PROJECT MANUAL

Hammerschlag Mall Improvements
Phase I

University of Rhode Island
Kingston Campus

January 14, 2019

Volume II of II

Fuss and O'Neill Project # 20141310.S10
Milone & MacBroom Project # 7575492
URI Project # KC.L.KCPI.2017.001

Owner: The State of Rhode Island, acting by and through the Department of Administration Division of Purchases and Rhode Island Council on Postsecondary Education on behalf of the University of Rhode Island

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PROJECT MANUAL
FOR
HAMMERSCHLAG MALL
UNIVERSITY OF RHODE ISLAND
KINGSTON, RHODE ISLAND

PREPARED FOR:

University of Rhode Island
Office of Capital Projects
60 Tootell Road
Kingston, RI 02881

December 19, 2018

Owner:	State of Rhode Island Board of Education, University of Rhode Island and the State of Rhode Island
In care of:	Office of Capital Projects University of Rhode Island 60 Tootell Road – Sherman Building Kingston, RI 02881 Attn: Paul M. DePace, P.E., Director
Design Agent:	Milone & MacBroom, Inc. 99 Realty Drive Cheshire, CT 06410 www.mminc.com
Land Surveyor:	Bryant Associates, Inc. 640 George Washington Hwy #100 Lincoln, RI 02865

DIVISION 31 – EARTHWORK

SECTION 310000

EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 REFERENCES

A. All work specified in this Section shall conform to “Standard Specifications for Road and Bridge Construction” of the Rhode Island Department of Transportation, latest revision, herein referred to as “State Standards”.

1.3 SUMMARY

A. This Section includes all excavation including, but not limited to, the following:

1. Excavating and backfilling for demolition of pavements.
2. Excavation and backfilling for site walls.

B. Related Sections include:

1. Section 315000 Excavation Support and Protection
2. Section 312319 Control of Water

1.4 SUBMITTALS

A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance with the following requirements indicated:

1. Gradation Test Results for each on-site and imported soil material proposed for fill and backfill.
   a. All submittals shall clearly indicate the proposed use and the specified material described herein for which they are intended. (e.g Imported Common Borrow, Sand Gravel Fill, etc.)
2. Laboratory compaction curve according to ASTM D 698 ASTM D 1557 for each on-site and imported soil material proposed for fill and backfill.

1.5 SITE INFORMATION

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

B. Plans, surveys, measurements and dimensions, under which the work is to be performed, are believed to be correct to the best of the Engineer’s knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found herein.

C. Data on indicated subsurface conditions are not intended as representations or warrants of continuity of such conditions between soil borings. It is expressly understood that the Owner and Engineer will not be responsible for interpretations or conclusions drawn there from by the Contractor.

D. The Contractor may request to perform additional test borings and other explorations at no cost to the Owner.

E. It is the responsibility of the Contractor under this Contract to do the necessary excavation, filling, grading, and rough grading to bring the existing grades to subgrade and parallel to finished grades as specified herein and as shown on the Drawings for this Work. The Contractor shall visit the site prior to submitting a bid to become familiar with the extent of the work to be done under this Contract. The Contractor shall be responsible for determining the quantities of earth materials that must be imported or hauled off the site necessary to complete the work under this Section. All imported earth materials required to construct the project shall be included in the Contractor's base bid.

F. The Contractor is allowed to re-use excavated On-Site Common Borrow as fill in accordance with this specification. All On-Site Common Borrow used as backfill shall be compacted to the required percentage of maximum dry density included in the Minimum Compaction Requirements Table below.

1. Additional efforts required to reuse On-Site Common Borrow are the responsibility of the Contractor and shall result in no additional expense to the Owner or a request for additional time for delays caused by its usage.
2. The Contractor agrees to use this material at his own risk and is responsible for any additional work required to install this material in accordance with the specifications.
3. If project delays will result from the additional time required to re-work On-Site Common Borrow, placed as fill in accordance with the specifications, the Contractor shall remove material that does not meet the compaction requirements and provide imported fill meeting the specifications. This imported material shall be provided at no additional expense to the Owner.
4. Any project delays resulting from additional time required to work this material are the responsibility of the Contractor and shall be made up elsewhere on the project.

G. The Contractor shall use suitable on-site soils and fill, and soil from off-site sources, as needed. Please note that not all on-site materials will be suitable for reuse, nor will all required material gradations be present on the site. Imported materials are anticipated for this project.

H. Contractor shall protect and adjust moisture condition of all on-site and imported materials for proper installation, compaction, and use. This includes covering, drying, and adding moisture as required to maintain suitable workability of the soil materials. Please note onsite and imported materials will not necessarily be encountered or delivered in a suitable condition as environmental factors prevalent at the time of construction will impact soil materials.

I. All existing topsoil shall be removed prior to filling. Depth of topsoil varies by location.

1.6 UNIT PRICES

A. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the limits specified in Section 3.4 Rock Excavation.

