2.3 COLD-APPLIED JOINT SEALANTS

- A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.

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. Crafcro Inc., an ERGON company; RoadSaver Silicone.
  - b. Dow Corning Corporation; 888.
  - c. Pecora Corporation; 301 NS.
- B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.
  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. Crafcro Inc., an ERGON company; RoadSaver Silicone SL.
    - b. Dow Corning Corporation; 890-SL.
    - c. Pecora Corporation; 300 SL.
- C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.
  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; Urexpam NR-200.

## 2.4 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.
- D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

## 2.5 PRIMERS

- A. Primers: Product 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.

### 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 joint-sealant performance.
- 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.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on 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.

#### 3.3 INSTALLATION

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Cleaning of Joints: Clean out joints immediately before installing joint sealants.
- C. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- D. Install joint-sealant backings of kind indicated to support joint 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 joint-sealant backings.
  - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
  - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place joint 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 Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements 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 joint sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- G. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.
- H. Clean off excess joint 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.

#### 3.4 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 and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION 321373



## SECTION 321400 - UNIT PAVERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Clay Pavers on sand setting bed over concrete base
  - 2. Bluestone Steps.
  - 3. Carterock Ashlar cut stone curbing with reveal.
- B. Related Sections include the following:
  - 1. Division 2 Section "Earthwork" for excavation and compacted subgrade.
  - 2. Division 2 Section "Cement Concrete Pavement" for concrete base under unit pavers and for concrete paving with stone insets.
  - 3. Division 7 Section "Joint Sealants" for sealing control and expansion joints in unit pavers with elastomeric sealants.

#### 1.3 SUBMITTALS

- A. Product Data: For materials other than water and aggregates.
- B. Product Data: For the following:
  - 1. Pavers.
  - 2. Bluestone Steps.
  - 3. Mortar and grout materials.
  - 4. Stone curbs.
  - 5. Edge restraints.
- C. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.
- D. Samples for Initial Selection: For the following:
  - 1. Each type of unit paver indicated.
  - 2. Joint materials involving color selection.
  - 3. Stone curbs.
  - 4. Grout type and colors for stone curb.
  - 5. Edge restraints.

6. Bluestone Steps.

E. Samples for Verification:

1. Full-size units of each type of unit paver indicated.
2. Joint materials.
3. Stone curbs.
4. Bluestone Steps.

F. Compatibility and Adhesion Test Reports: From latex-additive manufacturer for mortar and grout containing latex additives.

#### 1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Preconstruction Compatibility and Adhesion Testing: Submit to latex-additive manufacturer, for testing indicated below, samples of paving materials that will contact or affect mortar and grout that contain latex additives.

1. Use manufacturer's standard test methods to determine whether mortar and grout materials will obtain optimum adhesion with, and will be nonstaining to, installed pavers and other materials constituting paver installation.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

#### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store liquids in tightly closed containers protected from freezing.

## 1.6 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.
- B. Weather Limitations for Mortar and Grout:
  - 1. Cold-Weather Requirements: Protect unit paver work against freezing when ambient temperature is 40 deg F and falling. Heat materials to provide mortar and grout temperatures between 40 and 120 deg F. Provide the following protection for completed portions of work for 24 hours after installation when the mean daily air temperature is as indicated: below 40 deg F, cover with weather-resistant membrane; below 25 deg F, cover with insulating blankets; below 20 deg F, provide enclosure and temporary heat to maintain temperature above 32 deg F.
  - 2. Hot-Weather Requirements: Protect unit paver work when temperature and humidity conditions produce excessive evaporation of setting beds and grout. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.
    - a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set pavers within 1 minute of spreading setting-bed mortar.

## PART 2 - PRODUCTS

### 2.1 CLAY PAVERS

- A. Clay pavers: Complying with ASTM C 1272 for Heavy Vehicular Paving Brick.
  - 1. Manufacturer: Whitacre Greer Boardwalk with Lugs or approved equal
  - 2. Size: 3"x3"x9"
  - 3. Colors: Two colors mixed 50% of each from the full line of Manufacturer's colors

### 2.2 COBBLE CURBING

- A. Standard Jumbo Cobbles: Cobbles, made from granite complying with ASTM C 615.
  - 1. Granite Color and Grain: Light gray.
  - 2. Top dimensions: 6-inches x 8-inches.
  - 3. Depth: 16-inches
  - 4. Face Finish: Split all sides.
- B. Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

## 2.3 STONE STEPS

- A. Bluestone Steps: Shaped Steps, made from bluestone complying with ASTM C 616.
  - 1. Color: Select Blue Pennsylvania
  - 2. Finish: Thermal-finish faces and edges
  - 3. Thickness: As shown in drawings
  - 4. Face size: reference drawings for details.

## 2.4 ACCESSORIES

## 2.5 MORTAR SETTING-BED MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Sand: ASTM C 144.
- D. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.
- E. Water: Potable.

## 2.6 CLAY PAVERS BASE & SETTING-BED MATERIALS

- A. Graded Aggregate for Subbase: Sound, crushed stone or gravel MD-SHA CR-6.
- B. Concrete Base: MD-SHA #3 concrete mix & complying with Section 03 30 00 Cast-in-Place Concrete
- C. Setting Bed & swept joints: Sound, sharp, washed, crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.
  - 1. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
  - 2. Permittivity: 0.02 per second, minimum; ASTM D 4491.
  - 3. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- D. Edge restraint: Product: PermaLoc Brick Block, (or approved equal) .075 inch thick x 2-3/4 inches high, extruded aluminum, 6063 alloy, paver restraint edging with horizontal base shall have holes spaced 4 inches (102 mm) apart along its length to receive stainless steel concrete nails .
  - 1. Ramset/Hilti (or approved equal) 1" stainless steel nail with washer at 8" O.C.
  - 2. Length: 8 feet
  - 3. Finish: Natural Mill Aluminum.

## 2.7 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement, unfading mineral pigments and white or colored sand as required to produce required color.
  - 1. Latex Additive: acrylic-resin or styrene-butadiene-rubber water emulsion, serving as replacement for part or all of the water, of type specifically recommended by latex-additive manufacturer for use with field-mixed sand-portland cement grout.
- B. Polymer-Modified Grout: ANSI A118.7, sanded grout; in color indicated.
  - 1. Product Type: Dry mix, containing ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients.
- C. Grout Colors: As selected by Architect from manufacturer's full range.
- D. Water: Potable.

## 2.8 MORTAR AND GROUT MIXES

- A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimum performance characteristics. Discard mortars and grout if they have reached their initial set before being used.
- B. Mortar-Bed Bond Coat: Mix neat cement or cement and sand with latex additive to a creamy consistency.
- C. Portland Cement-Lime Setting-Bed Mortar: Type M complying with ASTM C 270, Proportion Specification.
- D. Latex-Modified, Portland Cement Setting-Bed Mortar: Proportion and mix portland cement, sand, and latex additive for setting bed to comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.
- E. Latex-Modified, Portland Cement Slurry Bond Coat: Proportion and mix portland cement, sand, and latex additive for slurry bond coat to comply with written instructions of latex-additive manufacturer.
- F. Job-Mixed Portland Cement Grout: Proportion and mix job-mixed portland cement and sand to match setting-bed mortar, except omit hydrated lime and use enough water to produce a pourable mixture.
- G. Job-Mixed, Polymer-Modified Portland Cement Grout: Add liquid-latex additive to portland cement and sand in proportion and concentration recommended by liquid-latex manufacturer. Proportion cement and sand to comply with written instructions of latex-additive manufacturer.

1. Pigmented Grout: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1:10, by weight.
  2. Colored-Aggregate Grout: Produce color required by combining colored sand with portland cement of selected color.
- H. Packaged, Polymer-Modified Grout Mix: Proportion and mix grout ingredients according to grout manufacturer's written instructions.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.
  2. Where pavers are to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations. Examine areas where waterproofing system is turned up or flashed against vertical surfaces and horizontal waterproofing. Proceed with installation only after protection is in place.

#### 3.2 PREPARATION

- A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
- B. Clean concrete substrates to remove dirt, dust, debris, and loose particles.
- C. Proof-roll prepared subgrade according to requirements in Division 2 Section "Earthwork" to identify soft pockets and areas of excess yielding. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive subbase and base course for unit pavers.

#### 3.3 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible in finished work.
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly.
1. Use full units without cutting where possible.
  2. Cutting the paver parallel to the 9-inch length is not permissible.
  3. Hammer cutting is not permissible.

- D. Exercise care in handling coated brick pavers to prevent coated surfaces from contacting backs or edges of other units. Remove coating from bonding surfaces before setting brick.
- E. Joint Pattern: As indicated in the construction documents.
- F. Tolerances: Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches and 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.
- G. Expansion and Control Joints: Provide for sealant-filled joints at locations and of widths indicated. Provide foam filler as backing for sealant-filled joints, unless otherwise indicated. Install joint filler before setting pavers. Make top of joint filler flush with top of pavers.

### 3.4 AGGREGATE SETTING-BED APPLICATIONS

- A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 laboratory density.
- B. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Place aggregate base, compact by tamping with plate vibrator, and screed to depth indicated.
- D. Place leveling course and screed to a thickness of 1-1/2 to 2 inches , taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.
- E. Set steps being careful not to disturb leveling base.

### 3.5 CLAY PAVERS BASE & SETTING-BED APPLICATIONS

- A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 laboratory density.
- B. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Place aggregate base, compact by tamping with plate vibrator, and screed to depth indicated.
- D. Place concrete base in accordance with Section 03 30 00 Cast-in-Place Concrete to depth indicated.
- E. Place leveling course and screed to a thickness of 1-1/2 inches, taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.
- F. Install Edge restraint with Ramset/Hilti (or approved equal) 1" stainless steel nail with washer at 8" O.C.

### 3.6 MORTAR SETTING-BED APPLICATIONS

- A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.
- B. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing setting bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch thickness for bond coat.
- C. Apply mortar bed over bond coat immediately after applying bond coat. Spread and screed setting bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.
- D. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Cut back, bevel edge, remove, and discard setting-bed material that has reached initial set before placing pavers.
- E. Wet pavers before laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.
- F. Place pavers before initial set of cement occurs. Immediately before placing pavers on setting bed, apply uniform 1/16-inch- thick, slurry bond coat to bed or to back of each paver with a flat trowel.
- G. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.
- H. Spaced Joint Widths: Provide 1/2-inch 3/4-inch nominal joint width with variations not exceeding plus or minus 1/8 inch.
- I. Grout joints as soon as possible after initial set of setting bed.
  - 1. Force grout into joints, taking care not to smear grout on adjoining surfaces.
  - 2. Clean pavers as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.
  - 3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
  - 4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.
- J. Cure grout by maintaining in a damp condition for seven days, unless otherwise recommended by grout or liquid-latex manufacturer.



3.7 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
- B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point up joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.
- C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.
  - 1. Remove temporary protective coating from brick pavers as recommended by protective coating manufacturer and as acceptable to unit paver and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

END OF SECTION

## SECTION 321443 - POROUS UNIT PAVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 322R Storm Drainage and Stormwater Management

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Solid concrete pavers with openings between pavers.
  - 2. Aggregate setting bed for pavers.
  - 3. Stone vents for connections into existing grade.
- B. Related Requirements:
  - 1. Section 321313 "Concrete Paving" for cast-in-place concrete curbs that serve as edge restraints for porous paving.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to include the Manufacturer, representative, General Contractor, Installing Contractor and M-NCPPC Construction Manager.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Pavers.
  - 2. Geotextile.
  - 3. Underdrain Pipe.
  - 4. Impermeable Liner.
- B. Sieve Analyses: For aggregate materials, according to ASTM C 136.
- C. Samples:
  - 1. Full-size units of each type of unit paver indicated.
  - 2. Aggregate fill.

3. Aggregate setting bed materials.
4. Aggregate stone for vents.

D. Contractor Qualifications.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.
  1. For solid interlocking paving units, include test data for freezing and thawing according to ASTM C 67.
- C. Soil Compaction Testing Reports: For in-situ soils in parking lot areas of fill. Performed by a Professional Geotechnical Engineer. Results provided to M-NCPPC Construction Manager.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Representative
  1. The Manufacturer's Representative is required on Site during all major milestone of the installation to insure that the product is installed correctly. These include but not limited to the following:
    - a. Mockup installation
    - b. Final preparation of the subgrade
    - c. Installation of the Geotextile
    - d. Installation of the graded aggregate base
    - e. Delivery and installation of the Porous Unit Paver system
- B. Mockups: Build mockups to demonstrate the Contractor's technical understanding, aesthetic effects and set quality standards for materials and execution.
  1. Install porous paving to demonstrate typical joints, transitions between asphalt, concrete curb and other surfaces, including with aggregate bases, underdrain and imperv. Demonstrate installation of mats, cut blocks and standard of workmanship.
  2. Build mockups in the location and of the size and directed by the M-NCPPC Inspector.
  3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless M-NCPPC Inspector specifically approves such deviations in writing.
  4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Professional Geotechnical Engineer and Professional Civil Engineer: Both of these professional engineers or their qualified employees which are under the direct supervision are required onsite during the subgrade, base layer and product installation for SWM compaction and

permeability as applicable for proper installation for construction and as-built of the permeable paving parking lot.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavers to the site and handle according to manufacturer's written instructions.
- B. Prevent damage to the pavers during hauling, unloading, storage and handling.
- C. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.
- D. Store aggregates, under-drain pipes, geotextiles and liners where grading and other required characteristics can be maintained and contamination can be avoided.

#### 1.8 CONTRACTOR QUALIFICATIONS

- A. Submit a written statement of qualifications including:
  - 1. Minimum 5 years experience installing porous unit paving systems.
  - 2. Minimum 3 successful projects of similar scope and size, with references.

### PART 2 - PRODUCTS

#### 2.1 CONCRETE UNIT PAVERS

- 1. Subject to compliance with requirements, provide The Pavedrain<sup>R</sup> permeable articulating concrete block/mats (or approved equal)
  - A. Material.
    - 1. 11.9- inch x 12-inch x 5.65-inch Cellular Concrete Blocks meeting the following
      - a. Cementitious Materials – Materials shall conform to the following applicable ASTM specifications:
        - 1) Portland Cements - Specification C 150, for Portland Cement.
        - 2) Blended Cements - Specification C 595, for Blended Hydraulic Cements.
        - 3) Hydrated Lime Types - Specification C 207, for Hydrated Lime Types.
        - 4) Pozzolans - Specifications C 618, for Fly Ash and Raw or Calcinated Natural
        - 5) Pozzolans for use in Portland Cement Concrete.
      - b. Aggregates shall conform to the following ASTM specifications, except that grading requirements shall not necessarily apply:
        - 1) Normal Weight - Specification C 33, for Concrete Aggregates.
      - c. Physical Requirements: At the time of delivery to the work site, the units shall conform to the physical requirements of ASTM D 6684-04 as prescribed below.
        - 1) Compressive Strength (average of 3 units)- Min. psi = 4,000, mpa = 27.6

- 2) Water Absorption (average of 3 units)
  - 3) Max. lb/ft<sup>3</sup> = 10, kg/m<sup>3</sup> = 160
  - d. Infiltration Performance: The P-ACB/M will only be accepted when accompanied by documented third party surface infiltration performance characteristics based on ASTM C1701/C1701M-09. The surface infiltration rate shall be no less than 4,000 inches per hour on an outdoor working surface, with typical base material utilized for the test.
  - e. Structural Performance: The design of the P-ACB/M shall be capable of supporting AASHTO HS-20 and H-20 truck loading. The blocks should be analyzed as unreinforced concrete arches supporting a uniform truck tire load with impact per AASHTO standards.
  - f. Color: Standard Block Color
2. Polyester Revetment Cable and fittings. The revetment cable shall exhibit good to excellent resistance to most concentrated acids, alkalis, and solvents. Cable shall be impervious to rot, mildew and degradation. The materials used in the construction of the cable shall not be affected by continuous immersion in stormwater runoff.
- a. Revetment cable shall be constructed of high tenacity, low elongating, and continuous filament polyester fibers. Cable shall consist of a core construction comprised of parallel fibers contained within an outer jacket or cover. The weight of the parallel core shall be between 65% to 70% of the total weight of the cable. The cable size will be determined by the supplier based on the size of the mats to be placed. The revetment cable shall have the following physical characteristics listed below.

