HKS

HKS Project No. 16246.000

# Project Manual

## Minnesota Multi-Purpose Stadium

## Minneapolis, Minnesota

CCD-347

DTE West Plaza CD Set

February 01, 2016

SEAL PAGE - PLAZA – CIVIL

**SPECIFICATION**

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| 031119 | EXISTING CONDITIONS |
| 003132 | GEOTECHNICAL DATA |
| 024116 | STRUCTURE DEMOLITION |
| 312000 | EARTH MOVING |
| 312500 | EROSION AND SEDIMENT CONTROL |
| 321123 | AGGREGATE BASE COURSE |
| 321216 | ASPHALT PAVING |
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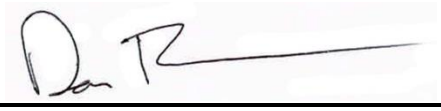
| 321723 | PAVEMENT MARKINGS |
| 334100 | STORM UTILITY DRAINAGE PIPING |
| 334600 | SUBDRAINAGE |

**PROFESSIONAL ENGINEER**

I hereby certify that the plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.



Dan Bowar, PE

Date: 02/01/2016 Lic. No. 45018

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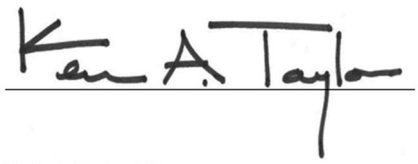
REGISTRATION:

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Architect under the laws of the state of Minnesota.



Kevin A. Taylor, AIA
License No. 51015

2/1/2016

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## ISSUES

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|---|---|
| 2013-02-11 | 50% Schematic Design |
| 2013-03-04 | Schematic Design |
| 2013-06-20 | 50% Design Development |
| 2013-08-15 | Design Development |
| 2013-08-15 | Demolition and Mass Excavation Permit Review |
| 2013-08-21 | DDSI-002 (Light Fixture Cut Sheets) |
| 2013-08-27 | DDSI-005 (Signage Count Spreadsheet) |
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| 2013-08-30 | DDSI-007 (Door Mechanization Revisions) |
| 2013-09-09 | CD Package 002 |
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| 2013-10-01 | DDSI-018 (Demolition and Mass Excavation Permit Review) |
| 2013-10-08 | Grade 65 Roof Steel Mill Order |
| 2013-10-09 | CD Package 004 |
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| 2013-10-23 | DDSI-020 (Artificial Turf) |
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| 2014-01-13 | CCD-026 |

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| 2014-01-24 | CCD-030 |
| 2014-01-30 | CCD-032 |
| 2014-02-18 | 50% Construction Documents |
| 2014-03-10 | CCD-045 |
| 2014-03-21 | CCD-047 |
| 2014-04-01 | CCD-048 Door and Hardware Schedule |
| 2014-04-02 | CCD-049 Exterior Enclosure CD |
| 2014-05-02 | CCD-060 Construction Documents |
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| 2015-07-03 | ASI-253 |
| 2015-08-07 | ASI-272 |
| 2015-08-17 | ASI-278 |
| 2015-08-21 | ASI-277 |
| 2015-08-21 | ASI-275 |
| 2015-09-18 | CCD-295 |
| 2015-10-09 | ASI-307 |
| 2015-10-23 | CCD-294 (Specification dated for 2015-09-18) |

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|---|---|
| 2015-12-04 | CCD-249.1 |
| 2015-12-04 | CCD-302 |
| 2015-12-23 | DTE West Plaza DD Set |
| 2016-02-01 | CCD-347 DTE West Plaza CD Set |

## DIVISION 00 - PROCUREMENT AND CONTRACT REQUIREMENTS



## DIVISION 01 - GENERAL REQUIREMENTS

## DIVISION 07 - THERMAL AND MOISTURE PROTECTION



## DIVISION 08 - OPENINGS

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## DIVISION 10 – SPECIALTIES



## DIVISION 11 – EQUIPMENT

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## DIVISION 20 – GENERAL MEP/FP REQUIREMENTS

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## DIVISION 21 – FIRE SUPPRESSION

## DIVISION 22 – PLUMBING



## DIVISION 23 – HEATING, VENTILATION, AND AIR CONDITIONING

## DIVISION 25 – INTEGRATED AUTOMATION

No Sections

## DIVISION 26 – ELECTRICAL

## DIVISION 27 – COMMUNICATIONS

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MINNESOTA MULTI-PURPOSE STADIUM
MINNEAPOLIS, MINNESOTA

SECTION 003119

# EXISTING CONDITION INFORMATION - PLAZA

## 1.1 EXISTING CONDITION INFORMATION

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

B. Existing drawings that include information on existing conditions including previous construction at Project site are available for viewing at the office of Architect.

C. Existing specifications and submittals that include information on existing conditions including previous construction at Project site are available for viewing at the office of Architect.

D. Survey information that includes information on existing conditions is available for viewing as part of Drawings.

E. Related Requirements:
   1. Division 00 Procurement and Contract Requirements

END OF DOCUMENT 003119

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MINNESOTA MULTI-PURPOSE STADIUM
MINNEAPOLIS, MINNESOTA

SECTION 003132

GEOTECHNICAL DATA - PLAZA

## 1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents. Soil-boring data for the Minnesota Multi-Purpose Stadium, obtained by American Engineering Testing, Inc, dated October 2, 2013. Additional reports for the Downtown East Pedestrian Bridge, obtained by American Engineering Testing, Inc. dated April 8, 2015 and Geotechnical Exploration and Testing for the Vikings Legacy Ship, US Bank Stadium dated October 20, 2015 is available for viewing at the office of Architect

B. A geotechnical investigation report for Project, prepared by American Engineering Testing, dated October 2, 2013, is available for viewing at the office of Architect.

C. Related Requirements:

1. Division 00 Procurement and Contract Documents.

END OF DOCUMENT 003132

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# SECTION 024116

# STRUCTURE DEMOLITION - PLAZA

## 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 buildings and site improvements.
2. Abandoning in-place and removing below-grade construction.
3. Disconnecting, capping or sealing, and abandoning in-place and removing site utilities.
4. Salvaging items for reuse by Owner.
5. Compliance with Local, State and Federal regulations for environmental protection, site safety and associated permitting and reporting requirements.

B. Related Sections:
1. Division 00 “Procurement and Contract Requirements”
2. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.
3. Section 331000 “Facility Sanitary Sewers” for removal of sanitary sewer pipe and structures.

### 1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage and maintain existing function, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

### 1.4 MATERIALS OWNERSHIP

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

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

## 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified refrigerant recovery technician.

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

1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.

C. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Shutoff and capping or re-routing of utility services.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Predemolition: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations.

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

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

## 1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by MPCA or EPA-approved certification program.

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

C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

D. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review demolition sequencing, temporary bracing to maintain structural stability and monitoring of environmental conditions (to include vibrations).
4. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
5. Review and finalize protection requirements.
6. Review procedures for noise control and dust control.
7. Review procedures for protection of adjacent buildings.
8. Review items to be salvaged and returned to Owner.
9. Review road/sidewalk closures.
10. Review work procedures around the LRT.

## 1.7 PROJECT CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.

a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

b. Do not close or obstruct operating rail or rail passengers. Work within the Metro Transit LRT easement, as shown on the drawings, requires notification of and approval by Metro Transit prior to work commencing. All persons working in or near the operating rail shall have the appropriate safety certifications required by Metro Transit and governing authorities.

C. Owner assumes no responsibility for buildings and structures to be demolished.

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

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1.8 CONSTRUCTION SEQUENCING CONSTRAINTS

A. In order for Metro Transit and/or the Owner of the site to continue to provide a level of service sufficient to meet the needs of the public, the Contractor must adhere to the following construction sequencing constraints:
   1. The Contractor is to coordinate with the Downtown East Pedestrian Bridge Contractor who may request up to three (3) weekend closures of the Light Rail Line. Closures must be scheduled and approved by the Metro Transit 30 days in advance of the requested closure. Additionally, these closures shall be included in the overall project schedule. Closure times are limited to 8 PM Friday to 2 AM Monday.
   2. Additional Light Rail Line closures outside those requested by the Downtown East Pedestrian Bridge Contractor will not be allowed.
   3. Road Closures are to be coordinated and approved with the City of Minneapolis.

1.9 The CONTRACTOR is responsible for the cost of City lane closure fees.

A. The CONTRACTOR shall meet with the CAR and other COUNCIL representatives, as necessary, to discuss planned work and to ensure that sequence of work does NOT interfere with the continued provision of service to meet the needs of the public.

B. The construction sequencing constraints identified above must be reflected in the

C. CONTRACTOR's project schedule.

   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. On-site storage or sale of removed items or materials is not permitted.

1.10 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations or operations of adjacent occupied buildings.

B. The Contractor shall coordinate with Metro Transit Staff with working on existing Metro Transit facilities.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

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

C. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

D. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

1. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning or avoidance.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 PREPARATION

A. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.

B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
4. Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
5. Sanitary sewer removal shall comply with plans.
6. Abandonment or removal of existing utilities shall be accomplished as specified herein or according to the utility provider or jurisdiction having authority over the utility. The more stringent requirements shall apply.
7. Utilities under the new structure foot print shall be removed.

8. Removal of signal systems, street lights, site lights, signs shall include full removal of foundations, handholes and conduit. Contractor shall not damage remaining utilities or structures, immediately notify the Engineer if conditions do not allow removal.

C. Existing Utilities: See plumbing and electrical Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

D. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition. Shoring design shall be conducted by or verified by a professional engineer.

E. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

## 3.3 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, rail platforms, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

## 3.4 DEMOLITION, GENERAL

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

1. Do not use cutting torches until work area is cleared of flammable materials and dust. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least 2 hours after flame cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.

C. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

D. Explosives: Use of explosives is not permitted.

## 3.5 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Salvage: Items to be removed and salvaged are indicated on Drawings.

D. Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within the project area.

1. Completely remove below-grade construction, including basements, foundation walls, and footings.

E. Below-Grade Construction: Demolish foundation walls and other below-grade construction.

F. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures that are within the project area and as designated on the plans.

1. Fill voids created by removal of utility structures with satisfactory soil materials according to backfill requirements in Section 312000 "Earth Moving."
2. Piping: See Para. 3.2 of this section.
3. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.
4. For sewer pipe and structure removal, comply with requirements of Section 311000.

## 3.6 SITE RESTORATION

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

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

## 3.7 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

## 3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

## 3.9 CLEANING

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

1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116

# SECTION 057300

# ORNAMENTAL HANDRAILS AND RAILINGS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Work required for this section includes ornamental handrails and, railings along with supplementary items necessary to complete their installation.

### 1.2 DEFINITIONS

A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

### 1.3 DELEGATED ENGINEERING REQUIREMENTS

A. Contract Documents Design Intent: Drawings and Specifications indicate design intent for products and systems and do not necessarily indicate or specify total Work required. Contract Documents shall not be construed as an engineered design; furnish and install all Work required for a complete installation.

B. Delegated Engineering Responsibility: Contractor shall employ a qualified professional engineer to provide engineering for products and systems including attachment to building structure required to meet design intent of Contract Documents.

1. Preparation of structural analysis data including engineering calculations, shop drawings and other submittals signed and sealed by the qualified professional engineer.

C. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated for products and systems similar to this Project and has a record of successful in-service performance.

D. Coordination of Work:

1. Product Variations: In the event of minor differences between products and systems of acceptable or available manufacturers, Contractor shall notify Architect of such differences and resolve conflicts in a timely manner. Failure of Contractor to provide notification shall be construed as acceptance of conditions indicated, and changes caused by minor differences between products and Contract Documents shall be included in the Work at no additional cost to Owner.

E. Allowable Adjustments: Minor dimension and profile adjustments may be made in interest of fabrication or erection methods or techniques or ability to satisfy design intent, provided design intent is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including related design or construction cost impacts. If accepted by Architect, deviations causing changes in materials, constructability, substrates, or conditions shall be included in the Work at no additional cost to Owner.

1.4 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.

1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
2. Manufacturer's product lines of railings assembled from standard components.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work.

C. Delegated Engineering Calculations: Informational submittal for products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation; test reports are not acceptable substitute for calculations.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Each type of glass required.
3. Fittings and brackets.
4. Welded or brazed connections, as applicable.
5. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.
6. Polymer-Coated Steel Wire Fabric: 12 inch by 12 inch (300 mm by 300 mm) square.

E. Qualification Data:

1. 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 and addresses of Architects and Owners, and other information specified.

F. Welding certificates.

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

H. Field Quality Control Reports: Written reports of inspection required by "Field Quality Control".

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.

B. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer/Fabricator Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer/fabricator to install products.

C. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including structural analysis, preconstruction testing, field testing, and in-service performance.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Source Limitations: Obtain each type of railing from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
2. AWS D1.6, "Structural Welding Code - Stainless Steel."

F. Safety Glazing Labeling: Permanently mark glass with certification label of the Safety Glazing Certification Council (SGCC) or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

G. Mock-ups: Prior to fabrication and installation, build mock-up for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up using materials indicated for the completed Work.

1. Build mock-up in the location and of the size indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.

a. Show typical components, attachments to building structure, and requirements of installation.

2. Notify Architect seven days in advance of the dates and times when mock-up will be installed.

3. Obtain Architect's acceptance of mock-ups before starting fabrication or installation.
4. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically noted by Contractor and accepted by Architect in writing.
5. Demolish and remove mock-ups when directed by Architect unless accepted to become part of the completed Work.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.7 PROJECT CONDITIONS

A. Field Measurements: Where products and systems are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not suit structural performance requirements.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers/Fabricators and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers/fabricators offering products that may be incorporated into the Work include, but are not limited to, those listed.

1. Aluminum Decorative Railings:

    a. Blum, Julius & Co., Inc.
    b. Blumcraft of Pittsburg.
    c. CraneVeyor Corp.
    d. Laurence, C.R. Co., Inc.
    e. Livers Bronze Co.
    f. Newman Brothers, Inc.
    g. Sterling Dula Architectural Products, Inc. Div. of Kane Manufacturing.
    h. Wagner, R & B, Ins.; a division of the Wagner Companies.

2. Stainless Steel Decorative Railings:

    a. Carl Stahl

3. Glass Supported Railings:

    a. Blum, Julius & Co., Inc.
    b. Blumcraft of Pittsburg.
    c. CraneVeyor Corp.
    d. Livers Bronze Co.
    e. Newman Brothers, Inc.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers/fabricators offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

1. Selections: As indicated in Design Selections.

### 2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Comply with requirements of Authorities Having Jurisdiction.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
2. Stainless Steel: 60 percent of minimum yield strength.
3. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."

C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) 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 (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
b. Infill load and other loads need not be assumed to act concurrently.

3. Top Rail at Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.

4. Safety Factor at Glass and Glass-Supported Railings: Design assembly to withstand loads indicated without exceeding allowable working stress determined by the following safety factor:

a. Safety Factor: 4.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

## 2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

1. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.

2.4 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

B. Extruded Bars and Shapes, Including Extruded Tubing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.

C. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.

D. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M), Alloy 6063-T832.

E. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 5005-H32 or Alloy 6061-T6 as required to meet specification and design performance requirements.

F. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.

G. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.5 STAINLESS STEEL

A. Wire Rope and Fittings:

1. Wire Rope: 7-by-7, 5mm diameter, wire rope made from wire complying with ASTM A 492, Type 316.
2. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

a. Accessories: Provide grommet, bushings, nuts, washers, turnbuckles, fittings and other components as required for system installation.

2.6 GLASS AND GLAZING MATERIALS

A. Laminated Glass: ASTM C 1172, Condition A (uncoated), Type I (transparent flat glass), Quality-Q3 with two plies of glass and cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations needed to comply with requirements.

B. Glazing Cement and Accessories for Structural Glazing: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal subrails.

1. Glazing Cement: Non-shrinking organic cement designed for curing by passing an electric current through metal subrail holding glass panel, as standard with manufacturer.

C. Glazing Gaskets for Glass Infill Panels: Glazing gaskets and related accessories recommended or supplied by railing manufacturer for installing glass infill panels in post-supported railings.

1. Refer to Division 8 Section "Glazing" for glass requirements.

2.7 CHAIN LINK FENCE FABRIC

A. PVC-Coated Fabric: ASTM F 668, Class 2b over zinc-coated steel wire.

1. Color: As selected by Architect from manufacturer's full range complying with ASTM F 934.

B. Coat selvage ends of fabric that is metallic coated during the weaving process with manufacturer's standard clear protective coating. Provide fittings with polymer coating over metallic coating.

2.8 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:

1. Aluminum Components for Interior Railings: Type 304 stainless-steel fasteners.
2. Stainless-Steel Components for Interior Railings: Type 304 stainless-steel fasteners.
3. Dissimilar Metals for Interior Railings: Type 304 stainless-steel fasteners.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.

1. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Anchors, General: Anchors 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.

E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.9 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. Aluminum Railings: For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

C. Non-shrink, Non-metallic Grout: Factory-packaged, non-staining, non-corrosive, non-gaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.10 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.

D. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.

E. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (0.8 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

F. Form work true to line and level with accurate angles and surfaces.

G. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

H. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

I. Connections: Fabricate railings with welded or Non-welded connections unless otherwise indicated.

J. 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 welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.

K. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

L. Form changes in direction by flush bends or by inserting prefabricated flush-elbow fittings. Where applicable, by radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.

M. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

N. Close exposed ends of hollow railing members with prefabricated end fittings.

O. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

P. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. Interior Installations at Plaster or Gypsum Board Partitions: At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

Q. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

R. For railing posts set in concrete, provide steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (12 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

2.11 GLAZING PANEL FABRICATION

A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.

1. Clean-cut or flat-grind edges at butt-glazed sealant joints to produce square edges with slight chamfers at junctions of edges and faces
2. Grind smooth exposed edges, including those at open joints, to produce square edges with slight chamfers at junctions of edges and faces.

B. Structural Balusters: Provide laminated, tempered glass panels for both straight and curved sections.

2.12 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.13 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Clear Anodic Finish at Interior Installations: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker, unless indicated otherwise.

2.14 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Finish: Refer to Design Selections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Interior Installations: Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer/fabricator's written installation instructions.
2. Accepted submittals.
3. Contract Documents.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. 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 (1.5 mm in 1 m).
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 (6 mm in 3.6 m).

C. Corrosion Protection for Aluminum or Copper Alloys: Coat concealed surfaces of aluminum or copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.5 RAILING CONNECTIONS

A. Non-welded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.6 ANCHORING POSTS

A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, non-metallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, attached to post with set screws.

C. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. Aluminum Railings: For aluminum railings, attach posts as indicated using fittings designed and engineered for this purpose.
2. Stainless Steel Railings: For stainless-steel railings, weld flanges to posts and bolt to metal-supporting surfaces.

3.7 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with flanges connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using non-welded connections.

C. Attach handrails to walls with wall brackets except where end flanges are used. Provide brackets with 1-1/2 inch (38 mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.8 INSTALLING GLASS PANELS

A. Glass-Supported Railings: Install assembly to comply with railing manufacturer's written instructions.

1. Attach base channel to building structure, then insert and connect factory-fabricated and -assembled glass panels if glass was bonded to base and top rail channels in factory.
2. Attach base channel to building structure, then insert glass into base channel and bond with glazing cement unless glass was bonded to base and top rail channels in factory.

a. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.