B. Unit prices for rock excavation include all labor, equipment, and materials required for removal of rock and hauling of rock off-site. Unit prices for rock excavation also include all labor, equipment, and materials required for replacement of rock excavation with approved materials where the rock excavation extends beyond the specified excavation limits. Any excavation beyond the specified excavation limits must be approved by the Owner's Representative prior

to removal. Specified excavation limits for rock are specified in Section 3.4 Rock Excavation.

1.7 DEFINITIONS

A. Backfill: Soil material used for fill and 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: Course placed between the subbase course and final paving.

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

D. Borrow: Satisfactory soil for use as fill or backfill.

E. Boulder: A soil particle with a minimum dimension of 12 inches.

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

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated on the Drawings.

1. Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Owner's Representative. Additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
2. Bulk Excavation: Excavation more than 6 feet in width and more than 10 feet in length for the installation of utilities, foundations, and footings.
3. Trench Excavation: Excavation 6 feet in width or less for the installation of utilities, foundations, and footings
4. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner's Representative. Unauthorized excavation, as well as remedial work directed by Owner's Representative, shall be without additional compensation.

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

I. Imported Material: Material obtained by the Contractor from sources off the site.

J. Influence Area: The area within planes sloped downward and outward at an angle of 60 degrees from the horizontal from (a) 1 foot outside the outermost edge at the base of foundations or slabs; or (b) 1 foot outside the outermost edge at the surface of roadways or shoulder; or (c) 0.5 foot outside the exterior edge at the spring line of pipes and culverts.

K. Optimum Moisture Content: Determined by the ASTM standard specified to determine the maximum dry density for relative compaction.

L. Relative Compaction: The ratio, in percent, of the as-compacted field dry density to the laboratory maximum dry density as determined by ASTM D1557. Corrections for oversize material may be applied to either the as-compacted field dry density or the maximum dry density, as determined by the Owner's Representative.

M. Relative Density: As defined by ASTM D4253 or D4254.

N. Rock material in beds, ledges, unstratified masses, conglomerate deposits that cannot be removed, in the opinion of the Owner's Representative, without systematic drilling, ram

hammering, blasting, or ripping. Weathered Rock that can be removed by an excavator without hammering or other mechanical means shall not meet the definition of rock.

Rock also includes boulders of rock material that exceed 2 cu. yd. for bulk excavation or 1 cu. yd. diameter for footing, trench, and pit excavation.

1. Bulk Rock Excavation: Rock encountered within bulk excavation as defined above.
2. Trench Rock Excavation: Rock encountered within trench excavation as defined above.

O. 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.

P. Subbase Course: Course placed between the subgrade and base course for asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or asphalt walk.

Q. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

R. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other non-soil materials.

S. Unsuitable Soils: Existing soils that, in the opinion of the Engineer and Owner's Representative, are unsuitable to remain in their existing location that are deposited outside the excavation limits. This does not include topsoil, subsoil, and silty-sand materials.

1. Anticipated unsuitable soils: Unsuitable soils identified in the test pits or boring logs, drawings, specifications, test pit logs, or boring logs provided as part of the project manual.
2. Unanticipated unsuitable soils: Unsuitable soils not identified in either the test pits or boring logs provided as part of the project manual.

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

U. Well-Graded: A mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes. Well-graded does not define any numerical value that must be placed on the coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters. Well-graded is used to define a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

1.8 IMPORTED MATERIAL ACCEPTANCE

A. All imported earth materials specified in this section are subject to the following requirements:

1. Gravel borrow shall be obtained from sources which have been previously tested and approved by the state. Results and information of such tests shall be provided to the engineer for review.
2. Materials imported to the site by the Contractor for on-site use shall not contain oil and/or hazardous materials.

1.9 QUALITY ASSURANCE

A. Employ a qualified surveyor, registered with the State of Rhode Island as a Professional Land Surveyor, as required for all layout and to establish grades for the work being performed.

1. Prior to commencing work, Contractor's surveyor shall perform a benchmark level verification to confirm vertical and horizontal control of the site. Notify Owner and Owner's Representative prior to commencing work if discrepancies are found.

B. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548 shall be hired to provide required testing of earthwork materials at the Contractor's Expense.

C. All temporary shoring and bracing shall be designed, detailed, and stamped by a Professional Engineer registered in the State of Rhode Island. Refer to Section 315000 – Excavation Support and Protection.

D. Pre-excavation Conference: Conduct conference at Project site prior to the start of construction. Date and time to be specified by the Owner's Representative.