Nominal Cable Diameter	Approx. Strength Lbs.	Weight/100 ft	
		Min lbs.	Max lbs.
1/4" – 20 mm	3,700	2.47	2.74
5/16" – 27mm	7,000	3.99	4.42
3/8" – 30mm	10,000	4.75	5.26
1/2" – 40mm	15,000	8.93	9.90

**B. Fabrication:**

- 1. Permeable articulating concrete block/mats shall be premanufactured of individual concrete blocks with specific stormwater runoff capacities, bound into mats by the use of revetment cables. The mats shall arrive at the jobsite assembled according to lengths and widths as specified on the shop drawings.
- 2. Individual blocks in the articulating concrete mats shall be staggered, beveled, and interlocked for enhanced stability. The mats shall be constructed of closed cell blocks with an arched storage chamber for additional stormwater storage as shown on the contract drawings. Parallel strands of cable shall extend through two (2) ducts in each block in a manner which provides for longitudinal binding of the blocks within the mats. Each row of blocks shall be laterally offset by one-half block width from the adjacent row

so that any given block is cabled to four other blocks (two in the row above and two in the row below). Six adjacent blocks shall also surround each block.

3. Each block shall incorporate interlocking surfaces that prevent lateral displacement of the blocks within the mats when they are lifted by the longitudinal revetment cables. The interlocking surfaces must not protrude beyond the perimeter of the blocks to such an extent that they reduce the flexibility or articulating capability of the articulating concrete mats or become damaged or broken when the mats are lifted during shipment or placement. Once the mats are in place, the interlocking surfaces shall prevent the lateral displacement of the blocks even if the cables should become damaged or removed. The mats must be able to flex a minimum of 10 degrees between any given row and column of blocks in the uplift direction.
4. The cables shall be inserted into the mats in such a manner to form lifting loops at one end of the mat with the corresponding cable ends spliced together to form a lifting loop at the other end of the mat with sleeves approved by the engineer.
5. Selection of cable and fittings shall be made in a manner that insures a safe design factor for mats being lifted from both ends, thereby forming a catenary. Consideration shall be taken for the bending of the cables around hooks or pins during lifting. Revetment cable splicing fittings shall be selected so that the resultant splice shall provide a minimum of 60% of the minimum rated cable

2.2 PAVE DRAIN END CAP

1. Products: Subject to compliance with requirements, provide the following:
  - a. Pavedrain<sup>®</sup> End Cap

2.3 GEOTEXTILE

A. Geosynthetic reinforcement grid.

1. Products: Subject to compliance with requirements, provide the following:
  - a. Mirafi<sup>®</sup> FW402

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Wide Width Tensile Strength	ASTM D4595	lbs/in (kN/m)	200 (35.0)	140 (24.5)
Grab Tensile Strength	ASTM D4632	lbs (N)	365 (1624)	200 (890)
Grab Tensile Elongation	ASTM D4632	%	24	10
Trapezoid Tear Strength	ASTM D4533	lbs (N)	115 (512)	75 (334)
CBR Puncture Strength	ASTM D6241	lbs (N)	675 (3004)	
Apparent Opening Size (AOS) <sup>1</sup>	ASTM D4751	U.S. Sieve (mm)	40 (0.43)	
Percent Open Area	COE-02215	%	10	
Permittivity	ASTM D4491	sec <sup>-1</sup>	2.1	
Permeability	ASTM D4491	cm/sec	0.14	

Flow Rate	ASTM D4491	gal/min/ft <sup>2</sup>	145 (5907)
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	90

2.4 AGGREGATE SETTING-BED MATERIALS

- A. Graded Aggregate for Clean Stone: complying with ASTM D 448 for AAHSTO Size No. 2 or 3.
- B. Graded Aggregate for Open Graded Base Stone: Sound clean washed crushed stone or gravel complying with ASTM D 448 for Size No. 57.

2.5 UNDERDRAIN PIPE AND FITTINGS

- A. Provide in accordance with Section 322R Storm Drainage and Stormwater Management and the drawings and details

2.6 Impermeable Liner

- A. 0.5mm, 30 mil PVC geomembrane liner.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proof-roll prepared subgrade to achieve uniform grade and stability without overcompacting according to requirements in this specification and specification 200. Proceed with porous paver installation only after deficient subgrades have been corrected and are ready to receive subbase and base course for porous paving.

3.2 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be structurally unsound or visible in finished work.
- B. Install pavers in approximately the order in which they were manufactured.
- C. Provide curbs as indicated. Install curbs before placing unit pavers.
- D. Maintain a minimum of 12" rough grade over Pavedrain areas at all times during construction until base stone layer is ready to be installed.
- E. Remove the rough grade and install the base stone in portions that can be completed in a single day's working operation. Progress from one end of the parking lot to the other using low impact construction equipment.

- F. Daily on site coordination with Pavedrain representative and M-NCPPC Construction Manager and inspector during construction is required.
- G. Provide a minimum 72 hour notice to Pavedrain representative and M-NCPPC Construction Manager prior to beginning construction operations.
- H. Pavedrain representatives, M-NCPPC Construction Manager to provide daily inspection and monitoring of installation of the subbase and pavers such that the subgrade can infiltrate during and after the installation and is not over compacted. Refer to sequence of construction item #6 on sheet ce1.3 for additional information.
- I. Do not over compact soil in areas of fill. Compact to a maximum dry density of 85% modified proctor or the existing underlying soil compaction %, whichever is less. Use low impact equipment at all times during installation.
- J. In fill areas, install 3'x3', 2-3" clean stone vent from 12" stone layer 24" into existing grade. See plans for locations.

### 3.3 SETTING-BED INSTALLATION

- A. Prepare subgrade in conformance to the lines, grades and cross sections shown on the plans. Compact soil subgrade uniformly to the lesser of the in-situ soil subgrade compaction rate or to at least 85 percent dry density of optimum moisture content. Test sub-base in-situ soils under permeable parking areas for in-situ compaction rates per specification 200 before rough grading operation begins and submit results to M-NCPPC Construction Manager.
- B. Proof-roll prepared subgrade to achieve uniform grade and stability. Excavate soft spots, unsatisfactory soils, areas of excessive pumping or rutting, or over compact subgrade as determined by M-NCPPC Construction Manager, and replace as directed. Any required corrections shall be made at no additional cost to M-NCPPC.
- C. Place Geotextile as follows:
  - 1. The geotextile shall be laid smooth without wrinkles or folds on the prepared subgrade in the direction of construction traffic. Adjacent geotextile rolls shall be overlapped, sewn or joined a minimum of 24-inches
  - 2. On curves, the geotextile may be folded or cut to conform to the curves. The fold or overlap shall be shingled in the direction of construction and held in place by pins or staples.
  - 3. Prior to covering, the geotextile shall be inspected by the to ensure that the geotextile has not been damaged during installation. Damaged geotextile, as identified by the M-NCPPC Construction Manager shall be repaired immediately. Cover the damaged area with a geotextile patch which extends an amount equal to the required overlap, or a minimum of two feet beyond the damaged area.
  - 4. The aggregate base shall be placed by end dumping onto the geotextile from the edge of the geotextile, or over previously placed subbase aggregate. On subgrade soils having a CBR value greater than 3, most rubber-tired vehicles can be driven at slow speeds, less than 10 mph (16 km/h) and in straight paths over the exposed geotextile without causing damage to the geotextile. Sudden braking and sharp turning should be avoided. Tracked construction equipment should not be operated directly upon the geotextile. A minimum



fill soil thickness of 6 in (15cm) is required prior to operation of tracked vehicles over the geotextile. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geotextile. Turning of vehicles shall not be permitted on the first lift above the geotextile.

5. On subgrades having a CBR value of less than 1, the aggregate base or subbase should be spread in its full thickness as soon as possible after dumping with low impact equipment such as a bobcat, to minimize the potential of localized subgrade failure due to overloading of the subgrade.
  6. Any ruts occurring during construction shall be racked out smoothly by hand immediately.
  7. If placement of the backfill material causes damage to the geotextile, the damaged area shall be repaired as previously described above. The placement procedure shall then be modified to eliminate further damage to the geotextile from taking place.
- A. Place AASHTO #2 or #3 aggregate subbase, impermeable liner and the underdrain system with low impact equipment to the depth indicated and in accordance with Section 322R Storm Drainage and Stormwater Management and the drawings and details
  - B. Place the AASHTO #57 Stone aggregate base and underdrain system with low impact equipment, compact with hand vibratory equipment and screed to depth indicated.
  - C. Place the AASHTO #8 Stone aggregate base with low impact equipment, compact with hand vibratory equipment and screed to depth indicated.

### 3.4 PAVER INSTALLATION

- A. Set unit pavers on bedding course, being careful not to disturb the bedding course in accordance with the shop drawings. The permeable articulating concrete block/mats shall be placed on the aggregate bedding layer so as to produce a smooth plane surface..
  1. Tolerances:
    - a. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/16-inch unit-to-unit offset from flush.
    - b. Variation from Level or Indicated Slope: Do not exceed 1/8 inch in 24 inches and 1/4 inch in 10 feet or a maximum of 1/2 inch .
- B. If installed in mats the permeable articulating concrete block/mats shall be attached to a spreader bar or other conventional device to aid in the lifting and placing of the mats in their proper position by the use of a crane or other approved equipment. The equipment used should be adequate capacity to place the mats without bumping, dragging, or otherwise damaging the aggregate bedding layer. The mats shall be “zippered” together forming a seamless mat to mat connection.
- C. As work progresses, remove and replace pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement. If previously cabled, recable the blocks per the Manufacture’s specifications.

- D. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Block splitting is not permitted. Hammer cutting is not acceptable.
  - 1. Cut all block flush where it meets a concrete curb or a concrete pavement. Voids and spaces greater than the standard size of the paver lug are not allowed adjacent to concrete. Pavedrain End Cap or any other type of filler are not permitted against concrete curb or concrete pavement.
  
- E. Install Pavedrain End Cap (or approved equal) per the manufactures, written specifications and only were adjacent to asphalt surfaces.

3.5 PROTECTION

- 1. It is the Contractor's responsibility to protect the paver system and permeability until final acceptance. Broken, chipped, or scraped pavers will be replaced at no additional cost to the Owner. Loss of permeability will be corrected to the satisfaction of the M-NCPPC Construction Manager at no additional cost to the Owner. This includes but is not limited to replacement of the stone layer and geotextile.

END OF SECTION 321443

## SECTION 321713 - PARKING BUMPERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes wheel stops.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

### PART 2 - PRODUCTS

#### 2.1 PARKING BUMPERS

- A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 4000-psi minimum compressive strength, 7 inches high by 10 inches wide by 72 inches long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.
  - 1. Mounting Hardware: Rebar, 1-inch diameter, 24-inch minimum length

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.
- B. Securely anchor wheel stops to pavement with hardware in each preformed vertical hole in wheel stop as recommended in writing by manufacturer.

END OF SECTION 321713

## SECTION 323113 - CHAIN LINK FENCES AND GATES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Chain-link fences.
  - 2. Gates: swing.

#### 1.3 PERFORMANCE REQUIREMENTS

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. Fence fittings, reinforcements, cable, bolts, and attachments.
  - 2. Gates and hardware.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.
- C. Samples for Initial Selection: For components with factory-applied color finishes.
- D. Samples for Verification: Prepared on Samples of size indicated below:
  - 1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.
- E. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer or testing agency or factory-authorized service representative.
- B. Product Certificates: For type of gate, from manufacturer.

- C. Product Test Reports: For framing strength according to ASTM F 1043.
- D. Field quality-control reports.
- E. Warranty: Sample of special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
  - 1. Polymer finishes.
  - 2. Gate hardware.

#### 1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.
- C. Mockups: Build mockups to set quality standards for fabrication and installation.
  - 1. Include 10-foot length minimum of fence.
- D. Preinstallation Conference: Conduct conference at Brookside Gardens
  - 1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
  - 2. Review sequence of operation for each type of gate operator.
  - 3. Review coordination of interlocked equipment specified in this Section and elsewhere.
  - 4. Review required testing, inspecting, and certifying procedure.

#### 1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

#### 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
  - a. Faulty operation of gate.
  - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CHAIN-LINK FENCE FABRIC

- A. General: Reuse salvaged ten-foot tall fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
  1. Fabric Height: As indicated on Drawings.
  2. Steel Wire Fabric for Gate : Match salvaged fence
    - a. Mesh Size: Match salvaged fence
    - b. Polymer-Coated Fabric: ASTM F 668, Match salvaged fence.
      - 1) Color: Match salvaged fence complying with ASTM F 934.
    - c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
  3. Selvage: Knuckled at both selvages

### 2.2 FENCE FRAMING

- A. Posts and Rails: Recycled light posts as indicated in the drawings :
  1. Post Size: As indicated on Drawings

### 2.3 TENSION WIRE

- A. As shown on Drawings

### 2.4 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts.
  1. Gate Leaf Width: As indicated on Drawings.
  2. Gate Fabric Height: As indicated on Drawings.
- B. Pipe and Tubing:

1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing and fabric.
2. Gate Posts: Rectangular tubular steel
3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Welded.

D. Hardware:

1. Hinges: self closing as shown on drawings.
2. ADA accessible latches permitting operation from both sides of gate.

## 2.5 FITTINGS

A. General: Comply with ASTM F 626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Tension and Brace Bands: Pressed steel.

E. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, tension wire, and frames, complying with the following:
  - a. Hot-Dip Galvanized Steel: 0.148-inch-diameter wiring thickness matching coating thickness of chain-link fence fabric.

F. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. .
  - a. Polymer coating over metallic coating.

G. Tension Wires & Hardware : As shown on Drawings

- a. Finish:
  - 1) Hot dipped Galvanized

## 2.6 ANCHORING CEMENT

A. As Indicated on Drawings

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
  - 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 200 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

#### 3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
  - 1. Install fencing on established boundary lines inside property line.

#### 3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
  - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
  - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    - a. Concealed Concrete: as indicated on Drawings to allow covering with surface material.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of as indicated on Drawings.
- D. Line Posts: Space line posts as shown on drawings.
- E. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c.



Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. As indicated on Drawings .
- F. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- G. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- H. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

### 3.5 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
1. . Include observations of weather and other phenomena that may affect test results.