3. Adjust spacing of glass panels so gaps between panels are equal before securing in position.
4. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

B. Post-Supported Glass Railings: Install assembly to comply with railing manufacturer's written instructions and with requirements in other Part 3 articles. Erect posts and other metal railing components, then set factory-cut glass panels. Do not cut, drill, or alter glass panels in field. Protect edges from damage.

3.9 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to prepare test reports. Payment for these services will be made by Contractor.

1. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.

a. Number and Location of Tests: Shall be acceptable to Authorities Having Jurisdiction.

2. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.

3.10 CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

B. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

3.11 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

# SECTION 07 1355

# MODIFIED BITUMINOUS SHEET WATERPROOFING - PLAZA

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes: Modified bituminous sheet waterproofing system and supplementary items necessary for installation at the following applications:

1. Vertical positive side applications at foundation walls.
2. Horizontal positive side applications at above grade split slabs.

### 1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product or system indicated.

1. Include manufacturer's specifications for materials and installation instructions.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components and attachments to other work. Distinguish between shop and field-assembled work. Include in shop drawings substrate joint and crack treatments, waterproofing applications, flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

### 1.3 INFORMATIONAL SUBMITTALS

A. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

B. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

D. Qualification Data:

1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include list of completed projects.

E. Warranty: Sample of warranty.

1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer's personnel with not less than 5 years of experience in the successful performance of Work similar to scope of this Project.
2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 5 years of experience installing products and systems similar to scope of this Project.
3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

B. Mock-Ups: Before beginning Work of this Section, install minimum 100 sf (9.3 sm) of waterproofing system using materials indicated for the completed Work; incorporating substrate construction, sealing at penetrations, and seaming to demonstrate installation of system. Acceptance of mock-ups does not constitute acceptance of deviations from the Contract Documents contained in mock-ups unless such deviations are specifically accepted by Architect in writing. Apply mock-ups to set quality standards for materials and execution.

1. Demonstrate surface preparation, crack, joint, and corner treatments.
2. If Architect determines mock-up does not comply with requirements, reconstruct mock-ups until accepted.
3. Accepted mock-ups may become part of completed Work if undisturbed at time of Substantial Completion.

1.5 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site.

1. Participants:

a. Architect.
b. Contractor, including superintendent.
c. Installer, including project manager and supervisor.
d. If requested, Manufacturer's qualified technical representative.
e. Installers of other construction interfaced with Work.

2. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

a. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review inspection and testing requirements.
e. Review environmental conditions and procedures for coping with unfavorable conditions.
f. Resolve deviations or differences between Contract Documents and the manufacturer's specifications.

3. Record discussions, including decisions and agreements, and prepare report.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by manufacturer. Do not apply waterproofing to a damp or wet substrate or during high humidity conditions including snow, rain, fog, or mist.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.9 WARRANTY

A. Manufacturer's Warranty: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion.

B. Installer's Warranty: Furnish installer's written workmanship warranty signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

1. Warranty Period: Installer shall warrant the installation to be free from workmanship Defects for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. General: Provide modified bituminous sheet waterproofing that prevents the passage of liquid water and complies with the following minimum physical requirements as demonstrated by testing performed by an independent testing agency of manufacturer's current waterproofing membrane formulations.

1. Tensile Strength: 250 psi (1.7 MPa) according to ASTM D 412, Die C, modified.
2. Ultimate Elongation: 300 percent minimum according to ASTM D 412, Die C, modified.
3. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C) according to ASTM D 1970.
4. Crack Cycling: Unaffected after 100 cycles of 1/8 in (3 mm) movement according to ASTM C 836.
5. Puncture Resistance: 40 lbf (180 N) minimum according to ASTM E 154.
6. Hydrostatic-Head Resistance: 150 ft (45 m) minimum according to ASTM D 5385.
7. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C) according to ASTM D 570.
8. Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m) according to ASTM E 96, Water Method.

B. Material Compatibility: Provide waterproofing materials that are compatible with one another under conditions of service and application required, as demonstrated by manufacturer based on testing and field experience.

2.4 MODIFIED BITUMINOUS SHEET WATERPROOFING MATERIALS

A. Modified Bituminous Sheet Waterproofing: 60 mils (1.5 mm) thick, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated to a 4 mils (0.10 mm) thick, polyethylene film with release liner on adhesive side.

1. Manufacturers and Products:

a. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
b. CETCO Building Materials Group; Envirosheet.
c. Grace Construction Products; Bituthene 3000.
d. Henry Company; Blueskin WP 200.
e. Meadows, W. R., Inc.; Mel-Rol.

f. Nervastral, Inc.; BITU-MEM.
g. Polyguard Products, Inc.; Polyguard 650.
h. Tamko Roofing Products, Inc.; TW-60.

2.5 ACCESSORY MATERIALS

A. General: Furnish accessory materials recommended by waterproofing system manufacturer for intended use and compatible with waterproofing.

B. Primer: Liquid primer suitable for substrate provided by waterproofing manufacturer.

C. Surface Conditioner: Liquid surface conditioner suitable for substrate provided by waterproofing manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity provided by waterproofing manufacturer.

E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating provided by waterproofing manufacturer.

F. Sheet Strips: Self-adhering, rubberized-asphalt sheet strips of same material and thickness as sheet waterproofing provided by waterproofing manufacturer.

G. Mastic and Adhesives: Liquid mastic and adhesives provided by waterproofing manufacturer.

H. Termination Bars: ASTM A 666, Type 304 formed stainless steel bars; 2 types, one flat and one flat with upper flange shaped to receive sealant, locations as indicated; 1 in by 1/8 in (25 mm by 3 mm) thick; predrilled at 8 in (200 mm) centers; with stainless steel fasteners. No aluminum or plastic bars allowed.

2.6 MOLDED-SHEET DRAINAGE PANELS

A. Molded-Sheet Drainage Panels; Vertical Applications:

1. Description: Pre-fabricated composite with drainage core faced with geotextile filter fabric on dimpled side (facing earth) and protective covering on flat side (facing waterproofing).
2. Protective Covering: Smooth polymeric film.
3. Drainage Core: Three-dimensional, non-biodegradable, molded polypropylene or polystyrene.

    a. Minimum Compressive Strength: 15,000 lbf/sf (718 kPa) according to ASTM D 1621.
    b. Minimum In-Plane Flow Rate: 15 gpm/ft (188 L/min per m) of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psig (172 kPa) according to ASTM D 4716.

4. Geotextile Filter Fabric: Non-woven needle-punched geotextile, manufactured for subsurface drainage, made from polypropylene, polyolefin, or polyester; complying with following properties according to AASHTO M 288:

    a. Survivability: Class 2.
    b. Permittivity: 0.1 per second, minimum.

5. Manufacturers and Products:

    a. American Hydrotech; Hydrodrain 420.
    b. American Wick Drain Corporation; AmeriDrain 520.
    c. Carlisle Coatings & Waterproofings; CCW MiraDRAIN 6200.
    d. Grace Construction Products; Hydroduct 220.
    e. Henry Company; DB 520.
    f. JDR Enterprises, Inc.; J-Drain 420.
    g. Polyguard Products, Inc.; Flow 15P
    h. Tremco Commercial Sealants & Waterproofing; TREMDrain 1000.

B. Molded-Sheet Drainage Panels; Horizontal Applications (as indicated below):

1. Location:

    a. Horizontal positive side applications at above grade split slabs.

2. Description: Pre-fabricated composite with drainage core faced with geotextile filter fabric on dimpled side (facing earth) and protective covering on flat side (facing waterproofing).
3. Protective Covering: Smooth polymeric film.
4. Drainage Core: Three-dimensional, non-biodegradable, molded polypropylene or polystyrene.

    a. Minimum Compressive Strength: 18,000 lbf/sf (862 kPa) according to ASTM D 1621.
    b. Minimum In-Plane Flow Rate: 18 gpm/ft (225 L/min per m) of unit width at hydraulic gradient of 1.0 and compressive stress of 25 psig (172 kPa) according to ASTM D 4716.

5. Filter Fabric: Non-woven needle-punched geotextile, manufactured for subsurface drainage, made from polypropylene, polyolefin, or polyester; complying with following properties according to AASHTO M 288:

    a. Survivability: Class 2.
    b. Permittivity: 0.1 per second, minimum.

6. Available Manufacturers and Products:

    a. American Hydrotech, Inc.; Hydrodrain 700
    b. American Wick Drain Corporation; AmeriDrain 654.
    c. Carlisle Coatings & Waterproofings; CCW MiraDRAIN 9800.

d. Grace Construction Products; Hydroduct 660.
e. Henry Company; DB 650n with G100s/s base/protection sheet.
f. Polyguard Products, Inc.; Flow 18-H.
g. Tremco Commercial Sealants & Waterproofing; TREMDrain 2000.

C. Adhesive for Bonding Drainage Panels: Product compatible with drainage panels being bonded and with demonstrated capability to bond securely to substrates indicated without damaging substrates.

D. Miscellaneous Accessories: As required by manufacturer for complete installation assembly, including flanges around piping penetrations and expanded base and tie-in fittings as necessary to coordination with foundation drainage system.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

### 3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. ASTM D 6135.
2. Respective manufacturer's written installation instructions.
3. Accepted submittals.
4. Contract Documents.

### 3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Excavation Dewatering: Verify that the waterproofing application area is dry and free of standing and uncontrolled water. Should the dewatering system fail at any time during application of waterproofing system, the materials shall be completely removed and work shall start over with new materials once the area is dry and free of water again.

C. Concrete Surfaces:

1. Verify concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.

2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Remove fins, ridges, mortar, and other projections.
4. Verify honeycomb voids, rock pockets, form tie holes, and other defects are filled by other Division 03 Sections.
5. Remove dust and dirt from joints and cracks according to ASTM D 4258.
6. Remove debris, oily substances, mud, grease, oil, bitumen, form-release agents, paints, curing compounds, penetrating contaminants or film-forming coatings from concrete, and similar substances.

## 3.4 MODIFIED BITUMINOUS SHEET WATERPROOFING INSTALLATION

A. General Installation Performance Requirements: Install waterproofing system to prevent passage of liquid water under hydrostatic pressure.

B. Joint and Crack Treatment: Prepare, treat, rout, and fill joints and cracks in substrate.

C. Primer: Apply to substrates at required rate and allow to dry. Limit priming to areas that will be covered by waterproofing in same day. Reprime areas exposed for more than 24 hours.

D. Waterproofing Tie-Ins: Install waterproofing and accessories to tie into adjacent waterproofing to ensure watertight installation.

E. Termination and Penetration Treatment: Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves.

F. Waterproofing Application: Apply and firmly adhere sheets over area to receive waterproofing.

1. Accurately align sheets and maintain uniform 2-1/2 in (63 mm) minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
2. Treat inside and outside corners. Install sheet strips centered over vertical inside corners. Install 3/4 in (19 mm) fillets of liquid membrane on horizontal inside corners and as follows:

    a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install sheet strip centered over corner.
    b. At deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

3. Apply sheets firmly without wrinkles, buckles or kinks.
4. Apply sheets so that direction of flow of water is over and not against laps.
5. Apply sheet strips under waterproofing membrane at, but not limited to, following locations:

    a. Expansion joints.
    b. Discontinuous deck-to-wall and deck-to-deck joints.
    c. Under clamping ring at drains.
    d. Wall angles and corners.
    e. Substrate cracks.

f. Penetrations.
g. Isolation, construction and contraction joints.
h. Where waterproofing membrane may be subject to unusual strain.

6. Apply liquid membrane fillet at interior corners under sheet strips.
7. If not indicated otherwise, terminate top edges of sheets under metal counterflashings or with metal termination bars and sealants.
8. Apply mastic or liquid membrane to vertical and horizontal terminations.
9. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or metal termination bars and sealants.

G. Damaged Waterproofing: Repair waterproofing not complying with requirements and patch with sheet waterproofing patch extending 6 in (150 mm) beyond repaired areas in each direction, pressed or rolled in place, with edges sealed with mastic.

1. Patch tears, voids, misaligned or inadequately lapped seams.
2. Slit fishmouths and blisters, overlap flaps, and patch.

3.5 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

A. Installation: Place and secure molded-sheet drainage panels with adhesive, with geotextile filter fabric facing away from waterproofed surface. Lap edges and ends of geotextile filter fabric to maintain continuity. Protect installed drainage panels during subsequent construction.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.

B. Testing Agency: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.

C. Correction of Deficiencies: Correct deficiencies in or remove waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair flashing.

D. Final Inspection: Arrange for waterproofing system manufacturer's qualified technical representative to inspect waterproofing installation on completion of waterproofing membrane and flashing. Notify Architect and Owner 48 hours in advance of date and time of final inspection.

3.7 CLEANING AND PROTECTION

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

# SECTION 10 1400

# SIGNAGE - PLAZA

## GENERAL

### 1.1 SUMMARY

A. CONTRACTOR shall be responsible for securing all sign permits, including payment of fees, required by the governing municipal offices for the installation of all exterior and interior signage for the Project.

B. Sign Fabrication: Types of signs, messages, and graphics are indicated on the Drawings and herein, and require various materials, finishes, illumination and fabrication and installation techniques.

C. Shop drawings, layouts, samples, and mock-ups for Construction Manager approval.

D. Structural design and calculations for all signage to confirm structural integrity of the designed support. All structural connections will require certification by licensed Engineer.

E. Installation of all fabricated signs, including all fasteners and fastenings and related electrical and data connections.

F. Coordination with all trades of this Contract required for the fabrication and installation of the signage, including the approvals by the Construction Manager required in this Section. Fabrication and installation of the Work in accordance with National Electrical Code (NEC); latest edition, Underwriters Laboratory UL); latest edition, National Fire Protection Agency (NFPA); latest edition and National Electrical Manufacturers Association Standards,

G. Coordination and verification of all messages & message schedules with Construction Manager/Client. Fabricator to complete sign message schedule for submission and approval by the Construction Manager.

H. Verification of all conditions and sign dimensions in the field. Sign fabricator to coordinate all signage requirements with the architectural, structural, lighting, electrical, and telecommunications drawings to ensure that all proposed signs can be installed, with power and required data connections and structurally supported. Verification of conditions and sign dimensions to be completed prior to sign fabrication and approval of all required submittals.

### 1.2 RELATED REQUIREMENTS

A. Structural Design: Details on Drawings indicate a design approach for sign fabrication but do not necessarily include all fabricating details required for the complete structural integrity of the signs, including consideration for static, dynamic, and erection loads during handling, erecting, and service at the installed locations, nor do they necessarily consider the preferred shop practices of the individual sign fabricators. Therefore, it shall

be the responsibility of the Fabricator to perform the complete structural design of the signs and to incorporate all the reasonable safety factors necessary to protect the Construction Manager and their representatives, against public liability. Designs which survive rational engineering analysis will be acceptable, provided that shop drawings, including structural design, are approved by the Construction Manager. Signs must meet all applicable local, state, and national codes, as well as testing laboratory listings where required. Connection details and structural calculations to be verified by the structural engineer prior to any fabrication. Fabricator to coordinate with General Contractor on all footings, structural attachments, and penetrations of slabs.

1. Shop Drawings
   The Shop Drawings presented for pricing are not fabrication drawings. The Contractor is expected to provide all details necessary to effectively explain and specify the fabrication process and the expected performance of the installed product. The Contractor must demonstrate through details and specifications their complete understanding of the desired final product and the method/process by which they are producing said product. The Contractor is responsible to field measure prior to submitting. Repackaging the supplied Drawings with new title blocks and delivering as submittals will not be accepted. Although art may be supplied electronically, Contractors must be prepared to create all graphic content from scratch – per instance as requested - to demonstrate and verify the quality and accuracy of the delivered product.
2. The Bid Set Drawings represent the design intent for the signs required for the Project. The sign fabricator is responsible for the proper engineering of all elements of the Work and where applicable, to include a set of wet stamped, signed engineering calculations by a licensed Structural Engineer. The internal structure, dimensions, and specifications for all items shall be indicated in the shop drawings.
3. Description: Provide shop drawings for all items including, but not limited to the following:
   a. Complete fabrication and installation drawings for each sign type. Indicate dimensions, materials, finishes, fastening, anchorage, joining, sealing, backing, utility requirements, rough-in, and adjacent related site conditions.
   b. Each sign type with all graphic elements.
   c. All letter styles shall be accurately reproduced.
   d. Connections and routing for all power and data cabling.

B. MAINTENANCE

1. Maintenance and Operating Manuals
   a. Submit four (4) copies of Maintenance and Operating Manuals to the Construction Manager’s Representative and 1 copy to the Executive Architect.
   b. Furnish complete manuals describing the materials, devices and procedures to be followed in operating, cleaning and maintaining the Work. Include manufacturers’ brochures and parts lists describing the actual materials used in the Work, including metal alloys, finishes, electrical components and other major components.
   c. Assemble manuals for component parts into single binders identified for each system.
2. Instruction

a. Prior to acceptance, establish with Construction Manager's Representative an instruction and training program for Construction Manager's Representative's personnel.
b. Notify the Construction Manager's Representative in writing at least 7 days prior to commencement of the program providing an outline of topics indexed to the Maintenance and Operating Manual.
c. Provide a trained instructor. Provide three (3) consecutive 4-hour periods of training scheduled during the normal 8-hour working day. Instruction and training shall include, but shall not be limited to, procedures to be followed in the normal day-to-day maintenance and operation of the Work.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Contractor shall make all submittals for each permit via the Construction Manager's Representative. Contractor shall be responsible for paying all fees, making adjustments as required, or any task necessary for obtaining local building and installation Sign permits for the proper execution of the Work.

B. Regulatory Requirements:

1. Comply with applicable portions in ADAAG.

2. References

a. International Building Code - IBC 2006
b. Local municipal building & signage code requirements
c. National Association of Architectural Metal Manufacturers (NAAMM) "Metal Finishes Manual."
d. American Welding Society (AWS) – AWS D1.1 "Structural Welding Code, Steel," and AWS D1.2 "Structural Welding Code, Aluminum."
e. Underwriters Laboratories Inc. (UL) – Standards for Safety, UL Publication 48 "Electric Signs."

1.4 SUBMITTALS

A. Procedure: Prepare submittals to include the following:

1. Notes on Drawings shall clearly define any actions requiring review by the Construction Manager.

2. First article of production-run/mock-up items, both large and small, will be reviewed by the Construction Manager before production run is commenced.

3. It shall be the responsibility of the Contractor to schedule all review meetings with the Construction Manager.

B. Submit physical samples of sufficient size and quantity to illustrate materials, finishes, equipment or workmanship, and to establish standards by which completed work will be judged. Samples must represent the functional characteristics of the product or material, with integrally related parts and attachment devices, colors, and finishes.

C. All samples to have a place for stamp approval.

D. Required samples for review:

1. Full 12" x 12" set of all specified paint colors and finishes.
2. Complete, full-size message in each typeface to demonstrate proper spacing (blue text on silver background: outline not accepted).
3. Sample of each type of fastener to be used.
4. Each type of exposed metal used for major elements of work with respective finish.
5. Each type of adhesive vinyl film, including computer-cut designs, shown full-size on each of the specified ground colors.
6. Mock-ups as scheduled in this section. Mock-ups shall become the property of Construction Manager and are not to be part of the completed work.
7. Other items as may be required by Construction Manager, or as noted on the Drawings or herein.

E. Extra Materials / Spares: Deliver to the appropriate Construction Manager's Representative contact person, in manufacturer’s original packaging and store at the Project where directed.