### 3.6 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113

## SECTION 323119.13 - DECORATIVE METAL SECURITY FENCES AND GATES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Vehicular Swing gate.
  2. Gate operators, including controls.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.
1. Include diagrams for power, signal, and control wiring.
- C. Samples: For each fence material and for each color specified.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For gate operators to include in maintenance manuals.
- B. Warranty: 5 year minimum

#### 1.5 REFERENCES

1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
3. ASTM D523 - Test Method for Specular Gloss.
4. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
5. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
6. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
7. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

8. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
9. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
10. ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

B.

## PART 2 - PRODUCTS

### 2.1 SWING GATES

1. Subject to compliance with requirements, provide AEGIS II® - Heavy Industrial Steel Ornamental Gate by Ameristar Fence Products or approved equal:

#### B. Material

1. Steel material for fence framework (i.e. tubular pickets, rails and posts), shall be galvanized prior to forming in accordance with the requirements of ASTM A653/A653M, with minimum yield strength of 45,000 psi (310 MPa). The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.90 oz/ft<sup>2</sup> (276 g/m<sup>2</sup>), Coating Designation G-90.
2. Material for pickets shall be 1" square x 14 Ga. tubing. The cross-sectional shape of the rails shall conform to the manufacturer's ForeRunner™ (or approved equal) double wall design with outside cross-section dimensions of 1.75" square and a minimum thickness of 14 Ga. Picket holes in the ForeRunner rail shall be spaced 4.715" o.c., except for Invincible style 6' long, which shall be, spaced 4.98" o.c. Picket retaining rods shall be 0.125" diameter galvanized steel. High quality PVC grommets shall be supplied to seal all picket-to-rail intersections. Gate posts shall meet the 8" x 1/4" square minimum size.

#### C. Fabrication

1. Pickets, rails and posts shall be precut to specified lengths. ForeRunner (or approved equal) rails shall be prepunched to accept pickets. Pickets shall be predrilled to accept retaining rods.
2. Grommets shall be inserted into the prepunched holes in the rails and pickets shall be inserted through the grommets so that predrilled picket holes align with the internal upper raceway of the ForeRunner (or approved equal) rails (Note: This can best be accomplished by making an alignment jig). Retaining rods shall be inserted into each ForeRunner (or approved equal) rail so that they pass through the predrilled holes in each picket.
3. The manufactured galvanized framework shall be subjected to the PermaCoat® (or approved equal) thermal stratification coating process (high-temperature, in-line, multi-stage, multi-layer) including, as a minimum, a six-stage pretreatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish. The base coat shall be a thermosetting epoxy powder coating (gray in color) with a minimum thickness of 2 mils (0.0508mm). The topcoat shall be a "no-mar" TGIC polyester powder coat finish (or approved equal) with a minimum thickness of 2 mils (0.0508mm).
  - a. The color shall be Black.

4. Completed sections (i.e., panels) shall be capable of supporting a 600 lb. load applied at midspan without permanent deformation. Panels shall be biasable to a 25% change in grade.
5. Swing gates shall be fabricated using 1.75" x 14ga Forerunner (or approved equal) double channel rail, 2" sq. x 11ga. gate ends, and 1" sq. x 14ga. pickets. Gates that exceed 6' in width will have a 1.75" sq. x 14ga. intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.
6. Field welding is not allowed

## 2.2 GATE OPERATORS

- A. Gate Operators:
  1. Basis-of-Design Product: Subject to compliance with requirements, provide the DoorKing, Model 6500 or approved equal:
- B. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
  1. Provide operator with UL approved components.
- C. Comply with NFPA 70.
- D. UL Standard: Manufacturer and label gate operators to comply with UL 325.
- E. Gate Operators: Concrete base mounted and as follows:
  1. Mechanical Gate Operators:
    - a. Frequency of Use: 60 cycles per hour.
- F. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with enclosure with space for additional optional equipment. Provide the following remote-control device(s):
  1. Control Station: 1 button functions; located in the gate house.
  2. Digital Keypad Entry Unit: Programmable, multiple-code capability.
  3. Click2Enter system for emergency vehicles
- G. Vehicle Loop Detector: System includes automatic closing timer with adjustable time delay and loop detector designed to open and close gate and hold gate open until traffic clears.
- H. Vehicle Presence Detector: System includes automatic closing timer with adjustable time delay, timer cutoff switch, and presence detector designed to open and close gate, hold gate open until traffic clears
- I. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately stop gate in opening cycle and reverse gate in closing cycle, and hold until clear of obstruction.

- J. Accessories:
  - 1. Instructional, Safety, and Warning Labels and Signs: According to UL 325.

## 2.3 MISCELLANEOUS MATERIALS

- A. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C 387/C 387M mixed with potable water according to manufacturer's written instructions.

## 2.4 GROUNDING MATERIALS

- A. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
  - 1. Material above Finished Grade: Copper.
  - 2. Material on or below Finished Grade: Copper.
- B. Grounding Connectors and Grounding Rods: Comply with UL 467.
  - 1. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

## PART 3 - EXECUTION

### 3.1 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

### 3.2 GATE OPERATOR INSTALLATION

- A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
- B. Excavation for Concrete Bases: Hand-excavate holes for bases in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.
- C. Concrete Bases: Cast-in-place or precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

- D. Vehicle Loop Detector System: Install vehicle loop detector before the final topcoat of asphalt is installed
  - 1. Seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.
- E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

### 3.3 GROUNDING AND BONDING

- A. Gates and Other Fence Openings: Ground fence on each side of opening. Bond metal gates to gate posts.
- B. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
- C. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- D. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
- E. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
  - 1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.

END OF SECTION 323119.13

## SECTION 323200 – DRY STACKED ROCKERY WALLS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes installation of dry stacked rockery walls
- B. Related Sections:
  - 1. Section 200 "Excavation Filling and Grading" for excavation rockery retaining walls.

#### 1.2 ACTION SUBMITTALS

- A. Samples: For each color and texture of stone required.

#### 1.3 QUALITY CONTROL

- A. Preconstruction meeting
- B. Contractor with 5 years minimum in the installation of dry stacked rockery walls
- C. Mockups: Build mockups to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build mockups in the location and as directed by M-NCPPC Construction Manager.
  - 2. Obtain M-NCPPC Construction Manager's approval of mockups before continuing the stone wall.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 BOLDERS

- A. Existing boulders from the site
- B. Additional boulders from Carderock will make up the rest of the stone as needed
  - 1. Size: One man stone, min size from 100 – 265 lbs

## 2.2 INSTALLATION MATERIALS

- A. Drainage Fill: #57 stone
- B. Soil Fill: Comply with requirements in Section 200 for satisfactory soils.
- C. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent.
  - 1. Apparent Opening Size: No. 70 to 100 sieve, maximum; ASTM D 4751.
  - 2. Minimum Grab Tensile Strength: 110 lb; ASTM D 4632.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Leveling Base: Place and compact base material to thickness indicated and with not less than 95 percent maximum dry unit weight according to ASTM D 698.
- B. Base rocks:
  - 1. Place the largest base rocks on a properly prepared foundation as shown in the drawings. Placed with the longest rock dimension perpendicular to the face of the rockery. The second largest dimension should be parallel to the layout line of the rockery, and the smallest rock dimension should be its vertical dimension. The base rocks should be placed such that the tops of the rock are sloped back at least 5% towards the back of the rockery.
- C. Face Rock
  - 1. Place Successive lifts of facing rocks should be placed above the base rocks. In general, the width of successive rows of facing rocks will be determined based on the design rockery face batter, which will generally vary between 4V:1H and 6V:1H.
  - 2. Each rock should be placed according to the following guidelines:
    - a. Each rock should bear on at least two other rocks.
    - b. Each rock should have at least three bearing points—two in front and one in back.
    - c. The front-most bearing points for each rock should be within 4 inches of the average face of the rockery.
    - d. The rear of the rocks should be aligned along an imaginary vertical plane. If rocks larger than the minimum specified B are used, they can extend beyond this imaginary plane provided they do not interfere with rockery drainage.
    - e. The tops of each rock should be sloped back towards the backdrain as previously
      - a. When looking at the face of the rockery, the rocks should be stacked in an approximate “running bond” pattern; that is, there should be no vertical



columns of rock or continuous vertical joints running through the rockery. Continuous horizontal joints should also be avoided. The rocks should be selected and stacked such that most of the rocks in a given row are approximately the same size and gaps between rocks are minimized.

D. Cap Rock

1. Place flatter cap rocks to finish the wall as needed following the guidelines for the face rock

E. Chinking rocks:

1. Provide chinking rocks for all gaps exceeding four (4) inches. Provide chinking rocks consisting of spalls from the parent (facing) rock. The purpose of the chinking rocks is to improve aesthetics and prevent the screened backdrain material from falling out through the face of the rockery. Chinking rocks should not be movable by hand and cannot provide primary support for overlying rocks.

3.2 FILL PLACEMENT

A. General: Comply with requirements in Section 200.

B. Fill voids between and within units with #57 stone drainage fill. Place fill as each course as stones are laid.

C. Place, spread, and compact drainage fill and soil fill in uniform lifts for full width and length of embankment as wall is laid. Place and compact fills without disturbing alignment of units. Where both sides of wall are indicated to be filled, place fills on both sides at same time. Begin at wall and place and spread fills toward embankment.

END OF SECTION 323223

## **SECTION 323223 - GABION RETAINING WALL**

### **PART 1 GENERAL**

#### **1.1. RELATED DOCUMENTS**

- A. All of the Contract Documents, including GENERAL AND SUPPLEMENTARY CONDITIONS and DIVISION 01 GENERAL REQUIREMENTS, apply to the work of this Section and are hereby made a part of this Section.
- B. Examine all Drawings and other Sections of the Specifications for requirements therein affecting the work of this trade.

#### **1.2. SUMMARY**

- A. Section Includes:
  - 1. Gabion Retaining Wall with a staggered hand placed stone and concrete mixed front edge

#### **1.3. SUBMITTALS**

- A. The Contractor shall submit the following information to the M-NCPPC Construction Manager for review and approval:
  - 1. Material Data for the Products indicated
  - 2. Shop Drawings

#### **1.4. QUALITY ASSURANCE**

- A. Mockups: Before constructing wall, build mockups to verify construction technique, craftsmanship, and recycled concrete material placement. Build mockups to comply with the following requirements using materials indicated for the completed work:
  - 1. Build mockups as directed by the M-NCPPC Construction Manager.
  - 2. Obtain M-NCPPC Construction Manager's approval of mockups before completing wall.
  - 3. The mockup shall remain on site during the construction of the rest of the wall as a basis of design
    - a. The mockup will be used as a basis of craftsmanship, and construction techniques for the rest of the wall and acceptance by the M-NCPPC Construction Manager.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## PART 2 PRODUCTS

### 2.1. GABION BASKET

- A. Gabions shall consist of rectangular wire mesh formed containers filled with rock. Gabions will conform to the following:
  - 1. Welded Mesh - Welded-wire mesh with a uniform square pattern and a resistance weld at each intersection. The welded wire connections shall conform with the requirements of ASTM A 185, including wire smaller than W1.2 (0.124 in.); except that the welded connections shall have a minimum average shear strength of 70% and a minimum shear strength of 60% of the minimum ultimate tensile strength of the wire.
  - 2. Gabions shall be furnished as baskets as shown in the construction plans.
  - 3. Baskets shall be fabricated within a dimension tolerance of plus or minus 5 percent.

### 2.2. RECYCLED CONCRETE AND STONE

- A. Used recycled concrete and stone that has been salvaged from the site in accordance with Section 017414 Construction Waste Material to include the following:
  - 1. Recycled concrete for the exposed front edge shall be varied to match the aesthetic quality per the mockups. Larger and smaller pieces can be intermixed. Pieces small enough to fall out of the basket are not permitted.
  - 2. Stone and simulated stone that has been cleaned of any mortar
  - 3. Recycled concrete for the backfill shall be evenly graded and installed to structurally support the gabion structure.

### 2.3. GRANULAR SUBBASE AND BACKFILL

- A. MD-SHA #57 Stone

### 2.4. GEOTEXTILE

- A. US 230C Woven Filtration Geotextile

## PART 3 EXECUTION

### 3.1. GENERAL

- A. The Contractor shall carefully schedule the wall construction with all other site developments.

### 3.2. FOUNDATION PREPARATION

- A. The foundation on which the gabions are to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. Surface irregularities, loose material, vegetation, and all foreign matter shall be removed from foundations. When fill is required, it shall consist of materials conforming to the specified requirements. Gabions and bedding or specified geotextiles shall not be placed until the foundation preparation is completed, and the subgrade surfaces have been inspected and approved by the M-NCPPC Construction Manager.

- B. Install the compacted base to 95% compaction.
- C. Install geotextile and drain as shown on the construction documents.

3.3. ASSEMBLY AND PLACEMENT

- A. Unless otherwise specified in the construction plan, the assembly and placement of gabions shall be in accordance with the following procedures:

- 1. Assembly - Rotate the gabion panels into position and join the vertical edges with fasteners for gabion assembly. Where lacing wire is used, wrap the wire with alternating single and double half- hitches at intervals between four (4) to five (5) inches. Where spiral fasteners are used for welded- wire mesh, crimp the ends to secure the spirals in place. Where ring type fasteners are used for basket assembly, install the fasteners at a maximum spacing of 6 inches. Use the same fastening procedures to install interior diaphragms where they are required.

- a. Interior diaphragms will be installed to assure that no open intervals are present that exceed three (3) feet.

- 2. Placement - Place the empty gabions on the foundation and interconnect the adjacent gabions along the top, bottom, and vertical edges using lacing wire, spiral fasteners, or ring fasteners. Wrap the wire with alternating single and double half-hitches at intervals between four (4) to six (6) inches. Ring fasteners shall not be spaced more than six (6) inches apart. Spirals are screwed down at the connecting edges, then each end of the spiral is crimped to secure it in place. Lacing wire will be used as needed to supplement the interconnection of welded mesh gabions, and the closing of lids.

- a. Interconnect each layer of gabions to the underlying layer of gabions along the front, back, and sides. Stagger the vertical joints between the gabions of adjacent rows and layers by at least one-half of a cell length.

3.4. Pattern:

- A. Provide a pattern that creates the appearance similar in appearance to that shown in the image. The final appearance shall be decided based on the approved mockup.



### 3.5. FILLING OPERATION

- A. After adjacent empty woven wire gabion units are set to line and grade and common sides properly connected, they shall be placed in straight line tension and stretched to remove any kinks from the mesh and to gain a uniform alignment. Staking of the gabions may be done to maintain the established proper alignment prior to the placement of recycled concrete and rock. No stakes shall be placed through geotextile material.
- B. Internal connecting cross-tie wires shall be placed in each unrestrained gabion cell greater than 18 inches in height, including gabion cells left temporarily unrestrained. Two internal connecting wires shall be placed concurrently with recycled concrete and rock, at each 12-inch interval of depth.

1. In welded mesh gabions, these cross-ties or stiffeners will be placed across the corners of the gabions (at 12 inches from the corners) providing diagonal bracing. Preformed hooked wire stiffeners will be used.
  - C. The front of each gabions shall be carefully hand filed with chunks of concrete and stone along the exposed front edge of the gabion to provide an aesthetically pleasing staggered appearance. Stich in the natural and synthetic stone materials along the front edge as shown in the drawings. Backfill the rest of the basket with recycled concrete maintaining alignment, avoiding bulges, and providing a compact mass that minimizes voids. The cells in any row shall be filled in stages so that the depth of rock placed in any one cell does not exceed the depth of rock in any adjoining cell by more than 12 inches. Along the exposed faces, the outer layer of stone shall be carefully placed and arranged by hand to ensure a neat, compact placement with a uniform appearance.
  - D. The last layer of rock shall be uniformly overfilled 1-2 inches for gabions and 0.5-1 inch for gabion mattresses to allow for rock settlement. Lids shall be stretched tight over the rock fill using only approved lid closing tools. The use of crowbars or other single point leverage bars for lid closing is prohibited. The lid shall be stretched until it meets the perimeter edges of the front and end panels. The gabion lid shall then be secured to the sides, ends, and diaphragms with spiral binders or lacing wire wrapped with alternating single and double half-hitches in the mesh openings. Ring fasteners spaced not more than six (6) inches apart may be used for lid closure.
  - E. Any damage to the wire or coatings during assembly, placement and filling shall be repaired promptly in accordance with the manufacturer's recommendations or replaced with undamaged gabion baskets.
- 3.6. CLEAN-UP
- A. Remove litter, debris, and waste material from site daily.
- 3.7. BASIS OF ACCEPTANCE
- A. Acceptance of the work shall be contingent upon the decision of the M-NCPPC Construction Manager.

END OF SECTION 323223

## **SECTION 323223 - VEGETATED SEGMENTAL RETAINING WALL**

### **PART 1 GENERAL**

#### **1.1. RELATED DOCUMENTS**

- A. All of the Contract Documents, including GENERAL AND SUPPLEMENTARY CONDITIONS and DIVISION 01 GENERAL REQUIREMENTS, apply to the work of this Section and are hereby made a part of this Section.
- B. Examine all Drawings and other Sections of the Specifications for requirements therein affecting the work of this trade.

#### **1.2. SUMMARY**

- A. Section Includes:
  - 1. Vegetated Segmental Retaining Wall System, as shown in the drawings and described herein
  - 2. Components of the Vegetated Segmental Retaining Wall System including but not limited to the footing
  - 3. Warranty and maintenance of the Vegetative Segmental Retaining Wall System

#### **1.3. SUBMITTALS**

- A. The Contractor shall submit the following information to the M-NCPPC Construction Manager for review and approval:
  - 1. Qualification Data of Installer, including resumes of key personnel assigned to this project. Include certification issued by the System Provider.
  - 2. Product Data for the vegetated segmental retaining wall system provided via a single full-system submittal prepared by the System Provider. Include MSDS sheets for all materials.
  - 3. Wall Design Submittal: Shop Drawings showing typical sections, full elevations, connection details, terminations, transitions, and other unusual or project-specific details. Shop Drawings shall bear the approval of the Wall Design Engineer of Record and the approval of the System Provider.
    - a. Include retaining wall design calculations and global stability analysis stamped by a registered Professional Engineer licensed in the State of Maryland.
  - 4. Planting Plan to be designed and installed by Brookside
  - 5. Samples:
    - a. Except as indicated, provide three (3) sets of samples indicated below
    - b. Five pound container of planting media
    - c. Six-inch by six-inch sample of filter fabric
    - d. Submit one (1) precast concrete module
    - e. Six-inch sample of reinforcement strap
  - 6. Warranty: Sample warranty. Include with the sample warranty options for the Owner to extend the terms of the warranty. Include details of warranty phase Stewardship Program
  - 7. Warranty Submittals: Stewardship reports, media tests and other warranty phase submittals per Part 3 of this Section

1.4. QUALITY ASSURANCE

- A. Installer shall:
1. Have a minimum of five (5) years of documented successful experience in installation of projects of similar complexity and scale
  2. Have the facilities capable of meeting all requirements of Contract Documents
  3. Provide full-time site supervision during all phases of installation; Site Supervisor must have a minimum of two (2) years documented experience in successful installation of projects of similar complexity and scale; Site Supervisor must be able to communicate effectively with Owner, M-NCPPC Construction Manager, and installation crews; Site Supervisor must be a full-time employee of Installer
- B. Source Limitations: With the exception of backfill, leveling pad material, and drainage aggregate, the System Provider will supply all materials in this Section for a complete and compatible system
- C. Geotechnical Engineer Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated
1. M-NCPPC Construction Manager shall engage Geotechnical Engineering inspection services during construction. These inspection services shall, at a minimum, include foundational soil inspection, soil and backfill testing, verification of design parameters, and observation of construction for general compliance with the design drawings and specifications
  2. Field inspection and testing shall be performed by the Wall Design Engineer of Record or the Geotechnical Engineer
- D. Tests for reinforcement strap shall be conducted by an independent laboratory with the experience and capabilities to prepare each test listed for reinforcement strap in Part 2, as well as melt flow index and molecular weight (polyester).
- E. Tests for precast concrete modules shall be conducted by an independent laboratory with experience and capabilities of testing precast concrete materials.
- F. Tests for growth media shall be conducted by an independent laboratory recognized by the Department of Agriculture of the state in which the wall will be installed. Laboratory must be experienced in conducting the tests indicated.
- G. Comply with all local, state and federal laws regarding earthwork, including the project's approved erosion and sediment control plan.
- H. Provide a mockup in a location as approved by the Engineer. Mockup shall illustrate typical construction craftsmanship and construction tolerances which are acceptable for this project. Maintain mockup during all Work of this Section. Mockup may remain in-place as part of the completed Work as allowed by the Engineer.
- I. Pre-Construction Meeting: At least one week prior to the commencement of work described under this section, the Installer and System Provider shall meet with the general contractor to discuss project sequence, procedures for methods for protecting the work, and review completed work for compliance with the specifications.



- J. Mockups: Before constructing wall, build mockups to verify construction technique, craftsmanship, and recycled concrete material placement. Build mockups to comply with the following requirements using materials indicated for the completed work:
1. Build mockups as directed by the M-NCPPC Construction Manager.
  2. Obtain M-NCPPC Construction Manager's approval of mockups before completing wall.
  3. The mockup shall remain on site during the construction of the rest of the wall as a basis of design
    - a. The mockup will be used as a basis of craftsmanship, and construction techniques for the rest of the wall and acceptance by the M-NCPPC Construction Manager.
  4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## PART 2 PRODUCTS

### 2.1. VEGETATED SEGMENTAL RETAINING WALL SYSTEM

- A. Subject to compliance with requirements, provide the following:
1. SmartSlope C185 by Furbish

### 2.2. PLANTS

- A. Species to be selected and installed by Brookside.

### 2.3. MODULES

- A. SmartSlope C185
1. Material: Wet-cast concrete
  2. Color: System Provider's standard olive green. Provide integral color.
  3. Dimensions: Each module is twenty inches (20") wide, eight inches (8") tall, and fifteen inches (15") deep
  4. Configuration: Each module contains one face, two side walls, a floor, and an unbound rear and top opening
    - a. A slot exists near the center of each module floor. The slot allows reinforcement strap to be laced through the module for a mechanical connection between concrete modules and structural reinforcement
    - b. Planting pocket ratio: 0.65 cubic feet of growth media planting zone per square foot of wall face
  5. Weight: Approximately 80 lbs per module
  6. Compressive strength: Minimum 5,000 psi at 28 days
  7. Concrete is mixed with air entrainment appropriate to the region in which the modules will be installed

### 2.4. REINFORCEMENT STRAP

- A. Material: Polymeric strap formed of high tenacity yarns placed in tension and co-extruded with polyethylene
1. Polyester molecular weight: minimum 25,000 Meg/m
  2. Carboxyl end group values: less than 30
- B. Dimensions: Four-inch (nominal) width

- C. Long-Term Allowable Tensile Design Load per the Wall Design Submittal
- D. Soil Interaction Coefficient (Ci) displacement Values shall be determined per GRI-GG5.

2.5. SOILS

- A. Backfill: Division 200R "Excavation, Filling & Grading"
- B. Leveling Pad: Acceptable subbase material per Division 212R "Stone Base"

2.6. ACCESSORIES

- A. Filter Fabric (Separation Fabric). Root-permeable, non-woven geotextile which is used to separate growth media from backfill and drainage aggregate. Inert to biological degradation and resistant to naturally occurring chemicals, alkalis and acids.
  - 1. Material: Polypropylene
  - 2. Recycled content:  $\geq 30\%$
  - 3. Unit weight: 4-6 oz/yd<sup>2</sup> ASTM-D3776
  - 4. Grab tensile strength:  $\geq 60$  lbs ASTM-D4632
  - 5. Grab tensile elongation:  $\geq 50\%$  ASTM-D4632
  - 6. Trapezoid tear strength:  $\geq 50$ lbs ASTM-D4533
  - 7. CBR puncture strength:  $\geq 70$  lbs ASTM-D6241
  - 8. Permittivity:  $\geq 0.9$ sec-1 ASTM-D4491
  - 9. Flow rate:  $\geq 100$  gpm/ft<sup>2</sup> ASTM-D4491
  - 10. UV Resistance at 500 hours:  $\geq 70\%$  ASTM-D4355
- B. Setback blocks: System Provider's standard form fitted blocks that provide a consistent register at 30° batter
- C. Drainage Pipe: Perforated schedule 40 PVC pipe, per ASTM D-3034

PART 3 EXECUTION

3.1. GENERAL

- A. The Contractor shall carefully schedule the wall construction with all other site developments.
- B. The Contractor shall install each component of the vegetated cover system in accordance with approved submittals and the Contract Documents
- C. Protect adjacent work from damage during all phases of installation

3.2. EXAMINATION

- A. Examine site conditions for compliance with drawings and other conditions which may affect the Work of this Section
- B. Confirm that the subbase has been graded per drawings and specifications or as directed by the design engineer. Ensure that exposed subbase soil shall be observed by the Geotechnical Engineer prior to construction to verify that the exposed material has been compacted to at least 95% standard Proctor Density and is suitable for the net design bearing pressure of the wall. Ensure that the base of the excavation is free of loose soil, non-compacted fill, water, or frozen material.

- C. Notify the Engineer immediately if any conditions are present that may be detrimental to the performance of the Work. Proceed only after unsatisfactory conditions have been corrected.

3.3. BACKFILL ZONE, REINFORCEMENT AND COMPACTION

- A. Sequence backfill, reinforcement and compaction to occur concurrent with wall construction.
- B. Backfill and compact reinforcement zone to at least 95% Standard Proctor Density and per Earth Moving specifications in eight-inch (8") lifts (one lift per wall course).
- C. Install reinforcement strap per the approved Wall Design Submittal.
- D. Lay straps horizontally at the same elevation as the floor of the modules through which they are laced. Gently pull slack out of strap before placing backfill. Position straps in a V-shaped formation so that terminal ends of straps are 30 to 34 inches apart, per the drawings and Installation Manual.
- E. Place and compact backfill in a manner that minimizes wrinkles and movement of the reinforcement.
- F. Do not operate equipment over reinforcement strap except rubber-tired or rubber-tracked equipment as approved by the Geotechnical Engineer. Do not operate any equipment other than vibratory plates within three feet (3') of the rear of modules.
- G. Geotechnical Engineer shall test field density and approve of backfill, reinforcement and compaction. Correct unsatisfactory work.
- H. Provide a drainage swale at the top of the wall, per the drawings, to prevent surface runoff from flowing along the face of the wall.

3.4. VEGETATED SEGMENTAL RETAINING WALL INSTALLATION

- A. Install leveling pad to lines and grades per drawings or as directed by the Engineer. Level to receive first course of modules. Compact leveling pad to minimum 95% Standard Proctor Density.
- B. Sequence wall construction to occur concurrent with backfill, reinforcement and compaction.
- C. Install drainage aggregate behind modules per drawings. Separate drainage aggregate from backfill and from growth media with filter fabric
- D. Install vegetated segmental retaining wall in accordance with System Provider's most current
- E. Construction tolerances
  1. Vertical alignment of wall face:  $\pm 1.5$  inch (37 mm) over any 10 ft (3 m) distance
  2. Horizontal alignment of wall face:  $\pm 1.5$  inches (37 mm) over any 10 ft (3 m) distance.
  3. Wall Batter: within 2 degrees of design batter.
  4. Maximum horizontal gap between erected units: 9 inches (23 cm).
  5. Lippage: maximum vertical distance between rails of adjacent units: 1/8 inch
  6. Corners, bends, curves:  $\pm 1$  ft (0.3 m) to theoretical location.
- F. Growth Media Placement:

1. Place media within each module. Lightly tamp into place using small, handheld tools, in conformance with approved mockup.

3.5. PLANTING

- A. Planting to be completed by Brookside Staff

3.6. CLEAN-UP

- A. Remove litter, debris, and waste material from site daily.

3.7. BASIS OF ACCEPTANCE

- A. Acceptance of the work shall be contingent upon the decision of the M-NCPPC Construction Manager.

END OF SECTION 323224

## **SECTION 328400 - IRRIGATION SYSTEM**

### **PART 1 GENERAL**

#### **1.1. RELATED DOCUMENTS**

- A. All of the Contract Documents, including GENERAL AND SUPPLEMENTARY CONDITIONS and GENERAL REQUIREMENTS, apply to the work of this Section and are hereby made a part of this Section.
- B. Examine all Drawings and other Sections of the Specifications for requirements therein affecting the work of this trade.

#### **1.2. SUMMARY**

- A. Section Includes:
  - 1. Piping.
  - 2. Encasement for piping.
  - 3. Manual valves.
  - 4. Pressure-reducing valves.
  - 5. Automatic control valves.
  - 6. Automatic drain valves.
  - 7. Transition fittings.
  - 8. Dielectric fittings.
  - 9. Miscellaneous piping specialties.
  - 10. Sprinklers.
  - 11. Quick couplers.
  - 12. Drip irrigation specialties.
  - 13. Controllers.
  - 14. Boxes for automatic control valves.
- B. Includes but not limited to furnishing labor, materials, equipment and services necessary to properly and completely install a fully functioning automatic sprinkler system as described herein and on the Drawings. Work shall include, but is not limited to:
  - 1. Complete, fully operational sprinkler system as described on Drawings, fully warranted and free of defects for twelve consecutive months after acceptance.
  - 2. Coordinate work of this section with work of related trades and sub-contractors to assure smooth progression of work and verify underground utility locations.
  - 3. Trenching and backfilling for all pipes, valves, and equipment specified. Tamping of all trenches to the compaction specified.
  - 4. Furnishing and installing all mains, laterals, fittings, control valves, electric wire, heads, manual valves, etc., and all necessary specialties and accessories as required for a complete, operational system
  - 5. Cutting and trimming turf around all sprinkler heads and equipment.