1. Furnish (1) gallon of each finish paint color for touch-up purposes.
2. Furnish (6) lamps of each type and size used in the signage (as applicable).
3. Furnish spare keys to master keyed locks on directory or Kiosk signage

F. Supplementary Product Literature: Submit for information. Furnish within seven (7) days of request, manufacturer’s literature describing the general properties of each product to be used in the Work

1.5 QUALITY ASSURANCE

A. Mock-ups and Prototypes:

1. Provide a mock-up (partial for large Signs; complete for smaller Signs) of each sign type requested at the fabrication facility for review.
2. Utilize the same materials and installation methods in the mock-up as intended for the final Work. Schedule the installation so that the mock-up may be examined, and any necessary adjustments made, prior to commencing fabrication of the final Work. Replace unsatisfactory items as directed.
3. When accepted, mock-up shall serve as the standard for materials, workmanship, and appearance for the Work throughout the project.

B. Work-In-Progress Approvals:

1. Provide work-in-progress sign elements reviews. Scheduled or unscheduled viewings at the Fabrication Facility may be initiated by the Construction Manager's Representative as deemed necessary to ensure continued quality control and make any adjustments required during fabrication. Unsatisfactory items are to be corrected by the Contractor as directed by the Construction Manager.

C. Regulatory Requirements:

1. Comply with applicable requirements of the Applicable Laws and Authorities. Obtain necessary approvals and permits from all such Authorities as required.

D. Markings and Labels:

1. Locate markings, labels, manufacturer names and other identifications so as to be concealed from public view and as acceptable by the Construction Manager's Representative.

2. No trade name or other identification shall appear on any item where it will be seen by the public except as specifically approved by the Construction Manager's Representative in advance.

E. Final Location of Signs:

1. The location of signs as shown on the Location Plans is for general reference only and in some cases is not representative of the exact final location. Final locations of Signs shall be field located in coordination with the Construction Manager's Representative.

2. Contractor shall arrange for meetings at the Project to accommodate direction of final locations according to Project Construction Schedule.

F. Lettering:

1. The Contractor shall be responsible for the quality control of all lettering. All letterforms shall be crisp, sharp, free of nicks, ragged edges and discontinuous curves. All lettering shall conform to approved typeface, weight and letter spacing. No substitutions of typeface foundry, brand or version or implementation technique will be accepted without prior approval.

2. Vinyl Die Cut Graphics: All camera-ready artwork shall be anagraph scanned for cutting on a Gerber Sign Maker II or approved equal.

3. All cutting and routing shall be executed in such a manner that all edges and corners of finished letterforms are true and clean. Letterforms with rounded positive or negative corners, nicked, cut, or ragged edges, etc., will not be accepted. All letterforms shall be so aligned as to maintain a baseline parallel to the sign format. Margins must be maintained as specified in drawings.

4. All Work under the Agreement shall be performed by skilled craftsmen under supervision of trained foremen, experienced in the trade of craft required to accomplish the Work and produce a product of high quality.

G. Tactile Sign Messages

1. All tactile sign messages must comply with ADAAG 2010; Sections 703.2-703.4

2. Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. Where characters have rectangular cross sections, spacing between individual raised characters shall be 1/8 inch (3.2 mm) minimum and 4 times the raised character stroke width maximum. Where characters have other cross sections, spacing between individual raised characters shall be 1/16 inch (1.6 mm) minimum and 4 times the raised character stroke width maximum at the base of the cross sections, and 1/8 inch (3.2 mm) minimum and 4 times the raised character stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements 3/8 inch (9.5 mm) minimum.

3. Braille shall be contracted Braille (Grade 2), domed and maintain a minimum 3/8 inch clear-space from other tactile elements.

4. Proofreading of Braille messages is to be performed by the sign fabricator prior to fabrication.

H. Dimensions

1. Written dimensions on bid set drawings shall have precedence over scaled dimensions.

2. Contractor shall verify and be responsible for all dimensions and conditions shown by these drawings. Shop details must be approved by the Construction Manager prior to fabrication.

I. Discrepancies

1. Contractor shall notify the Construction Manager of any discrepancies in the Drawings, Sign Location Plan or Sign Message Schedule, in field dimensions or conditions and/or changes required in construction details.

1.6 WARRANTY

A. Signage Warranty

1. Submit to the Construction Manager's Representative a 5-year written warranty (effective the date of final acceptance) covering all Signs, notarized by the Contractor and Installer (if Sub-Contractor is used), agreeing to repair or replace the Defective Signs. Upon notification of such Defective Signs within the warranty period, make necessary repairs or replacement at the convenience of the Construction Manager’s Representative.

B. Linear Polyurethane Paint Factory Finish Warranty

1. Submit to the Construction Manager’s Representative a 5 year written warranty, warranting that the factory-applied linear polyurethane finishes will not develop excessive fading or excessive non uniformity of color or shade, and will not crack, peel, pit, corrode or otherwise fail as a result of Defects in materials or workmanship within the following defined limits. Upon notification of such Defects within the Warranty Period, make necessary repairs or replacement at the convenience of the Construction Manager’s Representative.

C. “Excessive Fading”

1. A change in appearance which is perceptible and objectionable as determined when visually compared with the original color range standards.

D. “Excessive Non-Uniformity”

1. Non-uniform fading to the extent that adjacent panels have a color difference greater than the original acceptable range of color.

E. “Will Not Pit or Otherwise Corrode”

1. No pitting or other type of corrosion, discernible from a distance of 10’ (3 m), resulting from the natural elements in the atmosphere at the project site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All Specified Metals

1. Aluminum

a. Aluminum shall be suitable for ornamental, architectural work. Surface finish shall be smooth, free of extrusion marks or imperfections. Alloy shall be selected to meet the structural requirements of the specific application.

2. Steel

a. Steel shall be suitable for ornamental and architectural work. Surface finish shall be smooth, free of all extrusion marks or imperfections. Alloy shall be selected to meet the structural requirements of specific application. Structural metal for concealed framing shall be of galvanized rolled steel or equal as required to satisfy structural requirements.

B. Adhesive used for installing Signs shall be manufactured by Dow Corning or equal. “VHB” tape such as Polyfoam or “Isotac” contact adhesive tape manufactured by 3M shall be used in conjunction with silicone adhesives for installation of wall signs, in minimum thicknesses available.

C. Concrete Installation of anchoring devices into concrete slab shall be adjusted to avoid penetrating existing reinforcing conduit, etc. contained in the concrete slab. Coordinate with the Architect and Structural Engineer.

D. Acrylic intended for non-illuminated use shall be 0.25 inch cast acrylic sheet with non-glare finish, unless otherwise specified on Drawings. Acrylic intended for edge-illuminated use shall be 10mm extruded acrylic sheet with embedded diffuser particles designed specifically for edge-lighting, unless otherwise specified on Drawings. Notes above TBD.

E. Photopolymer: Use DuPont, Nova Polymer or equal high quality polymer. Finished signs shall meet all ADAAG and Title 24 tactile signage requirements for raised characters and Grade 2 braille. Routing cut to finished sizes. All edges shall be eased. Use acrylic polyurethane for all top coating. All raised characters shall be silk screened to specified colors.

F. Decal or Transfer: Provide special printed paper or vinyl suitable for reproducing the design onto material indicated, as required. Submit sample to the Construction Manager's Representative for approval.

G. Hardware / Hinges: Provide and install all incidental hardware necessary for the proper functioning of the Signs, including, but not restricted to, materials and products covered in this section. Provide stainless steel hinges for all hinged access panels. Provide pin tumbler locks for all access panels requiring locks. Provide stainless steel fasteners for assembling ferrous and non-ferrous metals.

H. Bolts, nuts, screws, washers, anchors and other devices required to complete the Work. Contractor shall use the same basic metal or alloy as the metal fastened, and finish to

match in color and texture. Use stainless steel 300 series alloy where used to join dissimilar materials.

I. All exposed fasteners to be 0.125 inch flathead stainless steel screws painted to match adjoining surfaces unless otherwise specified on drawings.

J. Insulation /Material Isolation: Separate all ferrous and non-ferrous metals with non-conductive gaskets to prevent electrolysis. In addition to gaskets, provide stainless steel fasteners for some cases as required.

K. Welding Electrodes and Filler Metal -

L. Provide the alloy and type of welding electrodes and filler metal required for strength, workability, compatibility and color match after grinding smooth and finishing the fabricated product.

M. Additional Material/Processes: For materials or processes described in the preceding list, the material and/or process as detailed in the design documents shall be used as the meet or exceed equivalent.

2.2 COMPONENTS

A. Electrical components must conform to applicable electrical codes and the following:

1. All materials must be approved and listed by Underwriters Laboratories, Inc.
2. Light Emitting Diode (LED) general lighting requirements:
   a. Provide sufficient LED wattage, quantities and spacing to ensure continuous, maximum illumination. Provide industry recognized product for reliability and performance for specific application such as a GE lighting system or approved equal.
   b. Provide LED lighting prototypes to verify brightness and uniformity of lighting with designer.
3. LED lighting component, color and power requirements:
   a. Edge lighting – fabricated linear white LED’s 24 VAC
   b. Back lighting – fabricated matrix white LED’s 24 VAC
4. Heavy duty, non-keyed, flush mounted, fused or un-fused disconnects. Provide NEMA 1 for dry locations and proper enclosure for others.
5. Dynamic LED fixtures (as appropriate, equal or better):

   Provide industry recognized product for reliability and performance for specific application or approved equal.

   **a. Philips Color Kinetics: iColor Cove MX Powercore:**

   **Output**
   Lumens*
   387 (125° x 120°)
   296 (50° x 70°)

   Lumen Maintenance† 120,000 hours L50 @ 25° C 90,000 hours L50 @

50°C
LED Channels Red / Green / Blue

**Electrical**
Input Voltage 100 – 240 VAC, auto-switching, 50 / 60 Hz
Power Consumption 13 W maximum at full output,steady state

**Control**
Interface Data Enabler Pro (DMX or Ethernet)
Control System Philips full range of controllers, including Light System Manager, iPlayer 3, and ColorDial Pro, or third-party controllers

B. Electrical Wiring and Equipment: Provide and install electrical materials such as ballasts, transformers, lamps, sockets, neon units, connectors, and all other equipment which shall be new and shall be approved by Underwriters Laboratories, Inc. The assembly of all components within the illuminated signs shall conform to all standards of Underwriters Laboratories, Inc. as published in the latest edition of “Standards for Sign Safety” and all illuminated signs shall bear the U.L. label. All wiring and equipment shall be concealed within the Sign structure.

C. Conduit and Devices: Provide Rigid steel conduit, junction boxes and associated devices in accordance with applicable codes as required.

D. Wiring: Minimum #12 AWG copper shall be used. High tension wiring shall not be less than GTO 15 wire as manufactured by Carol Cable Company or approved equal. All wiring shall be AWM 90 0 centigrade 1000 volt TW/MTW U.L. file no. 18971. Wiring connectors for wire splicing shall be U.L. approved 1000 volt capacity and shall be Scotch Lock type Y or R or equal. All splices should be easily accessible for inspection and should be shown on Shop Drawings.

E. Ballasts shall be used as required for internally illuminated cabinet signs, in quantity and arrangement as recommended by ballast manufacturer and accessible for maintenance and shown on Shop Drawings.

F. Disconnect Switch: All Signs or Sign components with electrical service shall be equipped with an approved external disconnect switch, flush mounted on the cabinet / Sign, with circuits and capacity to control all primary wiring within the Sign. Location of switch must be shown on Shop Drawings and is subject to approval.

G. Illumination: All Signs with fluorescent fixtures shall utilize minimum 800 milliamp T8 output cool white fluorescent lamps at the length and placement necessary to provide even illumination without light leaks. All Signs with LED light sources shall be built to perform as required by the Design Consultant's documentation. Contractor shall provide any specification information required to verify performance. All lamps and ballasts shall be provided by the Contractor. Contractor shall provide waterproof flush access panel(s), which shall be concealed wherever possible. Conduit wiring and electrical equipment from the field electrical connection to any part of the sign and within the sign shall be provided by the Contractor.

H. Ventilation: While maintaining a proper weather seal, Contractor shall provide for sufficient ventilation of Sign components to prevent overheating or warping; allowing for color of sign, mounting surface, climate conditions, etc. In providing for ventilation, Contractor shall protect sign from elements (rain, wind, debris, etc.) that might cause operational or cleaning problems. Signs / cabinets with light leaks will not be accepted. Contractor shall utilize stainless steel bug mesh screen for integration with weep holes or vent / louvers on the Signs to prevent insect migration into illuminated Signs.

## 2.3 FINISHES

### A. FINISHING MATERIALS

1. Linear Polyurethane Coatings: Provide the following, or other products as acceptable.
    a. Acrylic Linear Polyurethane enamel: Two components, acrylic aliphatic isocyanate / acrylic polyurethane having ultraviolet (UV) inhibitors and engineered for exterior application by Matthews Paint Company or approved equal.
    b. Primer for Aluminum: Two part component primer: One-coat Matthews 74-734 and 74-735 Metal Pretreat at. 25 mils dry film thickness or one-coat Matthews 74-793 Spray Bond at .15 to .25 mils dry film thickness or Wyandotte / AKZO Grip-Guard Wash Primer (2Afy-31284) with Grip-Guard Wash Primer Hardener (10AFK-31285) combined and applied per manufacturer’s specifications or approved equal (primer) for the application of the pre-approved and pre-formulated paint system.
    c. Primer for Steel: Two part component primer: One-coat Matthews 74-734 and 74-735 Metal Pretreat at .25 mils dry film thickness or Wyandotte / AKZO Grip-Guard Wash Primer (2Afy-31284) with Grip-Guard Wash Primer Hardener (10AFK-31285) combined and applied per manufacturer’s specifications or approved equal (primer) for the application of the pre-approved and pre-formulated paint system.
    d. Clear Sealers: Crystal clear matte polyurethane sealers By Matthews Paint Co. or approved equal. Sealers are to resist rust and corrosion associated with exposure to salt air. As required and of highest quality available, applied per manufacturer’s specifications.
2. Anodized Aluminum Components / Panels: If required, Contractor shall provide anodized (application of aluminum oxide film coating in clear or colored dye finish) aluminum panels or parts to match Executive Architect's color, grain, finish and specifications.
3. Silk Screening Materials: Provide photo processed screening, arranged to furnish sharp and solid images without edge build up or bleeding of the coating. Pattern-cut screens may be used for non-repeat copy, provided that final image copy is equal to photoscreen quality. Provide only weather-resistant coating materials, compatible with the intended substrates. All silk-screened graphics are to be done with the finest screen size feasible for sharp, even reproduction.
4. Vinyl Die-Cut and Pattern Cut-out Graphics: Use Scotchcal Opaque and Translucent film and Scotchcal Diamond Grade VIP Reflective film manufactured by 3M where specified. Use pressure-sensitive, non-yellowing, non-peeling and weather resistant vinyl as specified. Use approved fonts and equipment as specified.

B. SHOP APPLICATION OF SIGN FINISHES

1. Sign Graphics: Provide the letters, numerals, symbols, and other graphics markings, using the finish materials shown. Apply the graphics neatly, uniformly proportioned and spaced, and accurate within the dimensions indicated. Prepare the substrate surfaces and apply finish materials in accordance with manufacturers' instructions.

2. Metal Finishes: Remove scratches, abrasions, dents and other blemishes before applying finish. Apply the following to the fabricated Work, with texture and reflectivity as required to match the Architect's sample.

3. Linear Polyurethane Finishes: Clean the surfaces as required for proper adhesion of coatings. Use 3M Co. "Scotch Brite" pads with cleanser and water, and/or chemically treat as recommended by paint manufacturer to remove deleterious film or residue.

4. Linear Polyurethane Paint: Provide pretreatment and primer in accordance with manufacturer's recommendation. Add ultra violet inhibitors to paint subject to sunlight exposure.

5. Clear Linear Polyurethane Finish: Provide pretreatment, primer, and matte or semi-gloss finish coatings in accordance with manufacturer's recommendations. Apply 1.5 to 2.0 mils (0.0375 to 0.050 mm) dry film thickness.

C. GRAPHIC APPLICATION

1. Preparation: Surfaces to receive the graphic markings shall be clean, dry, and otherwise made ready for application of the materials. Accurately measure and lay out the required marking configurations as indicated on drawings.

2. Vinyl Die-cut and Pattern-cut Graphics: Use pressure sensitive, non-yellowing, non-peeling and weather resistant vinyl adhesive letters or images, custom flood coated as required, die cut from ScotchCal or ScotchLite as manufactured by 3M Company. Apply in strict accordance with manufacturer's instructions. Make uniformly smooth and free from bubbles, wrinkles, stretching and blemishes.

3. Painted or Silk-screened Graphics: All graphics shall be applied using photo processed screens from camera ready art, arranged to furnish sharp and solid images without build-up or bleeding of the coating. Comply with coating manufacturer's application instructions. Provide proper type of primer to suit each substrate and obtain a permanent bond. Verify compatibility of each substrate with the coatings to be used in the Work. Apply the markings with neat edges, minimum 3 mils (0.075 mm) dry film thickness and as required to obtain solid markings without voids.

4. Acid-Etched Graphics and Typography: Acid-etched typography and graphic imagery must be an average of 1/16" deep, with clean, crisp, sharp edges; ragged or soft (polished out) edges will be rejected. Acid baths used for etching should be fresh and used in an environment and temperature that will provide the highest quality etched images. Colorfill as indicated by the S/P color and finish schedule, keeping inks and fills true to the edges of letterforms / graphics.

2.4 FABRICATION AND ASSEMBLY

A. Signage shall be complete for proper installation as described in the Drawings.

B. Finish work shall be firm, well anchored, in true alignment, properly squared, with smooth clean uniform appearance, without holes, cracks, discoloration, distortion, stains, or marks.

C. Construct all work to eliminate burrs, dents, cutting edges, and sharp corners.

D. Finish welds on exposed surfaces to be imperceptible in the finished work.

E. Except as indicated or directed otherwise, finish all surfaces smooth.

F. Surfaces, which are intended to be flat, shall be without dents, bulges, oil canning, gaps, or other physical deformities.

G. Surfaces, which are intended to be curved, shall be smoothly free-flowing to required shapes.

H. Except where approved otherwise by Construction Manager, conceal all fasteners.

I. Make access panels tight-fitting, light proof, and flush with adjacent surfaces.

J. Conceal all identification labels and Underwriters Limited labels to conform to Underwriters Limited Codes.

K. Carefully follow manufacturer’s recommended fabricating procedures regarding expansion or contraction, fastening, and restraining of acrylic plastic.

L. Exercise care to ensure that painted, polished, and plated surfaces are unblemished in the finished work.

M. Isolate dissimilar materials. Exercise particular care to isolate nonferrous metals from ferrous metals.

N. All illumination shall be even and without hot spots.

O. Ease all exposed metal edges.

P. Provide miscellaneous metal items required for completion of the work even though not shown or specified.

Q. Refer to Drawings for sign color specifications.

R. Paint finishes shall be Matthews Acrylic Polyurethane with Matthews Primers and Metal Pre-Treatments or Construction Manager approved equal.

S. Shop painting to be uniform on and around all sign elements to ensure sign elements will withstand all weather conditions.

T. Mounting: Mounting plates shall be in conformance with manufacturer’s written recommendations.

U. Signs and Supports:

1. General: Provide custom manufactured Sign assemblies, components completely fabricated and finished at factory before delivery to Project. Construct to accurate detail and dimensions as shown and as review on approved Shop Drawings. Fit and assemble the Work at the shop and mark the components as required to facilitate assembly during installation. Exposed fasteners on finished faces will not be allowed, unless specifically indicated. Waviness and oil canning of surfaces is not acceptable. Minimum material thickness is to be 0.090 inches. Conceal wiring, conduct and other electrical items within sign enclosures.
2. Lettering: Cut and rout in a manner to produce true and clean edges and corners of finished letterforms. Letterforms having rounded positive or negative corners, nicked, cut, or ragged edges are not acceptable. Align letter forms to maintain a baseline parallel to the sign format. Maintain margins as indicated on the Drawings.
3. Seams and Joints: The Contractor shall cut walls and floors carefully and neatly repair them in an acceptable manner. Contractor shall consult the Architect of Record in cases where cutting into a structural portion of the building is required so that satisfactory reinforcement may be provided. Added joints shall be ground filled and finished flush and smooth with adjacent work. Such seams shall be invisible after final finish has been applied. Spot welded joints shall not be visible on exterior of signs after final finish has been applied. No gaps, light leaks, waves, or oil canning will be permitted in Work. If any of these are evident, the Contractor will be required to correct its Work or construct a new Sign at its own expense.
4. Metal Signs and Supports: Fabricate exposed surfaces uniformly flat and smooth, without distortion, pitting, or other blemishes. Form exposed metal edges to a smooth radius. Permanently bond the laminated metal components and honeycomb core with adhesive or sealant in accordance with product manufacturer’s recommendations. Grind exposed welds and rough areas to make flush with adjacent smooth surfaces.
5. Welding: Make welds continuous. Comply with American Welding Society, Aluminum Association, and Copper Development Association standards for the type of metal used.
6. Fasteners: Use exposed fasteners only if shown on the Construction Documents. Perform drilling and tapping at shop.
7. Dissimilar Materials: Where metal surfaces will be in contact with dissimilar materials, coat the surfaces with epoxy paint or plate with zinc chromate, or provide other means of dielectric separation as recommended by manufacturer to prevent galvanic corrosion (i.e. Neoprene gasket as an isolation membrane)
8. Castings: Exposed surfaces shall be uniformly free from porosity and roughness. Edges shall be filled and ground smooth. Faces shall be chemically etched and mechanically polished for specified finish.
9. Galvanizing: Provide for steel components in exterior construction, and where noted in Drawings shall be galvanized. Complete the shop fabrication prior to application of the zinc coating. Remove mill scale and rust, clean and pickle the units as required for proper pretreatment of the surfaces.
10. Hardware: Provide all incidental hardware necessary for the proper functioning of signs. External hardware shall conform to the external appearance of the Sign.
11. Supports and Backing in Walls: Contractor shall provide engineered Sign supports anchored to building structure where required and to meet requirements of

applicable building codes. Support or backing requiring installation within the building wall construction shall be immediately relayed to the Architect of Record and Construction Manager's Representative for field coordination. Contractor shall meet with the General Contractor to review all requirements.

12. Access Doors and Frames: Access doors and frames shall be flush with the material in which they occur, unless otherwise specified. Access doors and frames shall be provided upon prior written approval of the Architect. Each trade providing access doors and frames shall verify the need for fire rated doors on the Construction Drawings. Access doors in walls, partitions or ceilings shall bear UL fire rated labels of same fire rating. If access doors and frames are required to be exposed to view, they shall be chrome, brass, stainless steel, or other finish to match other finishes in the spaces in which they are to be installed, unless otherwise specified. Obtain Construction Manager's approval for location of each access door prior to placement.

13. Acoustical Requirements: Certain partition, floor and ceiling assemblies are required to have sound absorption and sound transmission loss characteristics as required in the Specification sections or as indicated on the Construction Drawings. The Contractor shall coordinate his work in constructing these assemblies and that of other contractors whose work adjoins, connects to, or penetrates these assemblies to assure that such work does not reduce acoustical characteristics of the assemblies.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. VERIFICATION OF CONDITIONS

1. Inspect all surfaces to receive signage and report all defects which would interfere with signage installation.
2. Starting Work implies acceptance of surfaces as satisfactory
3. Verify all conditions and sign dimensions in field. Contractor to review and study architectural, landscape, lighting, electrical and related plans to insure that all proposed signs can be installed and supported. Verification of conditions and sign dimensions to be completed prior to sign fabrication and reviewed with the architect.

### 3.2 INSTALLATION

A. Install signage upon acceptance by the CONSTRUCTION MANAGER of material and substantial completion of job site area to receive such materials.

B. Special Precautions: Guard against damaging existing pavements and planting where signage is to be installed.

C. Footings beneath topping surface shall be installed and located prior to top surface installation.

D. Prior to installation, check all components, nuts, bolts, and other connections for proper alignment, fit and any damage. Replace damaged or defective components.

E. Prior to installation, confirm all electrical locations and requirements with the CONSTRUCTION MANAGER.

3.3 SPECIAL TECHNIQUES

A. Keep areas of work clean, neat and orderly at all times. Clean surfaces, inside and out. Use approved cleaners if necessary to remove dirt.

B. Protective coverings and strippable films shall be removed at a time that will afford the greatest protection of the fabricated articles. Surfaces shall be cleaned to remove excess glazing and sealant compounds, dirt, and other substances.

C. Upon completion of work and before final acceptance, remove tools, surplus materials, apparatus, and debris from the site. Leave the site in a neat, clean condition, acceptable to the Construction Manager/General Contractor. Wash, clean, and leave paved areas without stains.

D. Upon completion of work, a final inspection for acceptance will be performed by the Construction Manager.

E. All mock-ups and unused submittals shall be removed from site prior to final acceptance.

F. Submit operation manuals, tools, and keys as specified in this Section.

END OF SECTION

# SECTION 12 93 00

# SITE FURNISHINGS-PLAZA

## 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. Custom Bicycle Racks
2. Manufactured Bench
3. Wood-Fencing and wall coping
4. Penetrating wood oil
5. End grain sealant
6. Skateboard deterrents
7. Stainless steel bench brackets
8. Aluminum fence posts

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts cast in concrete footings and surfaces.
2. Section 312000 "Earth Moving" for excavation for installing concrete footings.

### 1.3 ACTION SUBMITTALS

A. Product Schedule: For site furnishings.

B. Shop Drawings: For bike racks, seat wall tops and fence.

C. Shop Drawings: For bike rack, wood seat wall top and fence.

D. Samples:

1. Submit samples of bench and skateboard deterrent.

E. Mock Up:

1. Provide one completed bike rack to Architect for review and approval prior to commencing with fabrication of remaining bike racks.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, curbs stairs and other construction contiguous with metal fabrications by field measurements before fabrication or shop drawing submittal.

PART 2 - PRODUCTS

2.1 MANUFACTURED BENCH

A. 'Multiplicity' bench as manufactured by Landscape Forms Inc. 800-521-2546.

1. Style: Straight, backless
2. Mounting: Imbed
3. Seat Material: Ipe
4. Frame Color: Silver
5. Anchor bolts provided by bench manufacturer.

2.2 CUSTOM BIKE RACK

A. Custom 'football' shaped 2" dia. tube steel bike rack per drawings.

B. Mount: Surface Mount

1. Mounting Plate: 6"x6"x.25"

C. Size: 39.43" tall, 25.79" wide

D. Finish: Primed and powder coated. Color as elected by Architect

2.3 ALUMINUM FENCE POST

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

B. Extruded Bars and Shapes, Including Extruded Tubing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.

C. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

D. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.

E. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M), Alloy 6063-T832.

F. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 5005-H32 or Alloy 6061-T6 as required to meet specification and design performance requirements.

G. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.

H. G.Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

## 2.4 FASTENERS

A. General: Provide the following:

1. Type 304 stainless-steel.

## 2.5 WOOD

A. 100% clear all-heart grade Ipe wood kiln dried to 8% +/-.

B. Surfaced smooth on four sides with eased edges; kiln dried, free of knots.

C. Finish: Transparent penetrating oil. Shop apply penetrating oil and once again 3 months after it has been installed on site.

## 2.6 END GRAIN SEALANT

A. Color: Transparent natural

B. Shop apply oil to all surfaces of Ipe wood prior to attaching to all wood faces and again three(3) months after the element has been installed on site.

## 2.7 SKATEBOARD DETERRENTS

A. Manufacturer: SkateStoppers 1444 Pioneer Way, Ste. 13, El Cajon, Ca 92020-1640 P: 619-447-6374

1. Model: SkateStoppers "F2 Radius"
2. Material: Cast Bronze
3. Color: White Tombasil
4. Size; Blade thickness below surface shall be ¼", then expand to blunted ½" for safety.

B. Install per Manufactures written recommendations. See drawings for layout.

## 2.8 STAINLESS STEEL BENCH BRACKETS

A. 316 stainless steel sheet, strip, plate and flat bars: ASTM A 666

B. Finish: #4 on exposed surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, support members, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Take field measurements prior to preparation of shop drawings and fabrication, to ensure fitting of work.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

1. Do not weld, cut, or abrade surfaces of railing components that are 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.

B. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

ADJUSTING AND CLEANING

B. Touchup Painting: Clean and touchup painting of field welds, bolted connections, and abraded areas of shop paint using the same paint as originally applied.

3.3 PROTECTION

A. Protect finishes damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 129300

# SECTION 312000

# EARTH MOVING - PLAZA

## 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. Subgrade Preparation.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete pavements.
5. Subbase course and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.
8. Excavating well hole to accommodate elevator-cylinder assembly.

B. Related Sections:

1. Section 013200 "Construction Progress Documentation", Section 013233 "Photographic Documentation" for recording preexcavation and earth moving progress.
2. Section 015000 "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
3. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
4. Section 142400 "Hydraulic Elevators" for excavating well hole to accommodate elevator-cylinder assembly.
5. Section 311000 "Site Clearing" for site stripping, grubbing, stripping topsoil, and removal of above- and below-grade improvements and utilities.
6. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
7. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

### 1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect or Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect or Engineer. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.

I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

## 1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Geofoam.
4. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches.
2. Warning Tape: 12 inches long; of each color.

## 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D 2487.
2. Laboratory compaction curve according to ASTM D 698 and ASTM D 1557.

C. Blasting plan approved by authorities having jurisdiction, if required.

D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

## 1.6 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:

1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
2. Seismographic monitoring during blasting operations.

B. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

C. Preexcavation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect or Engineer.

C. Utility Locator Service: Notify Gopher State One Call for area where Project is located before beginning earth moving operations.

D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Section 015000 "Temporary Facilities and Controls," Section 311000 "Site Clearing," are in place.

E. Do not commence earth moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

I. Slope Stability – Obtain professional geotechnical engineering services to determine parameters for stable soil slope construction and associated sheeting, shoring and other soils support construction provisions for safety and protection of adjacent property.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. Materials meeting MnDOT specifications are allowed providing the material also meet the requirements specified herein.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Liquid Limit: See Geotechnical Report.
2. Plasticity Index: See Geotechnical Report.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of crushed stone; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C 33; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

## 3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

## 3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

## 3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. 24 inches outside of concrete forms other than at footings.
b. 12 inches outside of concrete forms at footings.
c. 6 inches outside of minimum required dimensions of concrete cast against grade.
d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
e. 6 inches beneath bottom of concrete slabs-on-grade.
f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

## 3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

## 3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

## 3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit or as indicated on the construction plans.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

## 3.8 EXCAVATION FOR ELEVATOR CYLINDER

A. Drill well hole plumb in elevator pit to accommodate installation of elevator-cylinder assembly. Coordinate with applicable requirements for diameter and tolerances in Section 142400 "Hydraulic Elevators."

B. Provide well casing as necessary to retain walls of well hole.

## 3.9 SUBGRADE INSPECTION

A. Notify Architect or Engineer when excavations have reached required subgrade.

B. If Architect or Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired loaded 9 ton axle weight to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph.
2. 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.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

## 3.10 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect or Engineer.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect or Engineer.

## 3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

## 3.12 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

## 3.13 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete" or Section 033053 "Miscellaneous Cast-in-Place Concrete."

D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

## 3.14 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

## 3.15 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

## 3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials at the direction of the soils engineer and in layers not more than 10 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 100 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 100 percent in building areas. In pavement areas the upper three feet shall be compacted to 100%. Trench areas below the upper three feet shall be compacted to 95%.

## 3.17 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

## 3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact subbase course and base course within 2% of optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

## 3.19 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

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

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area, but in no case fewer than three tests.
2. Foundation Wall Backfill: See section 312210.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

## 3.20 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect or Engineer; reshape and re-compact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

## 3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

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MINNESOTA MUTLI-PURPOSE STADIUM
MINNEAPOLIS, MINNESOTA

# SECTION 31 2500

# EROSION AND SEDIMENT CONTROL - PLAZA

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Furnishing, installing, inspecting, amending and maintaining construction storm water Best Management Practices (BMP's) in order to reduce the risk of soil erosion, minimize sediment transport and protect offsite areas from pollution.
   2. A Storm Water Pollution Prevention Plan (SWPPP) was prepared for the adjacent stadium work. This project is a Common Plan of Development and therefore the Plaza work is an amendment to the original SWPPP and NPDES Construction Stormwater Permit. Contractor is responsible for submitting a Permit Modification Form to the MPCA as required if applicable.

### 1.2 RELATED SECTIONS

A. 02 4116 – Structure Demolition

B. 31 1000 – Site Clearing

C. 31 2000 – Earth Moving

D. 31 2319 – Dewatering

E. 32 9113 – Soil Preparation

F. 32 9200 – Turf and Grasses

G. 32 9300 – Plants

H. 33 4100 – Storm Utility Drainage Piping

I. 33 4600 – Subdrainage Piping

### 1.3 REFERENCES

A. References to Mn/DOT shall mean the latest published edition of the Minnesota Department of Transportation Standard Specifications for Construction.

B. The Minnesota Pollution Control Agency (MPCA) is the governing authority in Minnesota for construction stormwater permit coverage administered by the U.S. Environmental Protection Agency (EPA) under the National Pollutant Discharge Elimination System (NPDES). References to the General Permit shall hereby mean the MPCA Construction Stormwater Permit obtained for the stadium project.

C. References to City shall mean the City of Minneapolis, MN.

# SECTION 31 2500

# EROSION AND SEDIMENT CONTROL - PLAZA

## 1.4 SUBMITTALS

A. This project requires Construction Stormwater Permit coverage from the MPCA. Contractor is responsible for submitting a Permit Modification Form to amend the existing permit to the MPCA as required if applicable.

B. Once the completed project has been stabilized per the General Permit requirements, the Contractor shall sign the Notice of Termination (NOT), have the Owner sign, and submit to the MPCA.

## 1.5 QUALITY ASSURANCE

A. The Contractor's individual responsible for implementing the SWPPP shall be located onsite or shall have the ability to be onsite within 2 hours of being requested by any authority having jurisdiction and/or the Engineer.

B. Periodic and unscheduled inspections may occur by representatives of the City, Engineer and/or other permitting authorities for purposes of observing conformance with permit requirements.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Unless specified otherwise herein or on the Drawings, erosion control BMP's shall conform to Mn/DOT 2575.2.

B. Unless specified otherwise herein or on the Drawings, sediment control BMP's shall conform to Mn/DOT 2573.2.

# PART 3 - EXECUTION

## 3.1 GENERAL

A. Perform work in accordance with the provisions outlined in the SWPPP, Mn/DOT 1717, 2573.3, and 2575.3, and City requirements.

B. The Contractor shall thoroughly review the Drawings, Specifications, and SWPPP prior to mobilization for clearing and/or removals.

C. With the exception of the removals and/or clearing required to install BMP's, no work shall begin until all appropriate erosion and sediment control BMP's have been completely installed, functioning, and inspected by authorities having jurisdiction and/or Engineer.

D. Interim erosion and sediment control adapting to construction phasing and/or as needed to adapt to site conditions shall be the responsibility of the Contractor incidental to the Contract. The SWPPP and Drawings shall be corrected and/or modified as the site conditions change. All changes shall be documented by the Contractor on the onsite SWPPP and Drawings and shall be available for review by authorities having jurisdiction.

E. Contractor shall phase the work in order to minimize areas of disturbed earth.

F. Contractor is responsible for conformance with all permit requirements. Any fines or penalties imposed on the project due to non-conforming work or site conditions shall be the responsibility of the Contractor.

END OF SECTION

# SECTION 321123

# AGGREGATE BASE COURSE – PLAZA

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Subgrade preparation.

B. Aggregate base course for bituminous and concrete paving.

C. Test rolling.

### 1.2 RELATED SECTIONS

A. Division 0 and 1 Sections

B. Section 310000 - Site Earthwork

C. Section 321216 - Asphalt Concrete Paving

D. Section 321313 - Portland Cement Concrete Paving

### 1.3 REFERENCES

A. Standard Specifications for Construction, Minnesota Department of Transportation, 2016 with current supplements. (MnDOT Specifications).

B. ASTM C88-90, Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

### 1.4 SUBMITTALS

A. Submit gradation test results of aggregate from the source.

### 1.5 QUALITY ASSURANCE

A. Construction testing, including test rolling and base density, will be performed by an Independent Testing Laboratory under provisions of Division 1.

## PART 2 - PRODUCTS

### 2.1 AGGREGATE BASE

A. The aggregate shall meet the requirements of MnDOT Standard Spec. 3138 Class 5, 100% crushed.

B. Other MnDOT aggregate class designations may be required as noted on the drawings. Comply with aggregate class designation requirements on the drawings.

C. Recycled material conforming to MnDOT Specification 3138.2C Class 5 is allowed where designated on the drawings upon written approval of the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify subgrade has been compacted and tested according to subgrade preparation specifications, and that grades and elevations are correct, and surface is dry.

3.2 AGGREGATE PLACEMENT

A. General – Construct aggregate base according to the requirements of MnDOT specification 2211.3 A through F except as modified herein.

B. Spread aggregate over prepared subgrade to a compacted thickness as shown on the Drawings. Compaction shall be the “Specified Density Method” as specified in MnDOT Specification 2211.3.D.2.a.

C. Place aggregate in lifts not to exceed a maximum of 6 inches in uncompacted thickness.

D. Add water as necessary to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

E. Use hand guided mechanical tamping equipment in areas inaccessible to driven compaction equipment.

3.3 TEST ROLLING

A. Test rolling will be required on the completed aggregate base of all paved areas. Test rolling shall be conducted in general compliance with MnDOT Standard Specification 2111.3. Test rolling shall be directed by the Independent Testing Laboratory. Significant deflection or rolling of the aggregate base, in the opinion of the Independent Testing Laboratory shall be considered a failure. Failing areas of the aggregate base shall be corrected by subcutting and replacing inadequate soil with clean sand or Class 5 material.

3.4 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with a 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

C. Variation from True Elevation: Within 1/4 inch.

3.5 FIELD QUALITY CONTROL

A. Compaction shall be controlled and tested according to the "Specified Density Method", MnDOT 2211.3.D.2.a..

END OF SECTION

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MINNESOTA MULTI-PURPOSE STADIUM
MINNEAPOLIS, MINNESOTA

SECTION 321216

ASPHALT PAVING – PLAZA

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. Cold milling of existing asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt overlay.
5. Asphalt curbs.
6. Asphalt traffic-calming devices.
7. Asphalt surface treatments.