6. Testing of irrigation system including mainline pressure test, overall system test and adjustment prior to acceptance, and overall system test, adjustment, and repairs at the end of the 12 month warranty period.
  7. Regulating and adjusting all emitters, time sequence control devices and section valves.
  8. Maintenance as defined in this Section.
  9. Submission of required documents, and required maintenance during warranty period.
- C. The Contractor shall provide all services, labor, materials and equipment required for all irrigation work and related operations necessary to complete the Work as shown on the Drawings or specified herein.
- D. The elevations shown on the Drawings as existing are taken from the best existing data and are intended to give reasonably accurate information about the existing elevations. The Contractor shall become satisfied as to the exact quantities of materials and labor required to complete the Work of this Section.
- E. Irrigation operations shall be performed in a safe and proper manner, by Contractors meeting the qualifications described herein, with appropriate precautions being taken against hazards.
- F. Work associated with this Section shall be maintained by the Contractor in good condition at all times until final acceptance by the M-NCPPC Construction Manager. Damage caused by erosion, acts of God, or construction operations during the life of the Contract, shall be repaired at the Contractor 's expense using material of the same type as specified herein.
- G. The plans and specifications provides performance requirements for the irrigation system. The contractor may provide an alternate system providing the criteria is met. Shop drawings shall be provided for the M-NCPPC Construction Manager's approval.
- H. Related Requirements:
1. Section 131200 "Fountains".
- 1.3. QUALITY ASSURANCE
- A. Inspection and Approval:
1. Materials and workmanship are subject to inspection by the M-NCPPC Construction Manager at any time and place, before or after installation, for compliance.
  2. Furnish the M-NCPPC Construction Manager with every reasonable facility for ascertaining whether or not the Work performed and the products used are in accordance with the intent and requirements of the Specifications and Contract Documents. No Work shall be done or products used without suitable inspection by the M-NCPPC Construction Manager. Failure to reject any defective Work or product shall not in any way prevent later rejection when such defect is discovered, or obligate the M-NCPPC Construction Manager to final acceptance.
  3. Inspection of the Work shall not relieve the Contractor of any obligations to fulfill the Contract. Defective Work shall be made good regardless of whether such Work has been previously inspected by the M-NCPPC Construction Manager and accepted or estimated for payment. Failure of the M-NCPPC Construction Manager to reject improper Work shall not be considered a waiver of any defect which may be discovered later, or for Work actually defective.

B. Warrantee Period

1. Materials, Equipment and Workmanship Warrantees Guarantee materials and Workmanship for 12 months from the date project is accepted by M-NCPPC Construction Manager to include:
  - a. Filling and repairing depressions and replacing sportsturf and skinned area material damaged from settlement or repair of irrigation trenches.
  - b. Protecting equipment from freeze damage.
  - c. Adjust sprinkler heads as required to maintain complete, effective coverage, and to keep spray off structures and pavement throughout warranty period.

C. Repair or replace defective parts

D. Contractors Qualifications:

1. Contractor performing the work of this Section shall be knowledgeable in the irrigation system at Brookside Gardens and have at least 10 years of experience installing Rainbird irrigation systems. Inspections:
  - a. Contractor shall coordinate with the M-NCPPC Construction Manager to monitor progress and compliance with Plans and Specifications.
  - b. Inspected work that is found to be in violation of the Plans or Specifications shall be brought into compliance before reinspection .

E. Utilities Protection: The irrigation plan is not a survey of underground utilities. It is the responsibility of the Contractor to have all utilities clearly marked before starting work and to have the markings maintained throughout construction.

F. Protection of Existing Plants and Site Elements: Protect remaining site elements, the work of other trades, adjacent properties, and easements, and rights-of-way, and all areas outside of the limit-of-work area. Damages shall be repaired at the Contractor 's expense.

1.4. JOB CONDITIONS

- A. Utilities and Existing Structures: The exact location of existing structures and overhead or underground utilities, shall be determined by the Contractor and he shall conduct his work so as to prevent interruption of service or damage to them. Protect existing structures and utility services and repair damages.
- B. Finish Grades: Verify the correctness of all finish grades within the work area to insure the proper soil-coverage depth over pipe lines
- C. Adjustments: Make minor adjustments to avoid fixed obstructions, to insure complete coverage, and as directed by M-NCPPC Construction Manager.
- D. Product Storage: During construction and storage, protect materials from damage and prolonged exposure to sunlight.
- E. Keep premises free from rubbish, debris, and excavated trench material, at all time. Store materials so as no to interfere with the operation of the Project.

- F. System Operation: System shall be under fully automatic operation for three days prior to the start of grassing operations.
- G. Timing and Scheduling: Field turf Contractor shall determine application rates and timer cycling. The Irrigation Contractor shall instruct the M-NCPPC Construction Manager on operation and programming, and shall assist the M-NCPPC Construction Manager in such operations throughout the maintenance period. Adjustments, repairs, etc., other than programming are the responsibility of the Irrigation Contractor.
- H. Provide hand watering required at any time during the project at Contractor 's expense.

#### 1.5. SYSTEM DESCRIPTION

- A. Layout of irrigation equipment.
  - 1. Locations of equipment shown on Drawings are approximate. Actual placement may vary as required to achieve full, even coverage without spraying onto buildings, sidewalk, fences, adjacent pavements, etc.
  - 2. During layout, consult with the M-NCPPC Construction Manager to verify proper placement and for recommendations where adjustments are required. Minimize head loss in the system.
  - 3. Make necessary adjustments in layout as required to connect to meter should such equipment not be located as shown, and as may be required to work around new construction, at no increase in contract award.
  - 4. Flag the locations of all equipment, emitters, etc., and obtain M-NCPPC Construction Manager's approval of their locations before installing.
  - 5. Brand the valve zone-sequence number or flow-control description on the underside of each valve box using a soldering gun or equal device capable of permanently engraving the description required.

#### 1.6. SUBMITTALS

- A. The Contractor shall submit the following information to the M-NCPPC Construction Manager for review and approval:
  - 1. Materials to Be Submitted With Bid
    - a. Contractor Qualifications:
    - b. Proposed construction schedule.
  - 2. Materials to Be Submitted After Award and During Construction
    - a. Certificates and Bills of Laden for all equipment and material and deliveries.
    - b. Product warranties and manufacturer specification sheets that prove a product's compliance and suitability for inclusion in the Work.
    - c. Instruction Manual
      - 1) Provide instruction manual which lists complete instructions for system operation and maintenance, and product information sheets and warranties.
      - 2) Include complete exploded drawings of all equipment installed showing components and catalog numbers with the manufacturer's name and address.
      - 3) Submit in black plastic, three-ring binder with the name of the project clearly and permanently marked on the cover. On the inside cover, clearly



mark name, address and phone number of installer, Utility-Location file number, permit numbers, and date of project acceptance.

3. As-Built Plans
  - a. Complete as-built drawings showing the locations of all installed equipment. Control valves shall be shown with measurements to two permanent locations (light poles, buildings, permanent structures, etc.). Control valves shall be prominently marked in the numbered sequence matching that of the controller. Submit one bond hard copy with one electronic CD copy on AutoCAD latest version.
4. Mainline Test Affidavit
  - a. Letter designating the hourly pressure readings taken during mainline test, with date and location of test, signed by Contractor.

## PART 2 PRODUCTS

### 2.1. PIPE, FITTINGS AND CONNECTIONS

- A. Pipe: Piping shall be from virgin parent material, homogeneous throughout, free from visible cracks, holes, foreign materials, blisters, sun-exposure, deleterious wrinkles and dents, and National Sanitation Foundation (NSF) approved. Larger sizes than specified may be substituted without M-NCPPC Construction Manager approval.
- B. Pressurized Laterals – PVC
  1. Polyvinyl Chloride (PVC), Sch 40 up to but not including 3 inches in diameter.
  2. Sch. 40 PVC with bell and gasketed ends and Sch 80 PVC fittings for all pressurized laterals 3 inches in diameter and over.
  3. Type I, Grade I, Pressure Rated Pipe meeting the requirements set forth in ASTM D-1784-81. Outside diameter shall be the same size as iron pipe.
  4. Marked at 5 foot minimum intervals with the following information: Manufacturer's name or trade mark, nominal pipe size, schedule, PVC type and grade SDR rating class, working pressure at 73 degrees F. - (NSF).
  5. PVC Type I shall not be threaded.

### 2.2. ELECTRICAL CONTROL WIRING

- A. All control wire shall be two wire as recommended by Rainbird to run the decoder system

### 2.3. SPLICING MATERIAL

- A. Provide splice kit from the manufacturer that is specifically made for direct burial irrigation applications. The kit shall contain every component to complete the splice to including the pre-filled insulator tube. No crimping is allowed.

### 2.4. VALVES

- A. Electric Control Valves - As described on Drawings.

B. Pressure Reducing Valve - As described on Drawings.

C. Quick Coupler - As described on Drawings.

## 2.5. BACKFILL MATERIALS

A. Pea Gravel: Use around drains and in base of valve boxes. 1/2-inch maximum round, water worn, washed rock.

B. Native Material: Soil native to project site free of wood and other deleterious materials and rock over 1 inch in diameter for backfilling pipe.

## 2.6. AUTOMATIC CONTROLLER

A. Tie into the existing Rainbird controller.

## PART 3 EXECUTION

### 3.1. GENERAL

A. The Contractor shall carefully schedule the irrigation work with all other site developments.

B. Sleeves are required wherever piping or electrical wires are placed under paved surfaces. Where electrical control wiring does not run in the trench with piping, it shall be encased in sch 40 PVC conduit set minimum 24 in. below finish grade.

C. Full and complete coverage is required. Make necessary adjustments to achieve full coverage of irrigated areas at no additional cost to the M-NCPPC Construction Manager.

D. Where piping is shown on the Drawings to be under paved areas but running parallel and adjacent to planted areas, the intent is to install piping in planted areas.

E. Visibly mark the location of all sprinkler heads with irrigation flags for inspection by M-NCPPC Construction Manager. Adjust locations and add additional heads to assure proper coverage of all areas. In no case shall spacing of sprinkler heads exceed distances shown on the Drawings.

F. Pipe sizes shall conform to those shown on the Drawings.

G. Damaged or rejected materials must be removed from the site immediately.

H. Install all equipment prior in coordination with the placement of planting soils section 32 94 00 topsoils as indicated in

I. After planting soils are installed and construction is complete and project is ready for planting, Contractor shall uncover the swing joints and install the sprinkler heads. Aluminum cans shall be discarded off site.

J. Contractor shall adjust all sprinkler heads and assure complete coverage is obtained.

- K. Assure sprinkler system is 100% operational and complete before planting commences.

### 3.2. TRENCHING AND BACKFILLING

- A. Perform excavations as required for installation of work included under this Section, including shoring of earth banks. Restore all surfaces, existing underground installation, etc., damaged or cut as a result of the excavations, to their original condition.
- B. Coordinate all trenching with tree protection measure requirements to include the use of the air spade, root pruning, and root protection mat. All trenching and backfill in these areas will be completed under the direction of the Certified Arborist hired for the project
- C. Notify the M-NCPPC Construction Manager if underground utilities not previously located are found. Failure to do so will make Contractor liable for damages. Indicate such utility crossings on the record drawings.
- D. Trenches shall be open, vertical sided construction wide enough to provide free working space around work installed and to provide ample space for backfilling and compacting.
- E. Depth of trenches shall be sufficient to provide a minimum cover above the top of the pipe as follows:
  - 1. Lateral Lines: 24 inches
  - 2. Main Line: 36-inches
- F. Cut trenches to required grade lines and compact bottom to provide accurate grade and uniform bearing for the full length of the line.
- G. Pulling of pipe is not permitted.
- H. Do not cover pressure main, sprinkler pipe, or fittings until lines and equipment have been inspected and approved.
- I. The balance of the trench backfill shall be placed in two layers, with each layer mechanically compacted to 98 percent of the maximum dry density. Hand tamping and water settling are not acceptable. Submit validation of compaction by Soils Engineer.
- J. The CONTRACTOR shall be held responsible for damages caused by these operations and shall immediately repair or replace damaged parts and materials.

### 3.3. INSTALLATION OF PLASTIC PIPE

- A. Install plastic pipe in manner to provide for expansion and contraction as recommended by manufacturer.
- B. Cut plastic pipe square. Remove burrs at cut ends prior to installation so unobstructed flow will result.
- C. Carefully set pipe in trenches to avoid fill under pipe. After completely flushing system, install pipe and fittings and close openings with duct tape.

3.4. SOLVENT-WELD JOINTS FOR PVC PIPES

- A. Make solvent weld joints in the following manner:
1. Do not make solvent weld joints if ambient temperature is below 40 degrees F.
  2. Clean pipe ends and fittings with clean, dry cloth and apply one coat of P-70 cleaner with rag and wipe thoroughly.
  3. Apply uniform coat of 711 solvent to outside of pipe.
  4. Apply solvent to fitting in a similar manner.
  5. Quickly insert into fitting, giving pipe or fitting a quarter turn to insure even distribution of solvent and to make sure pipe is inserted to full depth of socket.
  6. Hold in position for 15 seconds minimum or long enough to secure joint and wipe off excess solvent.
  7. Do not use excessive amount of solvent thereby causing obstruction to form on inside of pipe.
  8. Allow joints to set at least 6 hours before applying full pressure to pipe.
  9. Handle material carefully. Caution should be utilized in handling Type I pipe due to the possibility of cracking or splitting when dropped or handled carelessly.
  10. Do not handle pipe when the ambient temperature is below 40 degrees F.

3.5. THREADED JOINTS FOR PVC PIPE

- A. Use Teflon tape on all threaded PVC fittings.
- B. Use strap-type friction wrench only. Do not use metal-jawed wrench.
- C. Tape threaded connections with Teflon tape. Do not over-tighten threaded connections.

3.6. CONTROL VALVES

- A. Install control valves in accordance with manufacturer's recommendations and according to electric code.
- B. Provide valves in specified boxes with top set flush with finish grade. Use stacked, mortared brick to raise top of box flush with finish grade.
1. Fill below the box with a minimum of 12" of pea gravel for drainage as shown in the details
- C. Set valve boxes over valve so valve can be reached for service and as described on Drawings. Clean dirt and debris off gravel before final inspection.

3.7. CONTROLLER WIRING

- A. Electrical equipment and wiring to comply with local and state codes and shall be installed by those skilled and licensed in the trade.
- B. Wiring shall occupy the same trench as pressure supply or lateral lines wherever possible.
- C. Enclose wiring in specified conduit when wire is not set with piping.

- D. Install wire beneath piping and tape securely to piping every 10 feet.
- E. Control-wire splices at remote control valves to be crimped and sealed with specified splicing materials. Line splices will be allowed only on runs of more than 500 feet and must be located in "Jumbo" valve boxes. Use one splice per connector sealing packs.

3.8. FIELD QUALITY CONTROL

- A. Test under the supervision of the M-NCPPC Construction Manager. Submit written requests at least three days prior to anticipated inspection date.
- B. Flush lines under a full head of water before installing heads, valves, etc. Flush for a minimum of three minutes at the valve located furthest from water supply.
- C. After flushing, cap or plug openings to prevent entrance of materials that would obstruct the pipe or clog heads. Leave in place until removal is necessary for completion of installation.
- D. Test as specified below and then complete assembly and adjustment after testing.

3.9. BACKFILLING AND COVERING

- A. Backfill excavations and trenches after system is operating and required tests and inspections have been passed.
- B. Backfill for all trenches not under pavement shall be placed in two layers, with each layer mechanically compacted with a narrow-footed tamp to 95 percent of the maximum dry density in accordance with ASTM-D698-78. Hand compacting and water settling are not acceptable.
- C. Backfill material shall be as specified. Unsuitable material, including clods and rocks over 1-1/2-inches in size shall be removed.

3.10. ADJUSTMENT

- A. Adjust watering time of valves to provide proper amounts of water to all turf areas.
- B. Instruct Owner on timing adjustments required by seasonal weather conditions. Provide a typical 12 month timing schedule based on average rainfall and climatic conditions for the region.