B. Related Requirements:

1. Section 024116 "Structure Demolition" for demolition and removal of existing asphalt pavement.
2. Section 312000 "Earth Moving" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
3. Section 321123 “Aggregate Base Course”
4. Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.

C. References
1. Standard Specification for Construction, Minnesota Department of Transportation (MnDOT Specifications).
2. Mix Design Methods for Asphalt Concrete and Other Hot Mix Types, Manual MS-2, the Asphalt Institute (AI).

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at US Bank Stadium, Minneapolis, MN.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

    a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
    b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

## 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.
2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
3. Job-Mix Designs: For each job mix proposed for the Work.

B. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.

C. Samples for Verification: For the following product, in manufacturer's standard sizes unless otherwise indicated:

1. Paving Fabric: 12 by 12 inches minimum.

## 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.

B. Material Certificates: For each paving material.

C. Material Test Reports: For each paving material, by a qualified testing agency approved or certified by MnDOT.

D. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer accepted by MnDOT.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the City of Minneapolis and the State of Minnesota for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

## 1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F.
2. Tack Coat: Minimum surface temperature of 60 deg F.
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

# PART 2 - PRODUCTS

## 2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations and compliant with MnDOT Specifications. Comply with MnDOT Specification 2360.2A, B, C, D, and E.

## 2.2 ADDITIVES

A. Comply with MnDOT Specification 2360.2C.

## 2.3 ASPHALT MATERIALS

A. Asphalt Binder: Comply with MnDOT Specification 2360.2B

B. Prime Coat: Comply with MnDOT Specification 2358.1, 2, 3.

C. Tack Coat: Comply with MnDOT Specification 2357.1, 2, 3.

D. Water: Potable.

2.4 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Comply with MnDOT Specification 2360.2A.

B. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

C. Joint Sealant: Comply with MnDOT Specification 3725.

2.5 MIXES

A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes as designated on the plans and designed according to MnDOT Specification 2360.2; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Base Course: as designated on the plans.
3. Surface Course: as designated on the plans.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Comply with MnDOT Specification 2111.1, 2, 3 except as modified or supplemented herein.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth as designated on the plans.
2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, manholes, and other construction damaged during cold milling.

5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.
7. Handle milled asphalt material according to approved waste management plan required in Section 0174120 "Construction Waste Management and Disposal."
8. Keep milled pavement surface free of loose material and dust.
9. Do not allow milled materials to accumulate on-site.

## 3.3 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

## 3.4 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

## 3.5 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate according to MnDOT Specification 2358.3D. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate according to MnDOT Specification 2357.3D.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

## 3.6 PAVING GEOTEXTILE INSTALLATION

A. Apply tack coat uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd..

B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.

C. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.

## 3.7 PLACING HOT-MIX ASPHALT

A. Construction according to MnDOT Specification 2360.3

## 3.8 COMPACTION

A. Construct according MnDOT Spcification 2360.3.D.

## 3.9 ASPHALT CURBS

A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of 250 deg F.

1. Asphalt Mix: Same as pavement surface-course mix.

B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

## 3.10 ASPHALT TRAFFIC-CALMING DEVICES

A. Construct hot-mix asphalt speed bumps over compacted pavement surfaces. Apply a tack coat unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of 250 deg F.

1. Tack Coat Application: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
2. Asphalt Mix: Same as pavement surface-course mix.
3. Before installation, mill pavement that will be in contact with bottom of traffic-calming device. Mill to a depth of 1 inch from top of pavement to a clean, rough profile.

B. Place and compact hot-mix asphalt to cross section indicated, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

## 3.11 INSTALLATION TOLERANCES

A. Comply with MnDOT Specification 2360.3 and 2399.1, 2 and 3.

## 3.12 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

## 3.13 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency certified by MnDOT to perform tests and inspections according to MnDOT Specification 2360.3.

B. Comply with MnDOT Specification 2360.3 except as modified herein.

C. Replace and compact hot-mix asphalt where core tests were taken.

D. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

## 3.14 WASTE HANDLING

A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 0174120 "LEED Construction Waste Management and Disposal." Comply with Local, State, and Federal regulations regarding waste handling and disposal.

END OF SECTION 321216

MINNESOTA MULTI-PURPOSE STADIUM
MINNEAPOLIS, MINNESOTA

SECTION 321313

CONCRETE PAVING – PLAZA

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. Driveways.
2. Roadways.
3. Parking lots.
4. Curbs and gutters.
5. Walks.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
3. Section 321712 “Pavement Markings”

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. LEED Submittals:

1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and

preconsumer recycled content. Include statement indicating cost for each product having recycled content.

2. Design Mixtures for Credit ID 1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements. For each design mixture submitted, include an equivalent concrete mixture that does not contain portland cement replacements, to determine amount of portland cement replaced.

C. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

D. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

E. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:

1. Exposed Aggregate: 10-lb Sample of each mix.
2. Wheel Stops: 6 inches long showing cross section; with fasteners.
3. Preformed Traffic-Calming Devices: 6 inches long showing cross section; with fasteners.

F. Other Action Submittals:

1. Design Mixtures: For each 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 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. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. 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. 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 and meeting MnDOT requirements.

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

B. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated and meeting MnDOT requirements.

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.

C. Concrete Testing Service: Engage a qualified, according to MnDOT requirements, testing agency to perform material evaluation tests and to design concrete mixtures.

D. ACI Publications: Comply with ACI 301 unless otherwise indicated.

E. Mockups: Build mockups as may be required where indicated 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 concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches. Include full-size detectable warning.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with 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. Concrete paving subcontractor.
e. Manufacturer's representative of stamped concrete paving system used for detectable warnings.

## 1.7 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and according to Section 321723.

# 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 with 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 galvanized-steel wire into flat sheets.

C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

D. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A, plain steel.

E. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

F. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.

G. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 deformed bars.

H. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.

I. Plain-Steel Wire: ASTM A 82/A 82M, galvanized.

J. Deformed-Steel Wire: ASTM A 496/A 496M.

K. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated.

L. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767/A 767M, Class I coating. Cut bars true to length with ends square and free of burrs.

M. Epoxy-Coated, Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain-steel bars.

N. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.

O. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

P. 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. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

Q. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

R. Zinc Repair Material: ASTM A 780.

## 2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: Comply with MnDOT Specification 2461.2A, G, H.

B. Comply with MnDOT Specification 2461.2C, D.

C. Water: Potable and complying with ASTM C 94/C 94M.

D. Air-Entraining Admixture: Comply with MnDOT Specification 3113.

E. Chemical Admixtures: Comply with MnDOT Specification 3113, as given on the MnDOT Approved/Qualified Products List, or as specified herein. 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.
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.

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.

## 2.4 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete paving, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

## 2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry. Comply with MnDOT Specification 3751.

B. Water: Potable.

C. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating. Comply with MnDOT Specification 3754 and listed on MnDOT approved products list.

## 2.6 RELATED MATERIALS

A. Joint Fillers: MnDOT Specification 3702.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. 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.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work shall be on the MnDOT Approved/Qualified Products List:

F. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

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. Anti-Hydro International, Inc.; A-H S-Q Hardener.
b. BASF Construction Chemicals, LLC; Mastercron.
c. ChemMasters; ConColor.
d. Conspec by Dayton Superior; Conshake 600 Colortone.
e. Dayton Superior Corporation; Quartz Tuff.
f. Euclid Chemical Company (The), an RPM company; Surflex.
g. Lambert Corporation; COLORHARD.
h. L&M Construction Chemicals, Inc.; QUARTZPLATE FF.
i. Metalcrete Industries; Floor Quartz.
j. Scofield, L. M. Company; LITHOCHROME Color Hardener.
k. Southern Color N.A., Inc.; Mosaics Color Hardener.
l. Stampcrete International, Ltd.; Color Hardener.
m. Symons by Dayton Superior; Hard Top.

2. Color: As selected by Architect from manufacturer's full range.

G. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

## 2.7 DETECTABLE WARNING SURFACE

A. Cast iron conforming MnDOT Standard Plate 7038A.

1. Manufacturers: As listed in MnDOT approved/qualified products list.

## 2.8 PAVEMENT MARKINGS

A. Comply with Section 321723.

## 2.9 CONCRETE MIXTURES

A. Comply with MnDOT Specification 2301.2A and 2461.1, 2, 3.

B. Proportion mixtures to provide normal-weight concrete with the following properties or as specified in the MnDOT provisions:

1. Compressive Strength (28 Days): 4500 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: 5-1/2 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.
2. Air Content: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
3. Air Content: 6 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.

D. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume to reduce the total amount of portland cement, which would otherwise be used according to MnDOT Specification 2461.

E. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd..

F. 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.

## 2.10 CONCRETE MIXING

A. Comply with MnDOT Specification 2461.3, 4.

## 2.11 SIDEWALK MATERIAL

A. Material shall comply with MnDOT Specification 2521.2.

## 2.12 CURB AND GUTTER

A. Material shall comply with MnDOT Specification 2531.2.

## 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 concrete paving according to MnDOT Specification 2111.2, 3 to identify soft pockets and areas of excess yielding.
   1. Correct subbase with soft spots and areas of pumping or rutting 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.

### 3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Comply with MnDOT Specification 2401.3B

### 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. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M.

G. 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 of adjacent mats.

3.5 JOINTS

A. General: Comply with MnDOT Specification 2401.3E.

3.6 CONCRETE PLACEMENT

A. Comply with MnDOT Specification 2401.3C.

3.7 FINISHING

A. General: Comply with MnDOT Specification 2401.3F.

B. Acid Wash: Comply with MnDOT Specification 2521.D.1

3.8 DETECTABLE WARNINGS

A. Comply with MnDOT Standard Plate 7083 Installation.

3.9 CONCRETE PROTECTION AND CURING

A. General: Comply with MnDOT Specification 2301.3M.

3.10 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:

1. Elevation: 3/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/2 inch.
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

## 3.11 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal..

E. Comply with MnDOT Specification 2521.3.

## 3.12 CURB AND GUTTER

A. Comply with MnDOT Specification 2531.3.

## 3.13 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 5000 sq. ft. 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 500 psi.

D. Test results shall be reported in writing to Architect, 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 Architect 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 Architect.

G. 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.

## 3.14 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect 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.

D. Maintain 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 321313

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MINNESOTA MULTI-PURPOSE STADIUM
MINNEAPOLIS, MINNESOTA

SECTION 321373

CONCRETE PAVING JOINT SEALANTS - PLAZA

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. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Cold-applied, fuel-resistant joint sealants.
4. Hot-applied, fuel-resistant joint sealants.
5. Joint-sealant backer materials.
6. Primers.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.

4. Joint-sealant color.

## 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer .

B. Product Certificates: For each type of joint sealant and accessory.

## 1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

## 1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

# PART 2 - PRODUCTS

## 2.1 MATERIALS, GENERAL

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.

## 2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type NS.

1. Shall be from the MnDOT Approved/Qualified Products List.

B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893/D 5893M, Type SL.

1. Shall be from the MnDOT Approved/Qualified Products List

C. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.

1. Shall be from the MnDOT Approved/Qualified Products List

D. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.

1. Shall be from the MnDOT Approved/Qualified Products List

E. Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.

1. Shall be from the MnDOT Approved/Qualified Products List

## 2.3 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I.

1. Shall be from the MnDOT Approved/Qualified Products List

B. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I or Type II.

1. Shall be from the MnDOT Approved/Qualified Products List

C. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type I, II, or III.

1. Shall be from the MnDOT Approved/Qualified Products List

D. Hot-Applied, Single-Component Joint Sealant: ASTM D 6690, Type IV.

1. Shall be from the MnDOT Approved/Qualified Products List

## 2.4 COLD-APPLIED, FUEL-RESISTANT JOINT SEALANTS

A. Fuel-Resistant, Single-Component, Pourable, Modified-Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.

1. Shall be from the MnDOT Approved/Qualified Products List

B. Fuel-Resistant, Multicomponent, Pourable, Modified-Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade P, Class 12-1/2 or 25, for Use T.

1. Shall be from the MnDOT Approved/Qualified Products List

## 2.5 HOT-APPLIED, FUEL-RESISTANT JOINT SEALANTS

A. Hot-Applied, Fuel-Resistant, Single-Component Joint Sealants: ASTM D 7116, Type I or Type II.

1. Shall be from the MnDOT Approved/Qualified Products List

B. Hot-Applied, Fuel-Resistant, Single-Component Joint Sealants: ASTM D 7116, Type III.

1. Shall be from the MnDOT Approved/Qualified Products List

## 2.6 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and 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.

## 2.7 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine joints 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: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

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 OF JOINT SEALANTS

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

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings 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.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact 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.

E. 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.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

## 3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. 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.

## 3.5 PAVING-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within concrete paving.

1. Joint Location:

    a. Expansion and isolation joints in concrete paving.
    b. Contraction joints in concrete paving.
    c. Other joints as indicated.
2. Joint-Sealant Color: Manufacturer's standard or as noted on the plans.

B. Joint-Sealant Application: Joints within concrete paving and between concrete and asphalt paving.

1. Joint Location:

    a. Joints between concrete and asphalt paving.
    b. Joints between concrete curbs and asphalt paving.
    c. Other joints as indicated.

C. Joint-Sealant Application: Fuel-resistant joints within concrete paving.

1. Joint Location:

    a. Expansion and isolation joints in concrete paving.
    b. Contraction joints in concrete paving.
    c. Other joints as indicated.

END OF SECTION 321373

# SECTION 32 1443

# POUROUS UNIT PAVING-PLAZA

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Permeable precast concrete pavers on grade
2. Bedding materials
3. Joint material

B. Related Sections:

1. Section 312000 "Earth Moving" for excavation and compacted subgrade.
2. Section 321123 “Aggregate Base Course”.
3. Section 329450 “Structural Soil Vaults”.

### 1.2 SYSTEM DESCRIPTION

A. Permeable precast concrete pavers set on multi layered aggregate bases.

### 1.3 SUBMITTALS

A. Product Data: For the following:

1. Permeable paver
2. Paver edge restraint
3. Setting bed materials

B. Product Samples: Submit the following

1. Precast Paver- Full-size units of each type of unit paver indicated.
2. 12” section of edge restraint system
3. 1 lb. bags of bedding course materials
4. 1 lb. bags of jointing materials

C. Qualification Data: For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed permeable paver installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. 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.

C. Mockups: Before installing unit pavers, build mockups for each form and pattern of unit pavers required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work, including same base construction, special features for expansion joints, and contiguous work as indicated:

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting unit paver installation.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Approved mockups may become part of the completed Work.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect unit pavers and aggregate during storage and construction against soiling or contamination from earth and other materials.

1. Cover pavers with plastic or use other packaging materials that will prevent rust marks from steel strapping.

## 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.

# PART 2 - PRODUCTS

## 2.1 UNIT PAVERS

A. Unit Paver:

1. Type: Holland Paver
2. Size: 5”x10”x 80 mm
3. Color: Brushed Nickel
4. Supplier: Anchor Block. 800-440-8657

2.2 SETTING-BED MATERIALS

A. Unit Paver:

1. Joint Material: 1/4” to 3/8” Dresser Trap meeting AASHTO #8 or #9 standards, by Dresser Trap Rock Inc. 715.483. 3216.
2. Bedding Course meeting AASHTO #8 or #9 standards.
3. Base Course: 3/4” to 1” open graded stone, no fines. (AASHTO #57)
4. Subbase Course: 1 1/2” to 3” open graded stone, no fines (AASHTO #1) or MNDOT Class 5 aggregate base per MNDOT 3138.

2.3 PAVER EDGE RESTRAINT

A. Aluminum permeable paver edge restraint by Permaloc Corporation, Holland MI 49424, telephone (800) 356-9660. or approved equal.

1. Product: Permaloc GeoEdge, 4.5" x 4.5" high x 8 feet long, extruded aluminum, alloy 6063, T-52 hardness. Section shall have base system with legs spaced 4 inches on center with breakout tabs spaced between. Sidewall to have weep holes evenly spaced for drainage.
2. Connection Method: Section ends shall splice together with horizontal 0.060 inch (1.52 mm) thick x 1 inch (25 mm) wide x 2-3/4 inches (70 mm) long aluminum sliding connector on wall and base.
3. Finish: Mill Finish.
4. Biaxial Geogrid: Tenax MS220B or Equal.

PART 3 - EXECUTION

3.1 PREPERATION AND EXAMINATION

A. Examine the installation of Structural soil vaults, with installer present, for compliance with architect drawing and specification and manufacture instruction.

B. Proof-roll prepared subgrade according to requirements in Division 31 Section "Earth Moving" 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 base course for unit pavers.

C. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION

A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

Note: The minimum slope of the soil subgrade should be 0.5%. Actual slope of soil subgrade will depend on the drainage design and exfiltration type. All drainpipes, observation wells, overflow pipes, geotextile (if applicable) and impermeable liner (if applicable) should be in place per the drawings prior to or during placement of the subbase and base, depending on their location. Care must be taken not to damage drainpipes during compaction and paving. No mud or sediment can be left on the base or bedding aggregates. If they are contaminated, they must be removed and replaced with clean materials.

C. Any excess thickness of soil applied over the excavated soil subgrade to trap sediment from adjacent construction activities shall be removed before application of the geotextile and subbase materials.

D. Keep area where pavement is to be constructed free from sediment during entire job. Base and bedding materials contaminated with sediment shall be removed and replaced with clean materials.

E. Do not damage drainpipes, overflow pipes, observation wells, or any inlets and other drainage appurtenances during installation. Report any damage immediately to the project engineer.

F. Open-graded subbase and base course:

1. Moisten, spread and compact the #1 AASHTO subbase in 4 to 6 inch lifts without wrinkling or folding the geocomposite for structural soil valuts. Place subbase to protect geocomposite from wrinkling under equipment tires and tracks.
2. For each lift, make at least two passes in the vibratory mode then at least two in the static mode with a minimum 10 T vibratory roller until there is no visible movement of the No. 1 stone. Do not crush aggregate with the roller.
3. The surface tolerance of the compacted # 1 AASHTO subbase shall be ±3 inches over a 10 foot straightedge.
4. Moisten, spread and compact # 57 AASHTO base in 4 inch lift over the compacted # 1 AASHTO subbase with a minimum 10 T vibratory roller until there is no visible movement of the #57 AASHTO stone. Do not crush aggregate with the roller.
5. The surface tolerance the compacted # 57 AASHTO base should not deviate more than ±1 inch over a 10 foot straightedge.

   Note: In-place density of the base and subbase may be checked per ASTM D 4254. Compacted density should be 95% of the laboratory index density established for the subbase and base stone.

G. Bedding course:

1. Moisten, spread and screed the #8 or #9 AASHTO stone bedding material.
2. Fill voids left by removed screed rails with # 8 AASHTO stone.
3. The surface tolerance of the screeded # 8 AASHTO bedding layer shall be ±3/8 inch over a 10 foot straightedge.
4. Do not subject screeded bedding material to any pedestrian or vehicular traffic before paving unit installation begins.

H. Permeable interlocking concrete pavers and joint/opening fill material:

1. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
2. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after unit paver installation.

3. For metal edge restraints with top edge exposed, drive stakes at least 1 inch below top edge.
4. Cut pavers subject to tire traffic shall be no smaller than 1/3 of a whole unit. Cut pavers and place along the edges with a motor-driven masonry saw 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. Hammer cutting is not acceptable.
5. Joint Pattern: Running bond. Joint to be 3/16” wide typ.
6. Maintain straight pattern lines.
7. Fill gaps at the edges of the paved area with cut units.
8. Fill the openings and joints with # 8 or# 9 AASHTO stone.
9. Remove excess aggregate on the surface by sweeping pavers clean.
10. Compact and seat the pavers into the bedding material using low amplitude, 75-90 Hz plate compactor capable of at least 18 kN centrifugal compaction force. Perform at least three passes across paving with vibrator.
11. Vibrate under the following conditions: After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
12. Do not compact within 36 inches of the unrestrained edges of the paving units.
13. All pavers within 36 inches of the laying face must be left fully compacted at the completion of each day.
14. Cover pavers that have not been compacted, and leveling course on which pavers have not been placed, with non-staining plastic sheets to protect them from rain.
15. The final surface tolerance of compacted pavers shall not deviate more than ± 3/8 inch under a 10 foot long straightedge.
16. The surface elevation of pavers shall be 1/8 to 1/4 inch above adjacent drainage inlets, concrete collars or channels.
17. Apply additional aggregate to the openings and joints, and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.
18. Do not allow traffic on installed pavers until sand has been vibrated into joints.
19. Repeat joint-filling process 30 days later if joint material settles or washes out of paver joints.

I. 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. Hammer cutting is not acceptable.

## 3.3 FIELD QUALITY CONTROL

A. After sweeping the surface clean, check final elevations for conformance to the drawing

B. Lippage: 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.

Note: The minimum slope of the finished pavement surface should be 1%. The surface of the pavers may be 1/8” to 1/4” above the final elevations after compaction. This helps compensate for possible minor settling normal to pavements.

C. The surface elevation of pavers shall be 1/8” to 1/4” above adjacent drainage inlets, concrete collars or channels.

## 3.4 PROTECTION

A. After work in this section is complete, the General Contractor shall be responsible for protecting work from sediment deposition and damage due to subsequent construction activity on the site.

B. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units as intended. 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.

END OF SECTION 321443

# SECTION 321723

# PAVEMENT MARKINGS - PLAZA

## 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 painted markings applied to asphalt and concrete pavement.

B. Related Requirements:

### 1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to marking pavement including, but not limited to, the following:

a. Pavement aging period before application of pavement markings.
b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.2: For interior, field-applied, pavement-marking paints, documentation including printed statement of VOC content.

C. Shop Drawings: For pavement markings.

1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

D. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

## 1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the State of Minnesota for pavement-marking work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

## 1.6 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials 55 deg F for water-based materials, and not exceeding 95 deg F.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements.

B. Basis-of-Design Product: Subject to compliance with requirements, provide products from the MnDOT Approved/Qualified Products list.

## 2.2 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, colors complying with FS TT-P-1952.

1. Color: As indicated.

B. Pavement-Marking Paint: MPI #32, alkyd traffic-marking paint.

1. Color: As indicated.

C. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than three 45 minutes.

1. Color: As indicated.

D. Pavement-Marking Paint: MPI #97, latex traffic-marking paint.

1. Color: As indicated.

E. Glass Beads: AASHTO M 247, Type 1.

1. Roundness: Minimum 80 percent true spheres by weight.

F. VOC Content: Pavement markings used on building interior shall have a VOC content of 150 g/L or less.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

### 3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

### 3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

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# SECTION 32 8400

# PLANTING IRRIGATION PERFORMANCE- PLAZA

## 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. 329200 “Turf and grasses for turf, seeding and erosion control materials.
2. 329300 “Plantings” for trees, shrubs and groundcover plantings.
3. 312000 “Earth Moving” for excavation, trenching and backfilling.
4. Division 26-Plumbing
5. Division 22-Electrical

### 1.2 SUMMARY

A. Section Includes:

1. Piping
2. Pipe Sleeves
3. Manual valves
4. Automatic control valves
5. Transition fittings
6. Miscellaneous piping specialties
7. Sprinklers
8. Quick couplers
9. Drip irrigation
10. Controllers
11. Boxes for automatic control valves

### 1.3 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

D. Pipe Sleeves: Conduit placed wherever an irrigation line or control wire passes under pavement, walks, pavers or similar surfacing.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: 100 percent coverage irrigation system, locating water source and routing out of the existing parking structure, hanging of piping in the parking structure, comprehensive analysis by a qualified irrigation designer, using performance requirements and design criteria indicated. Irrigation zone control shall be automatic operation with controller and automatic control valve. Irrigation system must me water efficiency requirements of B3-State of Minnesota Sustainable Building Guidelines (MSBG).

B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.

C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:

1. Irrigation Main Piping: 200 PSI
2. Circuit Piping: 100 PSI

1.5 WATER SUPPLY

A. Utilize water supply line assuming to be capable of supplying 100 GMP at 60 PSI pressure for design purposes. Verify this performance level prior to installing irrigation system.

1. The project will be serviced by two water sources and thus have two points of connection and necessary controllers, water meters and backflow prevention devices at each POC.

a. The portion of the plaza south of the LRT tracks and station will be serviced by a non-potable water service line located in the lowest level of the parking ramp in the southeast corner of level P2 in the mechanical room. This water source will need to be routed vertically up through the ceiling of level P1 where the line can then be stubbed out to the plaza.
b. The portion of the plaza north of the LRT tracks will also be serviced by a non-potable water source on level P2. The contractor will need to determine the best location to make this connect and install the necessary irrigation components finding the shortest most economical route to get a water supply to the north side plaza. This water source will then need to be spit to provide water to the areas north and south of the parking structure garage entry off of Park Avenue as indicated on the plans.

1.6 ACTION SUBMITTALS

A. Product Data: Provide cut sheet for each type of product indicated. Include rated capacities, operating characteristics and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Design Submittal: For irrigation systems indicated to comply with performance requirements and design criteria.

1.7 INFORMATIONAL SUBMITTALS

A. Shop Drawings: Submit AutoCAD shop drawing of irrigation plan drawn to scale, on which components are shown and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions such as signs and light standards. Also include adjustments necessary to avoid plantings and obstructions such as signs and light standards.

B. Qualification Data: For qualified Installer.

C. Zoning Chart: Show each irrigation zone and its control valve.

D. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

E. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sprinklers, drip components, controller and automatic control valves to include in operation and maintenance manuals.

1.9 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. Rotary Sprinklers: 5 of each type
2. Spray Sprinklers: 5 of each type

1.10 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers that includes a Certified Irrigation Designer qualified by The Irrigation Association, a Certified Irrigation Contractor qualified by The Irrigation Association, a Power Limited Technician that qualifies the contractor to hold a Technology Systems Contractor License issued by the State of Minnesota.

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.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. Circuit Piping 1" & 1 ¼" sizes Polyethylene SDR 11.5, 100 PSI

1. Insert Fittings for PE Pipe: nylon or propylene plastic with barbed ends. Include bands or other fasteners.

C. Circuit Piping 1 ½" and Larger PVC 1120, SDR 26

D. Main Line Piping HDPE

E. Pipe Sleeves 4" & 6" sizes PVC 1120, SDR 21, Class 200

## 2.2 PIPING JOINING MATERIALS

A. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

## 2.3 MANUAL VALVES

A. Plastic Ball Valves:

1. Manufacturers: Subject to compliance with requirements

a. Spears Manufacturing Company.

2. Description:

a. Standard: MSS SP-122.
b. Pressure Rating: 150 PSI
c. Body Material: PVC.
d. Type: True Union.
e. End Connections: Socket or threaded.
f. Port: Full.

B. Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements,

a. Hammond Valve.
b. KITZ Corporation.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Powell Valves.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
g. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.

b. Class: 125.
c. CWP Rating: 200 PSI
d. Body Material: ASTM B 62 bronze with integral seat and screw-in, vented bonnet.
e. Ends: Threaded or solder joint.
f. Stem: Bronze, nonrising.
g. Disc: Solid wedge; bronze.
h. Packing: Asbestos free.
i. Handwheel: Malleable iron, bronze, or aluminum.

2.4 AUTOMATIC CONTROL VALVES

A. Plastic, Automatic Control Valves:

1. Manufacturer: Rain Bird Corporation

a. 1” model 100-PEB
b. 1 ½” Model 150-PEB
c. Or Approved Equal

2. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.

2.5 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI WH 201, with bellows or piston-type pressurized cushioning chamber and in sizes complying with PDI WH 201, Sizes A to F.

B. Pressure Gages: ASME B40.1. Include 4-1/2-inch diameter dial, dial range of two times system operating pressure, and bottom outlet.

2.6 SPRINKLERS

A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

B. Plastic, Pop-up, Gear-Drive Rotary Sprinklers:

1. Manufacturer: Rain Bird Corporation

a. 5004-PLRS
b. Or Approved Equal

2. Description:

a. Body Material: ABS.
b. Nozzle: ABS
c. Retraction Spring: Stainless steel.
d. Internal Parts: Corrosion resistant.

3. Capacities and Characteristics:

a. Flow: Based on nozzle size indicated on drawings
b. Pop-up Height: 4” aboveground to nozzle.
c. Arc: Adjustable
d. Radius: Adjustable
e. Inlet: NPS 3/4

C. Plastic, Pop-up Spray Sprinklers:

1. Manufacturer: Rain Bird Corporation

a. 1800-SAM-PRS
b. Or Approved Equal

2. Description:

a. Body Material: ABS.
b. Nozzle: ABS
c. Retraction Spring: Stainless steel.
d. Internal Parts: Corrosion resistant.
e. Pattern: Fixed, with flow adjustment.

3. Capacities and Characteristics:

a. Nozzle: ABS
b. Flow: Based on nozzle indicated on drawings
c. Pop-up Height: 4 inches aboveground to nozzle.
d. Arc: Fixed Nozzle
e. Radius: adjustable
f. Inlet: NPS 1/2

## 2.7 QUICK COUPLERS

A. Manufacturers: Rain Bird Corporation

1. 5-LRC
2. Or Approved Equal

B. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.

1. Locking-Top Option: Vandal-resistant locking feature. Include one matching key.

2. Provide quick couplers as indicated on plans; one must be adjacent to the irrigation vault to facilitate winterization.

## 2.8 DRIP IRRIGATION SPECIALTIES

A. Manufacturers: Rain Bird Corporation

1. XFS-09-12
2. Or Approved Equal

B. Application Pressure Regulators: Plastic housing, NPS 3/4, with corrosion-resistant internal parts; capable of controlling outlet pressure to approximately 20 psig.

1. XCZ-150-PRB-COM
2. XCZ-100-PRB-COM

C. Filter Units: Plastic housing, with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.

D. Air Relief Valves: Plastic housing, with corrosion-resistant internal parts.

E. Vacuum Relief Valves: Plastic housing, with corrosion-resistant internal parts.

2.9 CONTROLLERS

A. Manufacturers: Subject to compliance with requirements,

1. Rain Bird Corporation. Model ESP-LXD 50 Station 2-Wire Decoder with ET Manager Cartridge.

B. Decoders: FD-101TURF Single Valve Decoder

C. 120V Power Supply to controller location will be provided by the Electrical Contractor

D. LIMR-KIT 3.0 - Landscape Irrigation and Maintenance Remote 3.0

2.10 VALVE BOXES

A. Plastic Boxes: Control Valves and Wire Splices

1. Manufacturers: Subject to compliance with requirements,

a. Carson Industries LLC.
b. Ametek
c. Rain Bird Corporation

2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.

a. Size: As required for valves and service.
b. Shape: Rectangular

B. Drainage Backfill: Cleaned gravel or crushed stone installed below valve to the bottom of valve

PART 3 - EXECUTION

3.1 EARTHWORK

A. Provide minimum cover over top of underground piping according to the following:

1. Irrigation Main Piping: Minimum depth of 18” below finished grade
2. Circuit Piping: 12” below finished grade
3. Dripline Piping: 4” below finish grade
4. Sleeves: 18” below finish grade

3.2 PREPARATION

A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.

3.3 PIPING INSTALLATION

A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

B. Install piping free of sags and bends.

C. Install groups of pipes parallel to each other, spaced to permit valve servicing.

D. Install fittings for changes in direction and branch connections.

E. Install expansion loops in control-valve wiring in valve boxes.

F. Lay piping on solid sub base, uniformly sloped without humps or depressions.

G. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.

H. Install piping in sleeves under parking lots, roadways, and sidewalks.

I. Install sleeves made of class 200 PVC pipe and socket fittings, and solvent-cemented joints. Seal end of sleeves prior to backfill to prevent soil and rock from entering sleeves.

J. Install Control Wire in a separate 1 ½” PVC pipe sleeve.

3.4 JOINT CONSTRUCTION

A. PE Piping Fastener Joints: Join with insert fittings and bands or fasteners according to piping manufacturer's written instructions.

B. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

C. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
3. PVC Nonpressure Piping: Join according to ASTM D 2855.

## 3.5 VALVE INSTALLATION

A. Install valves in locations shown on drawings.

B. Maintain an equal distance between valves where multiple valves are built in a manifold.

1. Install only one valve in valve boxes. Valve boxes to be parallel with adjacent hard surfaces and equally spaced.

2. Center valve inside of valve box for servicing through valve box opening

C. Maintain a minimum of 4” from top of valve to inside bottom of valve box cover

D. Single valve decoders to be installed inside of valve box with wire lengths to sufficient to service decoder

E. Install XCZ Drip Kit equipment centered and serviceable from valve box opening

F. Drain Valves: Install in underground piping in boxes for automatic control valves.

## 3.6 SPRINKLER INSTALLATION

A. Install sprinklers at manufacturer's recommended heights.

B. Locate part-circle sprinklers to maintain a minimum distance of 4 inches from walls and 2 inches from other boundaries unless otherwise indicated.

## 3.7 DRIP IRRIGATION INSTALLATION

A. Install Drip Irrigation in all planted areas that are not turf. Shrubs, trees and perennial plantings to be on separate drip control valves.

B. Install Drip Line with source and return headers.

C. Install Drip Line at 12” spacing on the surface of sub-grade and under mulch. Use soil staples to secure grids in place.

## 3.8 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

A. Equipment Mounting: Install controller on wall in water supply/control vault.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.

## 3.9 WIRE CONNECTIONS

A. Use 3M DBY or DBR wire connectors for all wire splices.

B. Two-Wire path to decoder and decoder to valve connections to be made inside valve box.

C. Any Two-Wire path splice to be installed in a 10” round valve box and wire lengths left sufficient to be serviceable through valve box opening.

## 3.10 VALVE BOX INSTALLATION

A. Install valve boxes so they are level with and flush to finish grade. When multiple boxes are located adjacent to each other insure boxes line up and are parallel or perpendicular with each other. When adjacent to walks, plazas or planting beds, insure valve boxes are parallel or perpendicular to these site elements.

## 3.11 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

## 3.12 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Any irrigation product will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

## 3.13 STARTUP SERVICE

A. Perform system startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that controllers are installed and connected according to the Contract Documents.
3. Verify that electrical wiring installation complies with manufacturer's submittal.

3.14 ADJUSTING

A. Adjust settings of controllers.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with finish grade.

3.15 CLEANING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

3.16 DEMONSTRATION

A. Engage qualified representative to train Owner's maintenance personnel to adjust, operate, and maintain system including controller, valves and irrigation equipment

END OF SECTION 328400

# SECTION 32 9300

# PLANTS-PLAZA

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Plants
2. Fertilizers
3. Organic mulch
4. Rock mulches
5. Pesticides
6. Tree stabilization
7. Landscape fabric
8. Filter fabric
9. Separation fabric
10. Planting Soil
11. Rooftop Soil Mix

B. Related Sections:
1. Section 129300 "Site Furnishings" for exterior furniture.
2. Section 312000 "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
3. Section 334100 "Storm Utility Drainage Piping" for below-grade drainage of landscaped areas, paved areas, and wall perimeters.
4. Section 328400 “Planting Irrigation”.

### 1.2 ALLOWANCES

A. Allowances for plants are specified in Division 01 Section "Allowances."

1. Perform planting work under quantity allowances and only as authorized. Authorized work includes work required by Drawings and the Specifications and work authorized in writing by Architect.
2. Perform work that exceeds quantity allowances only as authorized by Change Orders.

### 1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than sizes indicated wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for type and size of plant required.

D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

F. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

G. Finish Grade: Elevation of finished surface of planting soil.

H. Imported Soil: Soil that is transported to Project site for use.

I. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

J. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

K. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

L. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

M. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

N. Planting Area: Areas to be planted.

O. Planting Soil: Imported soil or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

P. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

Q. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

R. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

S. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

T. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

U. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

V. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

## 1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including soils.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
3. Planting Soil and Rooftop Soil Mix: Include recommendations for application and use. Include test data substantiating that products comply with requirements. Include sieve analyses for aggregate materials. For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:

    a. Manufacturer's qualified testing agency's certified analysis of standard products.
    b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
    c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Samples for Verification: For each of the following:

1. Trees and Shrubs: Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph.
2. Organic Mulch: 1 lb of each mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on the site; provide an accurate indication of color, texture, and makeup of the material.
3. Rock Mulches: 2 lb bag of Type 1 &2. Digital photos of mulch Types 3 & 4 with a ruler in the photograph for scale.
4. All materials and a typical shop drawing for tree stabilization indicating materials, dimensions and layout of typical tree stabilization.
5. 1 sf sample of Landscape Fabric.
6. 1 sf sample of Separation Fabric.
7. 8’ long x 4’ wide section of Rock Mulch Type 4 placed on site adjacent to paved area in a location coordinated with the Architect to unsure placement of rocks meets desired aesthetics and ADA compliance.
8. Compost Mulch: 1 lb bag.
9. Planting Soil and Rooftop Soil Mix: 1-quart volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

C. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

D. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

F. Warranty: Sample of special warranty.

G. Qualification Data: For each testing agency.

H. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

I. Field quality-control reports.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Three years' experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Certified Landscape Technician - Exterior, with installation and maintenance specialty area(s), designated CLT-Exterior.
    b. Certified Landscape Technician - Interior, designated CLT-Interior.
    c. Certified Ornamental Landscape Professional, designated COLP.

5. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1. Selection of plants purchased under allowances will be made by Architect, who will tag plants at their place of growth before they are prepared for transplanting.

2. Trees shall be sourced from a single source to insure consistency of form, branching height, root ball size and soil composition.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Architect shall observe and tag trees at place of growth for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

E. Preinstallation Conference: Conduct conference at Project site.

F. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

## 1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil and imported soil.

1. Notify Architect seven days in advance of the dates and times when laboratory samples will be taken.

B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

## 1.7 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by contractor.

1. Number and Location of Samples: Minimum of three representative soil samples from varied locationsfor each soil to be used or amended for landscaping purposes.
2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.

4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

## 1.8 SOIL TESTING REQUIREMENTS

A. Physical Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; eleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
2. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
3. Report suitability of tested soil for plant growth.

    a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

## 1.9 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizer, lime, and soil amendments with appropriate certificates.

C. Protect all delivered soils from exposure to excess water and erosion at all times.

D. Deliver bare-root stock plants freshly dug. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

E. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide

protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

F. Handle planting stock by root ball.

G. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

H. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots that are in dry condition in water for two hours. Reject dried-out plants.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.10 PROJECT CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of each service or utility.
2. Do not proceed with interruption of services or utilities without Construction Manager's written permission.

C. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: May 1-June 15
2. Fall Planting: Aug. 25-Sept. 15

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

E. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

F. Coordinate planting operations with Irrigation Contractor and other onsite contractors to insure proper phasing and sequencing of work.