3.11. CLEAN-UP

- A. Remove litter, debris, and waste material from site daily.
- B. Sweep sidewalks and parking areas at the end of each day.
  - 1. Any impact to the pervious pavement associated with the installation of the irrigation system to include sediment loading, cracked pavers, and scratches will be the responsibility of the Contractor to repair at their own cost.

- C. Clean all equipment and remove standing water from valve boxes and other equipment prior to final inspection.
- D. Locate debris piles generally out of sight and allow safe, unobstructed access and to maintain traffic sightlines.

3.12. BASIS OF ACCEPTANCE

- A. After successful completion of a complete and fully functioning system, all required work, repairs, replacements, punch-list items, and the submittal of all required materials, the Contractor shall arrange a final inspection of the work by the M-NCPPC Construction Manager.
- B. Acceptance of the work shall be contingent upon the decision of the M-NCPPC Construction Manager.

END OF SECTION 329202

## **SECTION 329400 PLANTING SOILS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. All of the Contract Documents, including GENERAL AND SUPPLEMENTARY CONDITIONS and GENERAL REQUIREMENTS, apply to the work of this Section and are hereby made a part of this Section.
- B. Examine all Drawings and other Sections of the Specifications for requirements therein affecting the work of this trade.

#### **1.2 SCOPE OF WORK**

- A. This Section specifies administrative and procedural requirements for manufactured planting soils (planting soils) including, but not limited, to the following:
  - 1. Evaluation of rough subgrade water infiltration.
  - 2. Stripping of on-site topsoil, acquisition of additional base components for planting soils and blending of soils.
  - 3. Testing and analysis for specification conformance.
  - 4. Inspection and testing of subgrade for preparation of subgrade.
  - 5. Preparation of mixes and testing for conformance.
  - 6. Installation and placement of soils.
  - 7. De-compaction and re-compaction of soils.
  - 8. Final in-place testing of soils.
  - 9. Coordination with other contractors.
  - 10. Clean-up.
- B. References to other Sections are given that would duplicate provisions in this Section.

#### **1.3 RELATED WORK UNDER OTHER SECTIONS**

- A. Section 705 – Seeding and Sodding for Turf Areas
- B. Section 328400 – Planting Irrigation
- D. Section 200 - Excavation Filling and Grading

1.4 QUALITY ASSURANCE/DEFINITIONS

A. Definitions:

1. ASA: American Society of Agronomy.

B. Testing/Testing Agency

12. Refer to this section, 1.5 B.

C. Contractor is solely responsible for quality control of the Work.

D. The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the Work, including the preparation, mixing and installation of custom Planting Soil and planting mixes in urban locations.

1. Installer Field Supervision: Installer to maintain an experienced full-time supervisor on Project site when any Planting Soil preparation work is in progress.
2. The installer's crew shall be experienced in the installation of soil, grading and interpretation of grading plans in urban areas.

E. Soil work shall be performed by a firm that has sufficient earthwork machinery at the job site simultaneously to amply provide for the vigorous execution of the site work without interruption or delay, except for unforeseen circumstances, such as weather. Machinery operators shall be well experienced in this type of work.

F. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

G. Comply with all requirements for control of silt and sediment during soil installation work as indicated in the contract documents. Provide additional silt and sediment control to maintain silt and sediments within the working area as required by the progress of the work or as directed by the Landscape Architect and Soil Scientist.

H. Pre-installation Conference: Conduct conference at project site prior to the start of any work related to Planting Soil preparation and shall meet the requirements of this Section 3.1(D).

I. Layout and Grading:

1. Permanent benchmarks shall be established by a registered land surveyor or professional civil engineer, at the Contractor's expense. The Contractor shall maintain established bounds and benchmarks and replace them, if any are destroyed or disturbed.
2. The Contractor shall maintain at the site, sufficient surveying equipment, including a surveyors level, rod and measuring tapes, to accurately excavate to the required subgrades and install soil to the required finish grade. The Contractor shall set



wooden 1.5" x 1.5" grade stakes at intervals sufficient to establish excavation limits and final grade contours. Drive stakes solidly into the ground. Mark with a permanent marker. Stakes for soil depth areas and finished grades shall remain in place until planting work is completed and a landscape punch list has been issued by the Landscape Architect and Soil Scientist.

#### 1.5 TESTING, SUBMITTALS, MOCK-UPS AND INSPECTIONS

- A. Certificates: Within 2 weeks of placement, contractor shall submit certification that all soil blend components and all soil blends meet all environmental standards of the State of Connecticut for use in residential zones.
- B. Testing for Planting Bed Soil, Lawn & Bio Swale Soil, Sand Based Structural Soil, On-Site Topsoil and Horticultural Subsoil: Testing is required at the following intervals:
  - 1. Testing of individual components for all soil mixes. Tests are as described in Section 329400, 1.5, C.
  - 2. After test results for base soil components have been accepted, create sample mixes of each planting soil mix and perform tests described in Section 329400, 1.5, C.
  - 3. After the test results for planting soil mixes have been accepted, and during the placement of planting soils, test every 500 cubic yards of soil mix delivered to the job site. Testing applies to all soil layers of the planting profile.
  - 4. For sod lawn areas, prior to submitting sod for approval, submit sample of Sod Farm Growing Media and test analysis.
- C. Test Reports: Submit certified reports for tests as described in this Section.
  - 1. Mechanical gradation (sieve analysis) shall be performed and compared to the USDA Soil Classification System. Percent clay (0.002 mm) shall be reported separately in addition to silt (ASTM D-422-63, hydrometer method).
  - 2. The silt and clay content shall be determined by a Hydrometer Test of soil passing the #270 sieve.
  - 2. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH. Recommendations for pH adjustments and fertilizer soil amendments shall be included with all test reports.
  - 4. Tests shall be conducted in accordance with Recommended Soil Testing Procedures for the Northeastern United States, 2nd Edition, Northeastern Regional Publication No. 493; Agricultural Experiment Stations of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and West Virginia; Revised - December 15, 1995. Tests include the following:

- a. Test for soil Organic Matter by loss of weight on ignition, as described in Northeastern Regional Publication No. 493.
  - b. Test for soil CEC by exchangeable acidity method as described in Northeastern Regional Publication No. 493.
  - c. Test for soil Soluble Salts shall be by the 1:2 (v:v) soil:water Extract Method as described in Northeastern Regional Publication No. 493.
  - d. Test for Buffer pH by the SMP method as described in Northeastern Regional Publication No. 493.
5. Certified reports on analyses from producers of composted organic materials are required, particularly when sources are changed. Analyses will include all tests for criteria specified in 2.01F.
6. Density Tests: In-place density testing is required in all areas. Placed planting soils must be inspected for compaction level by the soil scientist or by the following: ASTM D1556 Density of Soil and Rock In Place Using Sand Cone Method, ASTM D6938-10 Nuclear Methods or ASTM D2167-08 Rubber Balloon method. ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. In-place density tests shall be carried out at a rate of one test per 1,000 square feet for each type of material placed.
- a. Sand Based Structural Soil must be tested for in place density by ASTM methods and reported as percent of Standard Proctor values.
7. Testing Agencies: The following firms are acceptable testing agencies for the various components.
- a. Leaf Yard Waste Compost Stability Test and Pathogens/ Metals/ Vector Attraction: Woods End Research Laboratory, P.O. Box 297, Mt. Vernon, ME, 04352, tel: 201.293.2457, fax: 201.293.2488.
  - b. Leaf Yard Waste Compost/ All other tests except those listed above: University of Massachusetts, West Experiment Station, Amherst, MA 01003, tel: 413.545.2311, fax: 413.545.1931.
  - c. Mechanical Gradation and Chemical Analysis, All Components and Soil Mixes: University of Massachusetts, West Experiment Station, Amherst, MA 01003, tel: 413.545.2311, fax: 413.545.1931.
  - d. Approved Equal
- D. Samples: Prior to ordering the below listed materials, submit representative samples to the M-NCPPC Construction Manager and Soil Scientist for selection and approval. Do not order materials until M-NCPPC Construction Manager's and Soil Scientist's approval has been obtained. Delivered materials shall closely match the approved samples.
1. Organic amendment (Compost): duplicate samples of 1 gallon.

2. Imported Base Loam: duplicate samples of 1 gallon.
  3. Coarse Sand: duplicate samples of 1 gallon
  4. Crushed Stone for use over Sand Based Structural Soil: duplicate samples of 1 gallon
  5. Planting Bed Soil, Lawn Soil, Bioretention Soil, and Sand Based Structural Soil after approval of individual components: duplicate samples of 1 gallon.
  6. Sod Farm Growing Media (if required): 1' by 1' section of sod to be used on the project.
- E. Sources for Soil Components and Soil Mixes: Submit information identifying sources for all soil components and the firm responsible for mixing of soil mixes.
1. M-NCPPC Construction Manager and Soil Scientist shall have the right to reject any soil blender. Soil components must be approved in writing prior to delivery to site.
- F. Mock Up and Inspection
1. At the beginning of site work, the contractor shall demonstrate, in the presence of the Soil Scientist, subgrade preparations, including de-compaction and re-compaction methods that achieve the requirements of this Section. All subsequent subgrade preparations shall be in accordance with approved methods.
  2. The Contractor shall not place Planting Soil, Lawn Soil, Bioretention Soil, Sand or Based Structural Soil on prepared subgrade prior to inspection and approval of M-NCPPC Construction Manager, Landscape Architect and Soil Scientist for compliance with depth, compaction and percolation rate. The Contractor shall request inspection before proceeding at least ten working days prior to placement of soils.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 200 - Excavation Filling and Grading for overall material handling requirements.
- B. In addition, the following provision is established: Material shall not be handled or hauled, placed or compacted when it is wet as after a heavy rainfall, early spring or if frozen. Soil shall be handled only when the moisture content is compliant with Section 329113 1.6.H. The Landscape Architect and Soil Scientist, the Soil Scientist and the Owner shall be consulted to determine if the soil is too wet to handle.
- C. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft.
- D. Sequence deliveries to avoid delay. On-site storage space is permissible only with written notice from M-NCPPC Construction Manager. Deliver materials only after preparations for placement of planting soil have been completed.

- E. Prohibit vehicular and pedestrian traffic on or around stockpiled planting soil.
- F. The Contractor shall set up a staging area in an agreed location to store base components and to blend Planting Soils. Planting Soils that are to be stockpiled longer than two weeks, whether on or off site, shall not be placed in mounds greater than six feet high.
- G. Vehicular access to the site is restricted. Before construction, the Contractor shall submit for approval a plan showing proposed routing for deliveries and site access.
- H. Soil Moisture Content
  - 1. Contractor shall not move, blend or grade soil when moisture content is so great that free moisture is apparent, nor when it is so dry that dust will form in the air or that clods will not break readily, nor when it is frozen. Apply water, if necessary, or allow to dry to bring soil moisture between 60% of optimum moisture content and optimum moisture content as determined by ASTM D698 for compaction, grading and plantings.
  - 2. Field Soil Moisture Test
    - a. Form soil in palm of hand, if soil retains shape and crumbles upon touching, the soil may be worked.
    - b. If the soil will not retain shape it is too dry and should not be worked.
    - c. If the soil retains shape and will not crumble, it is too wet and should not be worked.
    - d. If the soil glistens or free water is observed when the sample is patted in the palm of hand the soil is too wet and should not be worked.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

#### A. General

1. **It is anticipated that the on-site stripped and stockpiled topsoil will be removed and recycled in accordance with Section 103R “Construction Waste Management”. Provide amended soils as shown on Drawing CR 1.1 and 1.2 .**
  - a. All plant mix material shall fulfill the requirements as specified and be tested to confirm the specified characteristics.
2. Samples of individual components of soil mixes in addition to blended soil mixes including mulch materials shall be submitted by the Contractor for testing and analysis to the approved testing laboratory. Comply with specific materials requirements specified.
  - a. No base component material or soil components for soil mixes shall be used until certified test reports by an approved agricultural chemist have been received and approved by the Landscape Architect and Soil Scientist and Soil Scientist.
  - b. As necessary, make any and all soil mix amendments and resubmit test reports indicating amendments until approved.
3. The M-NCPPC Construction Manager and Soil Scientist may request additional testing by Contractor for confirmation of mix quality and/or soil mix amendments at any time until completion. Changes in mix ratios may be required.

#### B. Soil Testing and Soils Testing Report Submittal

1. All testing of the soil mix components shall be carried out by the Soils Testing Laboratory. Recommendations for amending and/or correcting the soil mix will be provided to the Contractor by the Soil Scientist after approval by the M-NCPPC Construction Manager and Soil Scientist.
2. Failure of any material by testing and/or amendment procedure to meet Specification requirements shall require the Contractor to seek another source for the failed material and the initiation of all testing procedures for the new replacement material shall immediately take place.
3. The Contractor shall be responsible for recognizing that these critical project materials warrant timely and serious attention, that the testing process to achieve Approved materials should be considered a lead time item, and that under no circumstance shall failure to comply with all specification requirements be an excuse for “staying on project construction schedule.”

- C. Soil Samples: Contractor is responsible for paying costs for testing. Submit 1 gallon planting soil samples in all phases. Submit samples concurrent with horticultural soil test reports in both phases. Submit as phase one, planting soil base components for approval. Only after approval of phase one components, submit as phase two, soil blend mixes / mediums for approval. Phase three is for QA/QC testing for each 300 cubic yards of material blended. All reports must be from recent analyses, less than 90 days old, and represent materials that are available for delivery to the site.
1. Phase One Submittals of Planting Soil Base Components:
    - a. Base Loam (Imported Topsoil)
    - b. On Site Topsoil for Amendment/Restoration
    - c. Organic Amendment Materials (Compost)
    - d. Coarse Sand for Amending Soil
    - e. Crushed Stone for Use Over Sand Based Structural Planting Soil
  2. Phase Two Submittals of Planting Mediums: mixing and batching of soil mediums to be submitted in the same manner as bulk soils and will be prepared prior to delivery to site.
    - a. Lawn Soil
    - b. Bioretention Soil
    - c. Horticultural Subsoil
    - d. Planting Bed Soil
    - e. Sand Based Structural Planting Soil
  3. Phase Three - QA/QC Submittals shall be conducted in the same manner as Phase Two Submittals for each 300 cubic yard of material. Do not deliver planting soils to the site without submittal approvals.
  4. Submit reports for each of the above samples: Submit sample from each proposed source for testing and approval. Deliver samples to both the testing laboratory and the project soil scientist and pay costs. Send report directly to M-NCPPC Construction Manager.
  5. Soil Sample Submittals: Sampling shall be done by the Contractor. The size of the samples and method of sampling shall be as follows: Samples shall be representative of the material to be brought to the site. Each sample shall be a Composite Sample, which consists of 5 separate sub samples taken from a minimum of (5) different locations at each source and mixed together to make the test sample.

6. The Contractor shall schedule this testing in order to permit reasonable time for testing, evaluation, and approvals prior to scheduled installation. Allow for a minimum of 4 weeks to perform testing and obtain approvals.