1.11 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
b. Structural failures including plantings falling or blowing over.
c. Faulty performance of tree stabilization.

2. Warranty Period: Begins from Date when final punch list items have been corrected and accepted.

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
c. Annuals: Three months.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
d. Provide warranty for replacements for period equal to original warranty period beginning at date of replacement plant installation.

1.12 MAINTENANCE SERVICE

A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

1. Maintenance Period: Until final punch list items have been corrected and approved.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

E. Select stock for uniform height, branching height, spread, form and health.

F. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

## 2.2 ORGANIC MULCHES

A. Organic Mulch: Commercially sold organic mulch free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Material: Shredded Pine Bark.
2. Color: Natural.

B. ROCK MULCHES

1. Type 1: Trap Rock
   a. Manufacturer: Dresser Trap Rock Inc.
   b. Product Number: 818
   c. Size: 3”-6”

## 2.3 LANDSCAPE FABRIC

A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.

## 2.4 FILTER FABRIC

A. MnDOT Type 1 geotextile meeting MnDOT section 3733.

2.5 SEPARATION FABRIC

A. MnDOT Type 5 geotextile meeting MnDOT section 3733.

2.6 PESTICIDES

A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.7 TREE STABILIZATION MATERIALS

A. Stakes and Guys:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by 3', pointed at one end.
2. Wood Deadmen: Timbers measuring 8 inches in diameter and 48 inches long, treated with specified wood pressure-preservative treatment.
3. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
4. Guy Cables: Five-strand, 3/16-inch- diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.
5. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.
6. Proprietary Staking-and-Guying Devices: Proprietary stake or anchor and adjustable tie systems to secure each new planting by plant stem; sized as indicated and according to manufacturer's written recommendations.

    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) Arborbrace; ArborBrace Tree Guying System.
        2) Better Bilt Products, Inc; Tree Anchor Kit.

2.8 PLANTING SOIL

A. General: Soil amendments, fertilizers, and rates of application shall be based on testing laboratory's recommendations after preconstruction soil analyses are performed.

B. Planting Soil-Imported, naturally formed soil from off-site sources and consisting of loam soil according to USDA textures; and modified to produce viable planting soil.

1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass,

poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass.

2. Unacceptable Properties: Clean soil of the following:

   a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
   b. Unsuitable Materials: Stones greater than 1” in any dimension, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 8 percent by dry weight of the imported soil.

3. Amended Soil Composition: Blend imported, unamended soil with soil amendments and fertilizers as suggested by soil analysis to produce planting soil meeting the following:

   a. Meeting ASTM 5268
   b. pH range 5.0-7.5.
   c. Minimum of 8 percent organic material.
   d. Ratio of loose compost to topsoil by volume of 1:4.

## 2.9 ROOFTOP SOIL MIX

A. Rooftop Soil Mix shall be Rooftop Garden Mix®, composed of lightweight aggregate, compost and washed sand as provided by Plaisted Companies Inc. (763) 441-1100 or approved equal.

## 2.10 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

   1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
   2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
   3. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

## 2.11 FERTILIZERS

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

E. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

## 2.12 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch sieve;; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

a.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

### 3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

E. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

## 3.3 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

1. Excavate approximately three times as wide as ball diameter for balled and potted stock.
2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
5. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected after working hours.
8. If drain tile is shown on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Subsoil and topsoil removed from excavations may not be used as planting soil.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches) apart, into free-draining strata or to a depth of 10 feet whichever is less, and backfill with free-draining material.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

## 3.4 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply and mix amended soil on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Apply 6” thickness of planting soil over prepared, loosened subgrade and mechanically till into top 4 inches of subgrade. Spread remainder of planting soil to total depth on Drawings , but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Lifts: Apply planting soil in lifts not exceeding 12 inches in loose depth for material compacted by compaction equipment, and not more than 8 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each blended lift of planting soil to 85 percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

F. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading

## 3.5 PLACING STRUCTURAL PLANTING SOILS

A. Place soils in 6” lifts compacting each lift.

B. Compact all materials to at least 95% Proctor Density from a standard compaction curve AASHTO T 99 (ASTM D 698). No compaction shall occur when moisture content exceeds maximum as listed herein. Delay compaction if moisture content exceeds maximum allowable and protect CU-Structural Soil® during delays in compaction with plastic or plywood as directed by the Architect.

C. Bring CU-Structural Soil® to finished grades as shown on the drawings. Immediately protect the CU-Structural Soil® from contamination by toxic materials, trash, debris, water containing cement, clay, silt or materials that will alter the particle size distribution of the mix with plastic or plywood as directed by the Architect.

D. The Architect may periodically check the material being delivered, prior to installation for color and texture consistency with the approved sample provided by the installing contractor as part of the submittal for CU-Structural Soil®. If the Architect determines that the delivered CU-Structural Soil® varies significantly from the approved samples, the engineer shall contact the licensed producer.

E. CU-Structural Soil® should not be stockpiled long-term. Any CU-Structural Soil® not installed immediately should be protected by a tarp or other waterproof covering.

## 3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on

laboratory testing according to ASTM D 698. Space tests at no less than one for each 1000 sq. ft. of in-place soil or part thereof.

B. Soil will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

## 3.7 TREE, SHRUB, AND VINE PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 2 inches adjacent finish grades.

1. Use planting soil for backfill.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Set container-grown stock plumb and in center of planting pit or trench with root flare 2 inches adjacent finish grades.

1. Use planting soil for backfill.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch (25 mm) from root tips; do not place tablets in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

## 3.8 MECHANIZED TREE SPADE PLANTING

A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.

B. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.

C. Cut exposed roots cleanly during transplanting operations.

D. Use the same tree spade to excavate the planting hole as was used to extract and transport the tree.

E. Plant trees as shown on Drawings, following procedures in "Tree, Shrub, and Vine Planting" Article.

F. Where possible, orient the tree in the same direction as in its original location.

## 3.9 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

C. Do not apply pruning paint to wounds.

## 3.10 TREE STABILIZATION MATERIALS

1. Staking and Guying: Guying and staking of trees shall be at the discretion of the Contractor. Contractor shall be responsible for maintaining all plantings plum until final punch list items have been corrected. Contractor shall guy and stake any plantings the Architect deem necessary at any time during the warrantee period.

2. Site-Fabricated, Staking-and-Guying Method: Install no fewer than three guys spaced equally around tree.

    a. Securely attach guys to stakes 30 inches long, driven to grade. Adjust spacing to avoid penetrating root balls or root masses. Provide turnbuckle for each guy wire and tighten securely.
    b. Support trees with bands of flexible ties at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.
    c. Support trees with guy cable or multiple strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk and reaching to turnbuckle. Allow enough slack to avoid rigid restraint of tree.
    d. Attach flags to each guy wire, 30 inches above finish grade.
    e. Paint turnbuckles with luminescent white paint.

3. Proprietary Staking and Guying Device: Install staking and guying system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

## 3.11 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as a shown on drawings in even rows with triangular spacing.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

## 3.12 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

## 3.13 ROCK MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Planting Beds with Mulch Type 1: Apply rock mulch to achieve an average thickness of 3” over Landscape fabric. Do not place mulch on top of plant branches or leaves or damage plantings when placing rock mulch. Insure Landscape Fabric is completely concealed by rock mulch.

2. Planting Beds with Mulch Type 2: Apply rock mulch to achieve an of average thickness of 3” over Separation fabric, Do not place mulch on top of plant branches or leaves or damage plantings when placing rock mulch. Insure Separation Fabric is completely concealed by rock mulch.

## 3.14 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or

vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated past management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

## 3.15 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

## 3.16 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation and before Substantial Completion remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

## 3.17 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 329300

# SECTION 32 9450

# STRUCTURAL SOIL VAULTS - PLAZA

## 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. Section Includes: Supply and installation of structural soil cell system and related materials, components and activities necessary to form a complete functioning system.
2. Geotechnical Report: A geotechnical report pertaining to project site, is available from project Civil Engineer, EVS.

B. Related Requirements:

1. Division 31 “Drainage”
2. Section 321443 “Porous Unit Paving”
3. Division 32 “Plants”

### 1.3 DEFINITIONS

A. Consultant: Architect or Landscape Architect.

B. Soil Cell Module: Patented, load-bearing engineered plastic module with vertical and lateral interlocks, for creating void space beneath pavements.

C. Soil Bridge Connector - component for connecting Soil Cell modules laterally. Is removable.

D. Soil Cell Connector - Component for connecting Soil Cell modules vertically.

E. Soil Cell Foot Plate – Component for placement at base of matrix, connecting to feet, for point load dispersion.

F. Soil Cell Top Grate – Component for placement at top of matrix for pavement support.

G. Soil Cell Matrix: Assembled and interconnected volume of soil cell modules.

H. Root Barrier: Linear root barrier with vertical integral root training ribs.

I. Filler Soil: Planting Soil. Correctly balanced soil mix to provide optimum growth conditions for tree root systems within the soil cell matrix.

J. Geocomposite: High strength geogrid bonded to filter fabric for reinforcement of granular pavement base.

K. Tree Pit Opening: The pavement opening within which the tree is planted.

L. Granular Base Course: MnDOT Class 5 or approved equal. Compacted granular material to specified requirements.

M. Tree Pit: Excavated space filled with appropriate soil media for tree planting.

N. Reinforcing Collar: A trench between the soil cell matrix and surrounding soil, lined with geocomposite, filled with granular base course and compacted aggregated.

## 1.4 ADMINISTRATIVE REQUIREMENTS

1. Coordination: Coordinate work of this section with other related work .
2. Pre-Installation Meeting: Convene a pre-installation site meeting at least 7 days prior to commencing work at site. Require attendance of parties directly affecting work of this section, including Consultant and, if appointed, testing agency. Review work activities and schedule. Tour site and inspect and discuss site physical conditions. Review required inspections.

## 1.5 SUBMITTALS

1. Provide consultant with submittals specified in this section at least 40 days prior to scheduled commencement of work at site.
2. Shop Drawings: Shop drawings shall show all information needed to fabricate, supply and install soil cell system including aggregate sub-base, horizontal and vertical dimensions and elevations.
3. Product Data: Submit manufacturer's product data for each type of product to be used. For soils and aggregates provide testing agency laboratory analysis.
4. Qualification Data: Submit proof of qualifications of installer and installer's site supervisor.

## 1.6 DESIGN

A. Soil Cell Matrix:
   1. Structural Design: Design soil cell matrix, sub-grade and subsequent fill layers to resist dead, live, lateral and environmental loads, with settlement, deflection and displacement within design limits.
   2. Wheel Load Rating: AASHTO H-20.
   3. Matrix Void space: Minimum 90% Free Volume

## 1.7 TESTING AGENCY SERVICES

A. Provide and pay for the services of an independent testing agency to perform the testing activities specified in this section. Testing agency shall be acceptable to Consultant.

B. Test work in accordance with specified standards. In the absence of a specified standard, comply with the relevant ASTM standard.

C. Test Reports: Testing agency shall prepare test reports for all tests performed. Submit copies of test reports to Consultant immediately upon their becoming available.

## 1.8 QUALITY ASSURANCE

A. Installer qualifications: Work shall be performed by an experienced installer with a successful track record in performing work of the same scope and quality as required by these specifications. Installer shall be acceptable to manufacturer of soil cells.

B. Installer's Site Supervision: Appoint an experienced full time site supervisor to be responsible for site activities for duration of work. Do not change site supervisor without consultant's prior written approval.

C. Site Mock-Up: Prior to installation of soil cells, construct on site a 9 square yard mock-up of the entire system including granular sub-base, placement of filler soil and granular base course. Materials and techniques used in construction of mock-up shall be acceptable to consultant who shall be present during mock-up construction. Mock-up may remain part of permanent installation if acceptable to consultant.

D. Manufacturer's Representative: Arrange for a representative of the soil cell manufacturer to be available to visit site within 48 hours' notice.

## 1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials in strict accordance with manufacturer's instructions.

B. Make provision on site to properly receive, handle and store materials. Provide sheltered and weather tight storage to protect materials from the elements.

C. Store soil cell modules on pallets, with pallet wrap intact until required for installation. Position pallets on firm, level base.

D. Protect geosynthetics from physical damage and from temperatures in excess of 100 degrees F. Do not expose geosynthetics to direct sunlight for more than 7 days.

E. Store and protect bulk materials by covering with tarpaulins and in a manner to prevent erosion.

## 1.10 SITE CONDITIONS

A. Ambient Conditions: Perform work on site when ambient conditions are conducive to proper performance and in accord with recommendations of soil cell manufacturer. Take all reasonable precautions to guard against effects of adverse weather conditions.

B. Site Information: Before commencing work on site examine available documentation pertaining to site and determine nature and location of above ground and underground utilities. Report demonstrable and potential conflicts with work of this section Consultant.

C. Existing Soil Conditions: Before proceeding with full scale excavation work, confirm nature of existing soil conditions and in particular the drainage characteristics of existing soil.

D. Abandoned utilities encountered during excavation shall be removed and their ends plugged.

E. Active utilities encountered during excavation and not indicated in Contract Documents shall be reported immediately to Consultant and utility owner who shall determine measures necessary to repair, relocate or remove utility.

## PART 2 - PRODUCTS

### 2.1 STRUCTURAL SOIL CELLS

A. Proprietary Product: Stratavault by Citygreen West, 4611 Morris Rd, Edmonton, AB, Canada,T6B2V9. P:780.462.5064.

B. Material: 100% recycled polypropylene. Stratavault 30 Series shall be reinforced with fiberglass.

C. Form and Configuration: Engineered plastic modules designed to assemble together to create a matrix under pavements. Interconnected skeletal matrix shall provide void space of at least 90% to accommodate filling with soil media or storing storm water.

D. Dimensions of Soil Cell Units: 24 inch x 24 inch x 16 inch in height. System also includes Bridge connectors, Vertical connectors, Foot Plates, Top Grates.

E. Ultimate Load Strength: Stratavault 30 Series: (44.38 PSI)

### 2.2 GEOSYNTHETICS

A. Geocomposite:

1. Composition: Geogrid and geotextile composite.
2. Geogrid: Stretched monolithic polypropylene flat bars with welded junctions.
3. Geotextile: Mechanically bonded filter geotextile welded within geogrid structure.
4. Color: White
5. Physical Properties: As specified in Appendix ‘A’.

B. Root Barrier:

1. Material: High density polyethylene.
2. Thickness: 1 mm
3. Form: Linear sheet with integral vertical ribs.
4. Color: Black

C. Filter Fabric:

1. See Division 32 “Plants” for product information.

D. Proprietary Products: The following by Citygreen, 4611 Morris Road, Edmonton, AB, Canada, T6B2V9. P:780.462.5064.

1. Geocomposite: FilterGrid
2. Root Barrier: ReRoot

2.3 SUBDRAINAGE PIPING

A. See Division 31 “Drainage” for product information.

2.4 FILLER SOIL

A. As Specified in Section 32 93 00 “Plants”.

2.5 BACKFILL AND AGGREGATES

A. Backfill: Clean, native excavated soil, free from organic matter, frozen materials, stones large than 3 inches in diameter, debris and other foreign substances.

B. Granular Base Course: ASTM D1241-07, Type 1, Gradation B consisting of stone, gravel or slag with natural or crushed sand and fine material particles passing a No. 200 sieve, graded as follows:

| SIEVE | PERCENT PASSING |
|---|---|
| 37.5 mm (1.5 inches) | 100 |
| 25 mm (1 inch) | 75-95 |
| 9.5 mm (.5 inch) | 40-75 |
| 4.75 mm (.25 inch) | 30-60 |
| 2.0 mm (.125 inch) | 20-45 |
| 425 um (.0625 inch) | 15-30 |
| 75 um (.003 inch) | 5-15 |

C. Drainage Pipe Covering Fill: See Division 31 “Drainage” for product information.

D. Drainage Pipe Bedding Fill: See Division 31 “Drainage” for product information.

2.6 SOURCE QUALITY CONTROL

A. Provide testing agency with representative samples of existing, on-site soil and of each type of fill proposed for use.

B. Testing agency shall perform the following laboratory tests on each soil and fill sample:

1. Sieve analysis
2. Particle size distribution
3. Liquid Limit
4. Plastic Limit
5. Plasticity index
6. Hydraulic conductivity
7. Compaction

C. Compaction testing shall be in accordance with ASTM D698-07e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (Standard Proctor Density).

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Tree Pit Layout: Layout tree pit locations and dimensions using string lines, survey pegs and marking paint. Obtain Architect's approval of layout before proceeding with excavation.

B. Tree Pit Depths: Confirm excavation depths with reference to finished pavement elevations. Allow for granular base course layer, and, where applicable, drainage layer.

### 3.2 TREE PIT EXCAVATION

A. Excavation: Accurately excavate to dimensions shown on Drawings. Allow 8 inches additional clearance in length and width. Excavation side walls shall be clean and straight, with 15 degrees of vertical. Measure and confirm that correct horizontal and vertical dimensions have been achieved.

B. Reinforcing Collar: Further excavate top perimeter of tree pit to a depth of 12 inches and to a width of 8 inches, sufficient to accommodate a narrow foot compacting plate. Excavated surfaces shall be clean and straight.

C. Protect sub-grade from softening, undermining, washout, or damage by rain or water accumulation. Reroute surface water runoff from excavated areas and do not allow water to accumulate in excavations.

### 3.3 SUBGRADE PREPARATION

A. Remove unstable bottom material, including large stones, debris and compressible soils. Scarify and mix sub-grade surface and moisture condition as required. Accurately construct and fine grade the sub-grade to required lines and levels. Compact sub-grade to 95% Standard Proctor Density.

B. Finished sub-grade shall be flat, uniform, dense, smooth, free from loose stones and foreign matter, and sloped to a grade of 5%.

### 3.4 TREE PIT DRAINAGE

A. See Division 31 "Drainage"

### 3.5 TREE PIT GRANULAR BASE COURSE

A. Install granular base course to depth shown on Drawings on sub-grade and under first layer of soil cell modules. Compact granular base course to minimum 95% Standard Proctor Density.

## 3.6 SOIL CELL INSTALLATION

A. Prior to installation of soil cell modules, confirm tree pit dimensions and mark location of trees with surveyor pegs. Rectify discrepancies and errors.

B. Install soil cell modules in strict accordance with manufacturer's written instructions and installation diagrams. Prior to placement, check each soil cell module for damage. Reject cracked, chipped and otherwise damaged modules. Ensure that modules in contact with granular base course are firmly seated, with no rocking. Ensure that modules are mechanically interconnected both horizontally and, in multiple layers, vertically.

## 3.7 AERATION AND INSPECTION PIPING

A. Vertical Inspection Piping: Place vertical piping within central opening of soil cell module, as recommended by manufactor instruction.

B. Trim vertical pipes to 6 inches above finished pavement and support in vertical position by temporary staking. Seal open ends of pipes.

## 3.8 ROOT BARRIERS

A. Install root barriers as Shown on Drawings. Overlap barrier joints 6 inches and tape both sides of joint. Top edge of barriers shall be level with adjacent construction. Ensure that earth surfaces in contact with barriers are flat and free of sharp debris and stones so as to avoid puncturing barriers. Install root barriers with ribs facing inward.

## 3.9 SOIL FILLING

A. Obtain Architect's prior approval to load soil cell matrix with filler soil. Install filler soil after soil cell matrix is fully assembled and piping systems and barriers are in place.

B. Except as shown otherwise on Drawings completely fill all void spaces with filler soil. Place filler soil using an excavator bucket and spread with rakes or shovels.

C. Keep outer trench free of filler soil.

D. Vibrate matrix using plate vibration or needle vibration equipment to shake filler soil into voids.

## 3.10 GEOCOMPOSITE LAYER

A. Install a single layer of geocomposite over the entire top area of soil cell matrix. At perimeter, extend geocomposite over upper side walls of soil cell matrix and over bottom of adjacent trench.

B. Overlap geocomposite joints 6 inches. Allow for pipe penetrations with two intersecting slits cut with a sharp knife.

3.11 GRANULAR REINFORCING COLLAR

A. Fill collar trench with granular base course material so that the collar is level with top of soil cell matrix.

B. Place granular base course in 6 inch lifts and compact each lift to 95% Standard Proctor Density.

C. Do not displace geocomposite from base of trench.

3.12 TREE PIT OPENINGS

A. Confirm exact location of tree pit openings. Cut geocomposite layer and fold back to expose opening. Position perimeter formwork.

B. Line opening with root barrier with ribs facing inward. Extend root barrier down to top of soil cell matrix and up to level of finished pavement. Lap root barrier joints 6 inches and tape both sides of joint.

3.13 GRANULAR BASE COURSE FOR NON POROUS PAVEMENT

A. Place granular base course over geocomposite to depth shown on drawings. Place granular base course in 4 inch lifts and compact each lift to 95% Standard Proctor Density.

3.14 GRANULAR BASE COURSE FOR POUROUS UNIT PAVING

A. See section 321443 “Porous Unit Paving”

3.15 UTILITIES WITHIN SOIL CELL MATRIX

A. Utilities over 5 inch in diameter will require special treatment within soil cell matrix.

3.16 SITE QUALITY CONTROL

A. Compaction Tests: Testing agency shall perform compaction testing on sub-grade and on each layer of fill to determine compliance with specified compaction. Determine method and frequency of testing in consultation with Architect.

3.17 CLEANING

A. Upon completion of work on site, clean areas within contract limits. Remove tools, equipment, debris, rubbish and excess materials. Leave site in broom clean condition.

3.18 SOIL CELL SCHEDULE

A. Use Stratavault modules as follows:

| STRATAVAULT SERIES | LOCATION |
|---|---|
| 30 SERIES | Under all pedestrian surfaces, not to be under vehicular parking or drive lanes. |

3.19 APPENDIX ‘A’

A. Appendix ‘A’ Geosynthetic Physical Properties is attached.

END OF SECTION 32 94 50

APPENDIX 'A' GEOSYNTHETIC PHYSICAL PROPERTIES

1. Geocomposite shall meet the following requirements:

| A. PROPERTY | TEST METHOD * | UNIT | REQUIREMENT |
|---|---|---|---|
| GEOGRID | | | |
| Raw Material | | | Polypropylene,white |
| Mass per unit area | EN ISO 9864 | $g/m^2$ | 200 |
| Max. tensile strength, md/cmd | EN ISO 10319 | kN/m | $\geq 30/\geq 30$ |
| Elongation at nominal strength, md/cmd | EN ISO 10319 | % | ≤8/≤8 |
| Tensile strength at 2% elongation, md/cmd | EN ISO 10319 | kN/m | 12/12 |
| Tensile strength at 5% elongation, md/cmd | EN ISO 10319 | kN/m | 24/24 |
| Aperture size, md x cmd | - | mm x mm | Approx. 32 x 32 |
| Production specific elongation | - | % | 0 |
| GEOTEXTILE | | | |
| Raw material | | | Polypropylene, white |
| Mass per unit area | EN ISO 9864 | $g/m^2$ | ≥ 150 |
| Maximum tensile strength, md/cmd | EN ISO 10319 | kN/m | 7.5/11.0 |
| Elongation at maximum tensile strength, md/cmd | EN ISO 10319 | % | 40/30 |
| Puncture force | EN ISO 12236 | N | 1,670 |
| Displacement at static puncture strength | EN ISO 12236 | mm | 30 |
| Detector tested | - | - | Yes |
| Roll dimensions, width x length | - | m x m | 4.75 x 100 |

*based on md = machine direction, cmd = cross machine direction

2. Root Barrier shall meet the following requirements:

| PROPERTY * | ASTM D | UNIT | REQUIREMENT |
|---|---|---|---|
| Density | 1505 | $g/cm^3$ | 0.952 |
| Melt Index | 1238 | g/10 min. | 0.35 |
| ESCR, $F_{50}$ Condition B | 1693 | h | 50 |
| Tensile Yield Strength | 638@50mm/min | MPa | 27 |
| Elongation at break | 638@50mm/min | % | >600 |
| Brittleness Temperature | 746 | Degrees C | <-90 |
| Flexural Modulus | 790 | Mpa | 1310 |
| Shore Hardness D | 2240 | - | 66 |
| Thermoforming** | | cm | 18-23 |
| ----Sheet sag | | h | >700 |

*Physical properties reported herein were determined on compression molded specimens prepared in accordance with Procedure C of ASTM D 1928. ** 0.61 x 1.22 x 3.2mm thick blank heated to forming temperature. *** Test conditions: 296 ml, 23gbottle, 10% fill, Orvus K Detergent.

END OF APPENDIX

MINNESOTA MULTI-PURPOSE STADIUM
MINNEAPOLIS, MINNESOTA

SECTION 33 4100

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm drainage piping, fittings, drains, manholes and accessories.

2. Stormwater management piping systems, fitting, drains, access risers and accessories.

3. Connection of drainage system to sewer system.

1.2 RELATED SECTIONS

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

B. Section 31 2000 – Earth Moving

C. Cast-in-Place Concrete shown on Structural Drawings

1.3 REFERENCES

A. AASHTO M 36M - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; American Association of State Highway and Transportation Officials; 2003.

B. ASTM A 48/A 48M - Standard Specification for Gray Iron Castings; 2003.

C. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.

D. ASTM C 14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe; 2003.

E. ASTM C 55 - Standard Specification for Concrete Brick; 2003.

F. ASTM C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2004a.

G. ASTM C 270 – Mortar for Unit Masonry.

H. ASTM C 443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2005.

I. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 2003a.

J. ASTM C 543 - Test Method for Resistance of Plastic Chemicals.

K. ASTM C 564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2003a.

L. ASTM C 923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals; 2002.

M. ASTM D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2004a.

N. ASTM D 3034 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

O. ASTM D 3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

P. ASTM F 679 - Standard Specification for Large Diameter Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

Q. IMIAWC (CW) - Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council; 1993.

R. Minnesota Department of Transportation Standard Specifications for Construction, 2016 Edition and Corresponding Supplements.

1.4 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

B. See Section 31 2000 – Earth Moving.

1.5 SUBMITTALS

A. See Divisions 0 and 1 for submittal procedures.

B. Product Data: Provide data indicating pipe, pipe accessories, structures, castings and appurtenances to provide a complete working system.

C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Project Record Documents:

1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
3. All sanitary and storm sewer lines and all appurtenances installed on site will require a drawing no later than 60 days following installation of the sewer facilities for final approval and building occupancy permit. Changes to the design shall be shown in red on design drawings to be submitted to Civil Engineer two weeks prior to deadline. Changes include the following: invert elevations, dimensions, notes to existing infrastructure within the area. The drawings submitted to the Owner will require the following items: exact size, length of pipe, type, exact location of pipe; locations, size and inverts of manholes and catch basins.
4. A letter from the contractor shall be written to the Civil Engineer and Owner that confirms the underground infiltration system was built per the design drawing and shall include pictures of system installation, dimensions of excavated area and any redlined changes or

modifications made to the design. This letter shall be on company letterhead and submitted within 45 days of complete construction of system.

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten (10) years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work of this section

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions

1.9 PROJECT CONDITIONS

A. Coordinate the Work with termination of storm sewer connection to existing storm sewer connections, trenching, and structural design.

PART 2 - PRODUCTS

2.1 SEWER PIPE MATERIALS

A. Concrete Pipe: Reinforced, ASTM C 76, Class V or as specified on drawings; mesh reinforcement, bell and spigot end joints. If not specified on drawings, pipe shall be Class V.

B. Reinforced Concrete Pipe Joint Device: ASTM C 443 rubber compression gasket joint.

C. Ductile Iron Pipe: AWWA C151:
   1. Fittings: Ductile iron, standard thickness.
   2. Joints: AWWA C111, rubber gasket with rods.
   3. Jackets: AWWA C105 polyethylene jacket.

D. HDPE Pipe: High density corrugated polyethylene, smooth interior pipe manufactured in conformity with the latest AASHTO specifications of M294 Type S and the material compound shall conform to ASTM D3350.

E. PVC Pipe: Polyvinyl chloride pipe and fittings (PVC), SDR 35 to comply with ASTM D3034. Either solvent cement or flexible watertight joints.

F. StormTrap Precast Concrete Modular Stormwater Management System, single-trap 5’-8” height, HS-20 loading.

2.2 PIPE ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

C. Filter Fabric: Non-biodegradable, woven, per MnDOT specification section 3733.
1. Type V under riprap areas.
2. Type I around underground stormwater management system filter materials.

D. Trace Wire: Magnetic detectable conductor, HPDE coated copper wire, imprinted with "Storm Sewer Service" in large letters.

E. Liner: High Density Polyethylene (HDPE) smooth geomembrane, minimum 40 mil thickness, Poly-Flex, Inc. brand or approved equivalent.

F. Concrete pad beneath StormTrap system.

2.3 MANHOLE AND CATCH BASIN MATERIALS

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C 478, with resilient connectors complying with ASTM C 923.

B. PVC Drain Basins: Nyloplast drainage structures in 8”, 10”, 12” and 30” diameter. Sump to be filled so bottom is flush with outlet invert.

C. Concrete: As specified in Section 03 3000 - Cast-in-Place Concrete: minimum 3500 psi concrete.

D. Mortar and Grout: Shall be an air-entrained mixture of one part Masonry cement, Type N, and two parts mortar sand, with sufficient water to produce proper consistency, and with sufficient air-entraining agent added to maintain an air content within the range of 7 to 10 percent. Mortar shall meet the requirements of ASTM C 270.

E. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.

F. Concrete Reinforcement: As specified in Section 03 3000 - Cast-in-Place Concrete.

G. Concrete materials from a certified plant.

2.4 MANHOLE AND CATCH BASIN AND TRENCH DRAIN ACCESSORIES

A. Lid and Frame: ASTM A 48/A 48M, Class 30B Cast iron construction; H2O live load rating; sealing gasket; lid molded with identifying sewer type; manufactured by Neenah Foundry, Nyloplast as indicated on the drawings or approved equivalent. Storm sewer manhole covers shall be stamped Storm Sewer. Casting schedule shown on civil drawings.

B. Manhole Steps: Formed galvanized steel rungs; 3/4 inch diameter. Formed integral with manhole sections.

C. Trench drains shall be H20 loading galvanized steel with lockable/bolted covers.

1. Trench drains in all other areas shall also be ADA and heel-proof ACO Drain per drawings or approved equivalent.
   a. 8” wide grates shall be 678Q.
2. All trench grates shall be galvanized and slip-resistant.

2.5 MANHOLE CONFIGURATION

A. Concrete Manholes:
   1. Shaft Construction: Concentric with concentric cone top section; lipped male/female dry joints; sleeved to receive pipe sections.
   2. Shape: Cylindrical.
   3. Clear Inside Dimensions: 48 inch diameter unless noted otherwise on plan sheets. Minimum size shall be 48 inch diameter.
   4. Design Depth: As indicated on drawing sheets.
   5. Clear Lid Opening: As indicated on drawing sheets.
   6. Pipe Entry: Provide openings as indicated on drawing sheets.

B. PVC Manhole:
   1. Shape: Cylindrical.
   2. Clear Inside Dimensions: 8”, 10”, 12” or 30” as noted on the drawings.
   3. Design Depth: As indicated on drawing sheets.
   4. Clear Lid Opening: As indicated on drawing sheets.
   5. Pipe Entry: Provide openings as indicated on drawing sheets.
   6. Manholes over Existing Roof Drains:
      a. Provide watertight seal at base of manhole at connection to existing roof deck storm sewer systems.
      b. Provide perforated manhole body and base, manholes need to act as two-way drains.

C. Manhole Risers: Refer to details for risers over underground stormwater system.

2.6 BEDDING AND COVER MATERIALS

A. Bedding and cover: As specified in Section 31 2000 – Earth Moving.

B. Cover: Minimum 1 foot over reinforced concrete storm sewer pipe.

C. Cover: Minimum 1 foot over stormwater infiltration systems.

D. **Minimum cover does not account for heavy construction traffic or point loads. Contractor shall refer to manufacturer of pipe for safe cover limits if the storm sewer and systems are installed beneath areas of expected construction loads and traffic.**

PART 3 - EXECUTION

3.1 TRENCHING

A. See Section 31 2000 – Earth Moving for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.2 INSTALLATION – STORM SEWER PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building collection pits, through installed sleeves. Coordinate connections with mechanical and structural.

E. Install continuous trace wire 6 inches above top of pipe; coordinate with Section 31 2000 – Earth Moving.

3.3 INSTALLATION – MANHOLES AND CATCH BASINS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place concrete base pad, with provision for storm sewer pipe end sections.

C. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated. Set cover frames and covers level without tipping, to correct elevations. Verify elevation of cover fits with intended grade elevations and drainage patterns on site. Notify A/E of any conflicts with rim of catch basin or manholes with that of surrounding area.

3.4 INSTALLATION - UNDERGROUND INFILTRATION SYSTEM

A. Form bottom of excavation clean and smooth to correct elevation. See Earth Moving – 31 2000.

B. Prior to installation of underground system, install pipe and outlet control manhole starting at downstream connection to the city storm sewer to confirm there will be positive slope from the underground system to the existing storm sewer.

C. Install concrete base per manufacturer’s recommendations and per plans.

D. Install StormTrap system and risers per manufacturer’s installation requirements.

E. Lay impermeable membrane on sides of trench and trench below grade as indicated on the drawings. The impermeable membrane shall be trenched a minimum of one foot into the soils along the perimeter of system. Keep bottom of trench free of membrane to maintain infiltration.

F. In areas of HDPE liner surrounding stormwater management system, follow manufacturer’s installation procedures for watertight product.

G. Internal to the StormTrap system, lay geotextile fabric on the bottom to wrap filter material.

H. Install filter material at the bottom of the system. See plans for thickness. Wrap geofabric around filter material and tuck edges into the sides so the filter material does not wash out.

3.5 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Divisions 0 and 1 for quality requirements.

B. Contractor shall review that storm sewer is placed in cross-section and elevation per design documents. Contractor shall also test with water flow to check that storm lines are free flowing prior to backfilling.

C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to City of Minneapolis and State of Minnesota (Minnesota Rules, part 4715.2820) standards.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
   4. Submit separate report for each test.
   5. Leakage Testing: Test storm sewerage according to requirements of authorities having jurisdiction.
      a. Leaks and loss in test pressure constitute defects that must be repaired.
   6. Deflection Testing:
      a. Perform deflection testing on all plastic gravity sewer pipes after piping has been backfilled to finished grade a minimum of 30 days.
      b. The deflection test shall be performed by pulling a rigid ball or nine-point mandrel through the pipe without the aid of mechanical pulling devices. The ball or mandrel shall have a minimum diameter equal to 95% of the actual inside diameter of the pipe. The maximum allowable deflection shall not exceed five percent of the pipe's internal diameter. The line will be considered acceptable if the mandrel can progress through the line without binding.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.6 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

B. Protect storm sewer system from construction sediment. See Section 31 2500 - Erosion Prevention and Sediment Control.

END OF SECTION

MINNESOTA MULTI-PURPOSE STADIUM
MINNEAPOLIS, MINNESOTA

SECTION 33 6000

SUBDRAINAGE PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Under Landscape Areas and Planters over Slab. DOES NOT include Perimeter Draintile or Under-Slab Drainage Systems.

B. Filter aggregate and fabric and bedding.

1.2 RELATED SECTIONS

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

B. Section 31 2000 – Earth Moving

1.3 SUBMITTALS

A. See Divisions 0 and 1 for submittal procedures.

B. Shop Drawings: Indicate dimensions, layout of piping, high and low points of pipe inverts, gradient of slope between corners and intersections, and connections to structures.

C. Product Data: Provide data on pipe drainage products, pipe accessories, and appurtenances.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Project Record Documents: See Section 334111 - Site Storm Utility Drainage Piping.

F. MnDOT Standards Specifications for Construction, 2016 Edition.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the work of this section.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

A. Polyvinyl Chloride Pipe: ASTM D 2729; plain end, 6 inch inside diameter with 1/4” minimum and 3/8” maximum diameter with Class 2 ASTM F-758 perforations.

1. This pipe shall be used within all areas of the precast plank and MSE wall area on the south side of the stadium.

2. THIS IS THE MATERIAL TO BE USED UNLESS SPECIFICALLLY STATED OTHERWISE ON THE DRAWINGS.

B. Perforated Polyethylene (PE) Flexible Pipe per MnDOT Specification Section 3278, 6 inch inside diameter with 1/4” maximum diameter AASHTO Class 1 perforations.

C. Use perforated pipe within landscape area; unperforated through sleeved walls and at connections to manholes.

2.2 AGGREGATE AND BEDDING

A. Filter Aggregate and Bedding Material: Coarse Aggregate Bedding per MnDOT 3149.G2.

2.3 ACCESSORIES

A. Pipe Couplings: Solid plastic.

B. Joint Covers: No. 15 asphalt saturated roofing felt.

C. Geofabric Filter Fabric to Wrap around Draintile Pipe: Water pervious type, black polyolefin, per MnDOT Specification Section 3733 Type I.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout Drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over-excavation with fill as specified in Section 31 2000 – Earth Moving.

B. Remove large stones or other hard matter which could damage drainage piping or impede consistent backfilling or compaction.

3.3 INSTALLATION

A. Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.

B. Place drainage pipe bedding on clean cut subsoil or carved geofoam.

C. Lay geofabric on bedding material and install layer of coarse filter aggregate.

D. Lay pipe to slope gradients noted on Drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

E. Loosely butt pipe ends. Place joint cover strip 12 inches wide, around pipe diameter centered over joint.

F. Place pipe with perforations facing down. Mechanically join pipe ends. Install pipe couplings.

G. Install filter aggregate at sides, over joint covers and top of pipe. Place aggregate in maximum 4 inch lifts.

H. Wrap with filter fabric per drawings. Place filter fabric over leveled top surface of aggregate cover prior to subsequent backfilling operations. Lap filter fabric as shown on drawings. Remove excess filter fabric from trench area, do not allow excess to fold into the trench.

I. Refer to Section 31 2000 – Earth Moving.

J. Place fill over drainage pipe aggregate cover.

K. Connect to storm sewer system with unperforated pipe, through installed sleeves.

L. Coordinate the Work with connection to mechanical connections to deck drains and structural for work through geofoam and deck fill.

3.4 FIELD QUALITY CONTROL

A. See Divisions 0 and 1 for quality requirements: Field inspection and testing.

B. Request inspection prior to and immediately after placing aggregate cover over pipe.

C. Filter fabric shall not be exposed to ultraviolet rays. Any fabric left uncovered will start to degrade and will need to be replaced.

3. 5 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION

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