D. Imported Base Loam

1. Imported Base Loam, if required for blending with sand and compost, shall be a naturally occurring A-horizon topsoil formed from geologic soil forming processes without admixtures of sand or organic matter sources (composts). Base Loam, which has been contaminated by incorporation of subsoil, shall not be acceptable for use. Base Loam as required for the work shall be free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots or other objectionable, extraneous matter or debris. Base Loam shall also be free of quack-grass rhizomes, Agropyron Repens, and the nut-like tubers of nutgrass, *Cyperus Esculentus*, and all other primary noxious weeds. Base Loam shall not be delivered or used for planting while in a frozen or muddy condition. Base Loam for mixing shall conform to the following grain size distribution for material passing the #10 sieve:

U.S. Sieve Size Number	Percent Passing	
	Minimum	Maximum
10	---	100
18	85	100
35	70	95
60	50	90
140	36	68
270	32	60
0.002mm	3	12

2. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.
3. The organic content shall be between 3.0 and 8.0 percent by weight.
4. Base loam with more than 42% passing the 270 sieve or with more than 8 percent clay must have a well developed and stable crumb (ped) structure as determined by an agricultural chemist.
5. pH shall be between 5.8 and 7.0.
6. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

E. Coarse Sand

1. Sand for Planting Soil Blends, protection of filter fabric and for drainage as required, shall be uniformly graded medium to coarse sand consisting of clean, inert,

rounded to sub-angular grains of quartz or other durable rock free from loam or clay, mica, surface coatings and deleterious materials with the following grain size distribution for material passing the #10 sieve:

U.S. Sieve Size Number	Percent Passing	
	Minimum	Maximum
10	100	--
18	60	80
35	25	45
60	8	20
140	0	8
270	0	3
0.002mm	0	0.5

2. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.
3. The ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 3.0 or less ( $D_{70}/D_{20} < 3.0$ ). Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.
4. Coarse sand shall be non-calcitic and shall not be derived from serpentine.
5. The pH shall be less than 7.5.

F. Organic Amendment (Compost)

1. Organic Matter for amending planting soils shall be a stable, humus-like material produced from the aerobic decomposition and curing of Leaf Yard Waste Compost, composted for a minimum of one year (12 months). The leaf yard waste compost shall be free of debris such as plastics, metal, concrete or other debris. The leaf yard waste compost shall be free of stones larger than 1/2", larger branches and roots. Wood chips over 1" in length or diameter shall be removed by screening. The compost shall be a dark brown to black color and be capable of supporting plant growth with appropriate management practices in conjunction with addition of fertilizer and other amendments as applicable, with no visible free water or dust, with no unpleasant odor, and meeting the following criteria as reported by laboratory tests.
  - a. The ratio of carbon to nitrogen shall be in the range of 12:1 to 25:1.
  - b. Stability shall be assessed by the Solvita procedure. Protocols are specified by the Solvita manual (version 4.0). The compost must achieve a maturity index of 6 or more as measured by the Solvita scale. Stability tests shall be conducted by Woods End Research Laboratory, Mt. Vernon, Maine.



- c. Pathogens/Metals/Vector Attraction reduction shall meet 40 CFR Part 503 rule, Table 3, page 9392, Vol. 58 No. 32, and Commonwealth of Massachusetts 310 CMR 32.00 (for applications to soils with human activity).
- d. Organic Content shall be at least 20 percent (dry weight). One hundred percent of the material shall pass a 1/2-inch (or smaller) screen. Debris such as metal, glass, plastic, wood (other than residual chips), asphalt or masonry shall not be visible and shall not exceed one percent dry weight. Organic content shall be determined by weight loss on ignition for particles passing a number 10 sieve according to procedures performed by the West Experiment Station at the University of Massachusetts, Amherst or equal.
- e. pH: The pH shall be between 6.5 to 7.4 as determined from a 1:1 soil-distilled water suspension using a glass electrode pH meter American Society of Agronomy *Methods of Soil Analysis*, Part 2, 1986.
- f. Salinity: Electrical conductivity of a one to five soil to water ratio extract shall not exceed 2.5 mmhos/cm (dS/m).
- g. The compost shall be screened to 1/2-inch maximum particle size and shall contain not more than 3 percent material finer than 0.002mm as determined by hydrometer test on ashed material.
- h. Nutrient content shall be determined by the University of Massachusetts Soil Testing Laboratory or equivalent laboratory and utilized to evaluate soil-required amendments for the mixed soils. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Aluminum, Magnesium, Iron, Manganese, Lead, Soluble Salts, Cation Exchange Capacity, soil reaction (pH), and buffer pH.

G. Crushed Stone for use over Sand Based Structural Planting Soil

- 1. Crushed stone (3/4 inch) shall consist of durable crushed rock consisting of the angular fragments obtained by breaking and crushing solid or shattered rock and free from a detrimental quantity of thin, flat or elongated or other objectionable pieces. Crushed stone shall be reasonably free from clay, loam or deleterious material and shall conform to the following gradation.

U.S. Sieve No.	% Passing by Weight	
	Minimum	Maximum
1 inch	100	-
3/4inch	90	100
1/2 inch	10	50
3/8 inch	0	20
# 4 Sieve	0	5

- H. Filter Fabric, if required, shall be Mirafi 140N or approved equivalent.

2.2 PLANTING SOIL MIXES

- A. All existing vegetation shall be removed from stockpiles prior to blending. Uniformly mix ingredients by windrowing/tilling on an approved hard surface area or by alternately processing materials through a screening plant. All soil components and Organic Amendment shall be maintained moist, not wet, during mixing. Amendments shall not be added unless approved to extent and quantity by the owner and additional tests have been conducted to verify type and quantity of amendment is acceptable. Percentages of components are approximate, and will be verified upon completion of individual test results for components of the various mixes. Due to variability of soil materials, mix ratios may require adjustment and re-submittal at the expense of the Contractor.
- B. After component percentages are determined by the Soil Scientist, each planting soil mix shall be tested for physical and chemical analysis. Component percentages may be modified at any time by the soil scientist dependent upon the results of testing of the various components or final blends.

C. Sand Based Structural Soil

1. Base Loam, Sand and Compost, each as specified above, shall be combined in an approximate mix ratio of four parts by volume Sand to one part by volume Base Loam to one and one half part by volume Compost (4S:1L:1.5C) to create a uniform blend which meets the following requirements.
2. Gradation for Material Passing the Number 10 Sieve:

U.S. Sieve Size Number	% Passing by Weight	
	Minimum	Maximum
10	100	-
18	68	90
35	38	63
60	18	39
140	9	18
270	8	10
0.002mm	1	2

3. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 15% by weight of the total sample.
4. Ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 3.2 or less. (D70/D20 <3.2)
5. Saturated hydraulic conductivity of the mix: not less than 6 inches per hour, according to ASTM D5856-95 (2000) when compacted to a minimum of 92% Standard Proctor, ASTM 698.
6. Organic content: between 2.5 and 3.5 percent by weight.
7. The pH shall be between 6.0 and 6.5.

D. Planting Bed Soil

1. Planting Bed Soil shall consist of a combination of approximately equal parts by volume Base Loam, Coarse Sand and Organic Amendment/Compost (1L:1S:1C). The following gradation for material passing a Number 10 Sieve shall be achieved in the final mix.

U.S. Sieve Size No.	Percent Passing	
	Minimum	Maximum
10	100	
18	85	95
35	60	85
60	42	65
140	21	44
270	18	24
0.002 mm	2	4

2. Maximum size shall be one half-inch largest dimension. The maximum retained on the #10 sieve shall be 10% by weight of the total sample.
5. The final mix shall have an organic content between 5 and 7 percent by weight.
6. The final mix shall have a hydraulic conductivity of not less than 1.5 inches per hour when compacted to a minimum of 86 percent Standard Proctor ASTM D 698. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.
7. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

E. Lawn Soil

1. Base Loam, Sand and Compost, each as specified above, shall be combined in an approximate mix ratio of two parts by volume Sand to one part by volume Base Loam to one and one half parts by volume Compost (2S:1.5L:1.5C) to create a uniform blend which meets the following requirements.
2. Gradation for Material Passing the Number 10 Sieve:

U.S. Sieve Size No.	Percent Passing	
	Minimum	Maximum
10	100	100
18	70	90
35	45	72
60	26	36
140	18	22
270	14	17
0.002mm	2	4

3. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.
4. Ratio of the particle size for 70% passing (D70) to the particle size for 20% passing (D20) shall be 5.0 or less (D70/D20 <5.0).
5. Saturated hydraulic conductivity of the mix shall not be less than 3.0 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 86% Standard Proctor, ASTM 698.
6. Organic content shall be between 4.0 and 5.0 percent by weight.
7. pH shall be between 6.2 and 6.8
8. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium Magnesium, Aluminum, Iron, Manganese, Lead, Cation Exchange Capacity, Soluble Salts, acidity (pH) and buffer pH.

F. Fiber Lawn Soil

1. Lawn Soil reinforcing fibers shall be incorporated into, at a minimum, the upper six inches of Lawn Soil (Section 2.2.D) in the vehicle maintenance parking area as shown on the Drawings. Fibers are not required for other soil.
2. Reinforcement fibers shall be Turfgrids 36MLGF.
3. Turfgrids 36MLGF Lawn Soil reinforcing fibers shall be provided by Fiber Soils, Box 80198, Baton Rouge, LA, 1-866-342-3771. Reference Fiber Soils HD6 procedures.
4. Lawn Soil reinforcing fibers shall be green polypropylene fibers 0.5 to 0.75 inches long. Lawn Soil reinforcing fibers shall be inert to commonly encountered chemicals, hydrocarbons, mildew and rot resistant, resistant to ultraviolet light exposure, insect and rodent resistant.
5. Incorporation of Lawn Soil reinforcing fibers shall be observed and documented by the Soil Scientist and/or Landscape Architect. Lawn Soil reinforcing fibers shall be incorporated at a rate of four ounces per cubic foot of approved Lawn Soil, or by roto-tilling one pound per 8 square feet, 6-inches in thickness. A minimum of two perpendicular passes of a roto-tiller or other approved equipment is required to ensure an even, homogenous distribution of fibers into the soil matrix.

G. Sod Farm Growing Medium

1. Sod shall meet the following sod farm growing media requirements.
2. Soil in which sod was grown at the Sod Farm shall be USDA classified as sand and shall conform to the following grain size distribution for material passing the #10 sieve:

U.S. Sieve Size Number	Percent Passing	
	Minimum	Maximum
10	100	-

18	85	100
35	60	85
80	25	40
140	6	26
270	4	18
0.002mm	2	5

3. The maximum particle size shall be 1/2 inch.
4. The maximum retained on the #10 sieve shall be 10% by weight of the total sample. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.

### **PART 3 – EXECUTION**

#### **3.1 PRE-INSTALLATION EXAMINATION AND PREPARATION**

- A. Reference Other Sections as necessary.
- B. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.
- C. Pre-Installation Examination Required: The Contractor shall examine previous work, related work, and conditions under which this work is to be performed and shall notify Landscape Architect and Soil Scientist in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means Contractor accepts substrates, previous work, and conditions. The Contractor shall not place any planting soil until all work in adjacent areas is complete and approved by the M-NCPPC Construction Manager and Soil Scientist and Soil Scientist.
- D. Kickoff Meeting: At least 10 working days prior to the start of work, the contractor shall request a landscape construction kickoff meeting with the owners representative, landscape architect, soil scientist and any other parties involved with landscape construction. The contractor must demonstrate familiarity with this Section 329400 Planting Soils, and other relevant sections of the construction documents. The contractor shall articulate the means and methods of soil blending, subgrade preparation, soil placement and other steps outlined in the Specification.
- E. Examination of Subgrade: The subgrade shall be examined by the Contractor prior to the start of subgrade preparation, soil placement and planting. Any deficiencies shall be noted and related to the M-NCPPC Construction Manager and Soil Scientist in writing prior to acceptance of the subgrade. Deficiencies include, but shall not be limited to the following:
  1. Construction debris present within the planting areas.
  2. The subgrade is at incorrect depths for installing the designed soil profile and drainage layer.
  3. Incomplete irrigation and/or subsurface drainage installation.

4. Incomplete lighting and exterior electrical installation.
  5. Conflict with underground utilities.
  6. Subgrade contaminated with oils, compressible material, silt or clay
  7. Subgrade must infiltrate water at the rate of at least one inch per hour.
- F. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.
1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace slopes where required and maintain sides of slopes of excavations in safe condition until completion of backfilling. Provide protection measures as required for public safety.
  2. All subgrade areas to be filled with Planting Soil shall be free of construction debris, refuse, vegetation, compressible or decay able materials, all stones greater than 2 inches, concrete washout or soil crusting films of silt or clay that reduces or stops drainage from the Planting Soil into the subsoil; and/or standing water. Such material shall be removed from the site.
  3. The subgrade must slope at a minimum of two percent towards the bottom of slopes and subdrains. Subgrade levels shall be adjusted as required to ensure that all planting and lawn areas have adequate drainage.
- G. Do not proceed with the installation of Lawn or Planting Soils until all utility work in the area has been installed.
1. The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.
- H. Planting Soil Preparation: Refer to Section 329400, 2.2 for planting soil and mixtures. Examine soil and remove foreign materials, stones and organic debris over 1/2" in size. Remove all vegetation from stockpiles prior to blending. Mix-in fertilizers and amendments as required by tests and as approved by the Landscape Architect and Soil Scientist. All preparation and mixing shall be accomplished when the soil moisture content is compliant with Section 329400, 1.6.H and at a moisture content approved by the Landscape Architect and Soil Scientist. If lime is to be added, it shall be mixed with dry soil before fertilizer is added and mixed.

### 3.2 EXCAVATION AND REMOVAL

- A. Refer to Section 200R Excavation, Filling, and Grading

### 3.3 MIXING OF PLANTING SOILS

- A. Soil blends shall be produced with equipment that blends together each component in a thorough and uniform manner. This may be accomplished by a minimum of three

handling events on a hard surfaced area with earth moving equipment or by alternately passing soil components through a screener.

- B. Uniformly distribute soil amendments recommended on the Soil Test Reports and approved by the Soil Scientist.
- C. Incorporate Soil Amendments by roto-tilling/cultivating to a minimum depth of 6-inches. In areas of existing tree roots, incorporate soil amendments by air spading to a minimum depth of 8-inches or as directed.
- D. After cultivation/air spading, uniformly grade and compact the amended soil to match adjacent grades.

#### 3.4 WORKING AROUND UTILITIES

- A. Carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.
- B. Known underground and surface utility lines are indicated on the utilities drawings – See Drawings. Contact MISS Utility and give them their required time to respond and mark the property. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.
- C. Perform work in a manner that will protect utilities from damage. Hand excavate as required and provide adequate means of support and protection of utilities during soil installation operations. Maintain grade stakes set by others until parties concerned mutually agree upon removal. The Contractor shall repair all utilities damaged by soil operations at the Contractor's expense.

#### 3.5 SUBGRADE INSPECTION AND PERCOLATION TESTING

- A. After subgrade levels have been reached, the Soil Scientist shall de-compact and prepare the subgrade according to Section 3.7(B) and inspect soil conditions to evaluate subsurface drainage conditions. The Contractor shall carry out percolation tests according to the following procedures in locations identified by the M-NCPPC Construction Manager. The Contractor shall conduct one test per 300 square feet, and provide written test results to the M-NCPPC Construction Manager and Soil Scientist. The frequency of testing may be reduced based upon compliant test results.
- B. Percolation tests shall be performed according to the following test procedures.
  - 1. Utilize perforated canisters or buckets seven to ten inches in diameter and a minimum of six inches high.
  - 2. A test hole shall be hand dug at the soil horizon to be tested approximately one-inch larger than the diameter of the test canister and approximately six inches deep. The sides of the test hole shall not be smoothed.

3. Place one-half inch of clean coarse sand in the bottom of the hole and place the canister firmly into the hole. The space around the canister shall then be filled with coarse sand. Tamp the coarse sand to firmly fill any void space around the test canister.
4. Fill the canister with water to the soil horizon level and allow to drain until approximately one inch of water remains, or a minimum of 1 hour.
5. Refill the canister to the soil horizon level. After the water level drops approximately one inch, start the test. Record time versus water level as the water level drops. The percolation rate is the length of time for the water level to drop per inch. The field scientist shall record the rate of percolation for a minimum of two hours or until the water level has dropped a minimum of three inches after the start of measurements.

### 3.6 BACKFILLING OF HORTICULTURAL SOIL LAYERS

#### A. Soil Placement Preparation:

1. Verify that the plumbing for the irrigation system has been installed and accepted.
2. Verify that the subgrade preparations have been reviewed and accepted, including removal of all existing vegetation prior to placement of planting soils.
3. Notify the M-NCPPC Construction Manager and Soil Scientist of soil placement operations at least seven calendar days prior to the beginning of work.
4. Verify that the subgrade passes the minimum water infiltration requirement.
5. Do not proceed with the installation of Planting Soils, until all utility work in the area has been installed.
6. The Contractor shall identify the locations of underground utilities prior to proceeding with soil work and shall protect all utilities from damage.
7. Do not begin Planting Soil installation until all drainage, irrigation main lines, lateral lines, subgrade preparations and irrigation risers shown on the drawings are viewed and approved by the M-NCPPC Construction Manager and Soil Scientist.
8. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use plywood and/or plastic sheeting as directed to cover existing asphalt, concrete, metal and masonry work.
  - a. Clean up any soil or dirt spilled on any paved surface, including at the end of each working day.
  - b. Any damage to the paving or architectural work shall be repaired by the Contractor at the Contractor's expense.



- B. Coordinate the following scarification work as directed by the M-NCPPC Construction Manager to eliminate subgrade compaction resultant from Construction Operations when located in lawn and planting areas. Maintain 12" clearance from any underground utilities during subgrade de-compaction.
1. Heavy Site Subgrade Compaction Mitigation:
    - a. Heavily compacted subgrade areas such as, but not limited to, temporary parking areas, material stockpile areas, temporary roadways, construction areas and areas around structures and other similar areas.
    - b. Prior to establishing the final subgrade of Earthwork material, these areas shall be dug up or ripped to a depth of (18) inches to break up the soil hard pan, then re-compacted with two passes of the tracks of a wide track bulldozer size D-6 or smaller, or other approved equipment. Vibratory compaction of subgrade in planted areas is prohibited.
  2. General Site Subgrade Compaction Mitigation for all general lawn and planting areas that are not heavily compacted and would be mitigated as specified in Item 1 above:
    - a. Immediately prior to placing Planting Soil, the entire subgrade shall be loosened to a minimum depth of 8-inches using the teeth of a backhoe or other suitable equipment, then re-compacted with two passes of the tracks of a wide track bulldozer size D-6 or smaller, or other approved equipment. Vibratory compaction of subgrade in planted areas is prohibited.
- C. After Subgrade has been scarified as described above, it shall be recompressed by using the tracks of a wide-tracked bulldozer, multiple passes of a skid steer loader, or the curled bucket of an excavator. Foot tamping or 8x8 manual tamper should be used in areas inaccessible by machine.
- D. After the subgrade soils have been loosened, re-compressed and inspected, Planting Soil may be spread by using a wide track bulldozer size D-5 or smaller or may be dumped and spread with the bucket of a backhoe from the edge of the loosened area. No rubber-tired equipment or heavy equipment except for a small bulldozer shall pass over the subsoils (subgrade) after they have been loosened and recompressed. If the Contractor plans to utilize such areas for any use of heavy equipment, this work should be carried out prior to beginning the process of loosening soils or filling in that area.
- E. Placement of Planting Bed Soil, Lawn Soil, Bioretention Soil, and Sand Based Structural Soil:
1. Planting Bed Soil, Lawn Soil, Bioretention Soil, Sand Based Structural Soil, and Horticultural Subsoil shall be placed in lifts not to exceed 8 inches in thickness and compacted to meet minimum and maximum requirements as specified below:
    - a. A transition zone shall be formed between the prepared subgrade, Lawn Soil and Planting Bed Soil by placing one inch of the upper-layer soil and raking into the lower soil to a two-inch thickness.

- b. Planting Bed Soil and Bioretention Soil shall be compacted to between 80 and 84 percent Standard Proctor.
    - c. Lawn Soil shall be compacted to between 84 and 86 percent Standard Proctor.
    - d. Fiber lawn Soil shall be compacted to between 86 and 88 percent Standard Proctor.
2. Sand-Based Structural Planting Medium shall be spread in lifts not greater than eight inches and compacted with a minimum of three passes of vibratory compaction equipment to a density between 92 and 96 percent Standard Proctor Maximum Dry Density.
  - a. Density testing for Sand Based Structural Soil must be by ASTM D1556 Density of soil and rock in place using Sand Cone Method, ASTM D6938-10 Nuclear Methods, ASTM D2167-08 Rubber Balloon Method, after ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. Density testing shall be conducted for every 300 square feet of planting soil, or a minimum of one test for each plant bed.
  - b. Sand-Based Structural Planting Medium shall be placed to a minimum depth of two feet within the areas shown on the Drawings, except as otherwise indicated. A minimum of eight inches of 1/2 inch to 3/4 inch crushed stone shall be placed over the Sand-Based Structural Planting Medium in sidewalk areas and a minimum of twelve inches shall be placed in vehicular areas to provide support for the overlying surface. Perforated pipes shall be placed within the crushed stone and connected to open air conditions to provide aeration within the stone per Drawings.
3. In all cases, the soil being placed shall be in a dry to damp condition. No wet soils shall be placed. Soil moisture content must be compliant with Section 329113 1.6.H. All testing of in-place density for planting materials shall be made by the soil scientist or according to ASTM D1556 Density of soil and rock in place using Sand Cone Method, ASTM D6938-10 Nuclear Methods, ASTM D2167-08 Rubber Balloon Method, or ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
4. Prevention of compacted soils can be accomplished by beginning the work in corner, against walls, or the center of isolated beds, and progressing outwards towards the borders.
5. Subgrade soil and Planting Soils shall never be moved or worked when wet or frozen.
6. The Contractor shall place barricades or steel plates as required to prevent any unnecessary compaction of planting soil from vehicles, equipment, or pedestrian traffic.
7. After planting bed and Lawn soils have been spread, they shall be carefully prepared by hand raking. Stones and debris over one inch in any direction shall be removed

from the premises. Fine grade planting beds to a smooth even surface with loose uniformly fine texture. Remove ridges and fill depressions as required to meet finish grades. Limit fine grading to areas that can be planted immediately after grading. Maintain the finished surfaces at the grades shown and spread additional soil to correct settlement or erosion. Surface drainage shall be maintained. Soil shall be damp and free from frost during fine grading operations.

### 3.7 PROTECTION

- A. The Contractor shall protect landscape work and materials from damage due to landscape operations, operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Treat, repair or replace damaged Planting Soil installation work immediately.
- B. Provide all means necessary, including fences, to protect all soil areas from compaction and contamination by trash, dust, debris, and any toxic material harmful to plants or humans after placement. Any area, which becomes compacted, shall be tilled to the extent determined by the soil scientist and recompressed to the density ranges specified. Any uneven or settled areas shall be filled and re-graded. Soil that becomes contaminated shall be removed and replaced with specified soil material.
- C. Phase the installation of the planting soil blends such that equipment does not have to travel over already installed planting soil.
- D. Apply filter fabric coverings planking or other engineering controls over soil to collect dust and debris in any area where the Contractor must work after the installation of Planting Soil.
- E. Till compacted Planting Soil and replace Planting Soil that has become contaminated as determined by the M-NCPPC Construction Manager. Planting Soil shall be tilled or replaced by the Contractor at no expense to the Owner.

### 3.8 CLEAN-UP

- A. During installation, keep pavements clean and work area in an orderly condition.
- B. Keep the site free of trash and debris at all times. Immediately dispose of wrappings or waste materials associated with products necessary for the completion of the work.
- C. All trash and debris shall be kept in a central collection container. Do not bury trash and debris in back-fill.
- D. Once installation is complete, remove any excess soil from pavements or embedded in fixtures.

### 3.9 COORDINATION AND EXCESS MATERIALS

- A. Coordinate activities with other project contractors so that there is no soil disturbance from traffic or other construction activities subsequent to placement.

- B. Excess Planting Soil Mixtures and Materials: Remove the excess planting soil mixture and materials from the site at no additional cost to the Owner unless other wise requested.

3.10 POST-INSTALLATION TESTING

- A. In-place density testing is required in all areas. Placed planting soils must be inspected for compaction level by the soil scientist or by the following acceptable Density Test Methods: ASTM D1556 Density of soil and rock in place using Sand Cone Method", ASTM D6938-10 Nuclear Methods, ASTM D2167-08 Rubber Balloon method, after ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
- B. Density testing for Sand Based Structural Soil must be by ASTM D1556 Density of soil and rock in place using Sand Cone Method, ASTM D6938-10 Nuclear Methods, ASTM D2167-08 Rubber Balloon Method, after ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. Density testing shall be conducted for every 300 square feet of planting soil, or a minimum of one test for each plant bed.
- C. Placed Planting Soils must be capable of infiltrating water at the minimum rate provided in this Specification for each type of planting soil

END OF SECTION

## SECTION 329500 - VEGETATED ROOF ASSEMBLIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Vegetated roof assemblies.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each vegetated roof assembly and each component, including each growing medium.
- B. Samples: For each exposed product and for each color and texture specified.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Product test reports.
- C. Warranty: Sample of special warranty.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

#### 1.5 QUALITY ASSURANCE

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

#### 1.6 WARRANTY

- A. Special Warranty for Vegetated Roof Assembly: Installer agrees to repair or replace vegetated roof assembly and components that fail in materials or workmanship within specified warranty period.
  - 1. Failure includes, but is not limited to, ponding water or prolonged wetness of the growing medium caused as a result of failure of the assembly to properly drain.
  - 2. Warranty Period: Two years from date of Substantial Completion

## PART 2 - PRODUCTS

### 2.1 VEGETATED ROOF ASSEMBLY COMPONENTS

#### A. Moisture-Retention and Drainage Products:

1. Moisture-Retention Mat: Manufacturer's standard water-retaining fabric manufactured from synthetic fibers.
2. Molded-Sheet Drainage Panels: Manufacturer's standard drainage board formed from geotextile-faced, molded-plastic sheet with a geotextile face and "cups" of the molded sheet facing upward like small reservoirs to retain water while allowing excess water to drain away below the board.

#### B. Aggregate-Type Moisture-Retention and Drainage Products:

1. Protection Fabric and Drainage Gravel: Manufacturer's standard.

#### C. Root Barrier: 60 mil EPDM liner formulated to resist root growth and bacteria.

#### D. Erosion-Control Fabric: Manufacturer's standard erosion-control fabric.

1. Assembly Depth, Nominal: As shown on Drawings, including growing medium.
2. Assembly Weight: Maximum 28 lb/sq. ft. , including growing medium and plants and saturated with captured water, but not including weight of roofing system.

### 2.2 MANUFACTURED GROWING MEDIA

#### A. Growing Medium : Vegetated roof assembly manufacturer's lightweight, manufactured soil mixture.

### 2.3 ACCESSORIES

#### A. Protection Board: As recommended by membrane roofing manufacturer.

#### B. Soil Retainer: As shown on the drawings

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

#### A. Examine each area to receive vegetated roof assembly.

1. Verify that roof insulation over membrane roofing is in place, secure, and flush along all seams.
2. Verify that perimeter and other flashings are in place and secure along entire lengths where they will be covered by vegetated roof assembly.

- B. Protection Course: Cover membrane roofing with protection board with butted and fully taped joints before membrane roofing is subject to vegetated roof assembly installation work.
- C. Install vegetated roof assembly according to manufacturer's written instructions.
- D. Small Plant Stabilization: Install erosion-control fabric over planting area according to manufacturer's written instructions.

### 3.2 PLANTING

- A. Planting Individual Plants: To be installed by M-NCPPC

END OF SECTION 329500

## SECTION 331620 RAINWATER HARVESTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes This Section includes furnishing, and installing: Rainwater Harvesting System
- B. Related Sections
  - 1. Section 322R – Storm Drainage and Stormwater Management
  - 2. Section 13 12 00 – Fountains
  - 3. Section 32 84 00 – Planting Irrigation

#### 1.2 DEFINITIONS

- A. Rainwater Harvesting System: An assembly that collects, stores, and distributes rain water for use in situ; including water treatment as appropriate to intended use.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: Submit product data on all components of the rainwater harvesting system. Unless otherwise indicated, include the following for each type of product provided under work of this Section:
  - 1. Manufacturer's brochure indicating equipment model(s).
- B. Shop Drawings: For each system, include plans, sections, details, and attachments to other work, for the following:
  - 1. Pumps.
  - 2. Cistern.
  - 3. Connection to Storm-Drain System
  - 4. Connection to irrigation system.
- C. Operation and Maintenance Manuals Submittals: Provide the following:
  - 1. Operation and maintenance procedures, including variations of procedures appropriate for normal climatic conditions anticipated throughout an annual cycle of operations.

#### 1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: To the greatest extent possible, obtain the cistern system components from one source and from a single manufacturer.



- B. Pre-Construction Meeting: After award of Contract and prior to the commencement of the Work of this Section, schedule and conduct meeting to discuss the Work of this Section and to coordinate with related Work. Convene pre-construction meeting as follows:
1. Notify all attendees at least two weeks prior to the conference.
  2. Require attendance of parties directly affecting Work of this Section, including, but not limited to:
    - a. M-NCPPC Construction Manager
    - b. General Contractor
    - c. Cistern Contractor
    - d. Irrigation Contractor
    - e. Storm Drain Contractor
    - f. Fountain Contractor
  3. Review methods and procedures related to installation and operation of Work of this Section, including coordination with related Work.
  4. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

## PART 2 - PRODUCTS

### 2.1 STORAGE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:
1. Graf Carat-S Rainwater Tank Part # 372004 or approved equal
    - a. Size: 1700 Gallons
    - b. 15 Year manufacturer's warranty
    - c. Variable installation depth with double-sealed telescopic riser Convenient 31-1/2" manway opening
    - d. Locking green lid
    - e. Easy to transport and install
    - f. Ultra-high strength materials and design
    - g. Frost-proof installation underground

## PART 3 - EXECUTION

### 3.1 STEEL, SURFACE WATER-STORAGE TANK INSTALLATION

- A. Erect cistern shell, accessories, and appurtenances in accordance with the Manufacturers written installation instructions.

### 3.2 CONNECTIONS

- A. Connect tank to stormwater, irrigation, and fountain pumps

- B. Coordinating with adjacent disciplines
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.3 FIELD QUALITY CONTROL

- A. Testing:
  - 1. Leak Test: the system and connections to the fountain pumps, stormwater system and irrigation system
  - 2. Repair leaks and retest until no leaks exist.
  - 3. Test all pumps, sensors and electrical connections
  - 4. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

### 3.4 CLEANING

- A. Clean interior and exterior of surface water-storage tanks.

END OF SECTION 331620