1.10 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Owner or Owner's Representative not less than two weeks in advance of proposed utility interruptions in writing. Renotify 72 hours in advance of proposed utility interruptions.
   a. Notifications should be made to David Lamb – URI Utilities Director at (401) 874-7896.
   b. Do not proceed with utility interruptions without Owner's written permission.
   c. All power shutdowns shall be coordinated with the Owner.
2. Contact "Dig Safe" at 1-888-Dig Safe and Dave Lamb, URI Utilities Director, at (401)-874- 7896 to verify locations of existing underground utilities in areas of proposed excavation prior to commencing any excavation effort.

B. Demolish and completely remove from site existing underground utilities indicated to be removed on the Drawings. Coordinate with utility companies to shut off services if lines are active.

1.11 EXCAVATION SAFETY

A. The Contractor shall be solely responsible for making all excavations in a safe manner. Contractor shall comply with all Local and State OSHA requirements.

B. Provide appropriate measures to attain a stable base, retain excavation side slopes and prevent earth slides to ensure that persons working in or near the excavation are protected.

1.12 LAYOUTS AND GRADES

A. All line and grade work not presently established at the site shall be laid out by a survey team under the supervision of a Rhode Island Registered Land Surveyor or Professional Engineer employed by the Contractor in accordance with Drawings and Specifications. The Contractor shall supply all additional layout and grade control as necessary to properly implement and construct the work. The Contractor shall establish permanent benchmarks and replace

as directed any which are destroyed or disturbed.

B. The words “finished grades” as used herein shall mean final grade elevations indicated on the Drawings. Spot elevations shall govern over proposed contours. Where not otherwise indicated, project site areas outside of the building shall be given uniform slopes between points for which finished grades are indicated or between such points and existing established grades.

1.13 TOLERANCES

A. All material limits shall be constructed within a vertical tolerance of 0.1 foot and a horizontal tolerance of 1 foot except where dimensions or grades are shown or specified as minimum. All grading shall be performed to maintain slopes and drainage as shown. No reverse slopes will be permitted.

1.14 DRAINAGE

A. The Contractor shall control the grading in areas under construction on the site so that the surface of the ground will properly slope to prevent accumulation of water in excavated areas and adjacent properties.

B. The Contractor shall excavate interceptor swales and ditches where necessary prior to the start of major earthmoving operations to insure minimal erosion and to keep areas as free from surface water as possible.

C. Should surface, rain, or ground water be encountered during the operations, the Contractor shall furnish and operate pumps or other equipment and provide all necessary piping to keep all excavations clear of water at all times and shall be responsible for any damage to work or adjacent properties for such water. All piping exposed above ground surface for this use, shall be properly covered to allow foot traffic and vehicles to pass without obstruction.

D. Presence of ground water in soil will not constitute a condition for which an increase in the contract price may be made. Under no circumstances place concrete fill, lay piping, or install appurtenances in excavation containing free water. Keep utility trenches free of water until pipe joint material has hardened and backfilled to prevent flotation.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: The Contractor may reuse excavated on-site material for fill and backfilling where the material excavated is satisfactory and conforms with the below specified gradation requirements. The Contractor is to provide imported soil materials with satisfactory properties conforming with the below specified gradation requirements when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soils being free of rock or gravel larger than 3 inches in any dimension, debris, broken pavement, waste, frozen materials, vegetation, and other deleterious matter and conform to the criteria listed below:

1. Common Borrow shall be imported or excavated onsite material free of roots, sod, rubbish, debris, frozen materials, broken pavement, or other deleterious or organic matter, and conform to the following requirements.
   a. Imported Common Borrow shall conform to the specified gradation of Granular Fill in the table above.
   b. Onsite Common Borrow shall conform to the specified gradation of Granular Fill in the table above but may contain no more than 20-percent by weight passing the

No. 200 sieve. Onsite Common Borrow shall not be placed as foundation wall backfill, as pavement base or subbase courses, as retaining wall backfill, or locations where free-draining backfill are required.

c. Stones from excavated onsite material retained on a 3-inch sieve, less than 6-inches in diameter, and not exceeding two-thirds of the thickness of the horizontal layers placed after compaction can be placed for construction. Materials meeting these criteria shall not be included in the analysis for gradation. Materials exceeding this size shall not be placed in backfill below paved areas.

2. Subbase Material shall be free of rock or gravel larger than 3 inches in any dimension, debris, broken pavement, waste, frozen materials, vegetation, and other deleterious matter and conform to the gradation for Granular Fill in table above within this specification.
3. Base Course shall be material free of rock or gravel larger than 3 inches in any dimension, debris, broken pavement, waste, frozen materials, vegetation, and other deleterious matter and conform to the gradation for Sand Gravel Fill in the table above within this specification.
4. Special Graded Aggregate shall conform to Sand Gravel Fill.
5. Riprap shall conform to RI Standard M.10.03.2.
6. Filter stone shall conform to RI Standard M.10.03.1.
7. Drainage Stone or Crushed Stone or 1 ½" Crushed Stone shall be imported material conforming to the gradation for 1 ½" Crushed Stone in table above and having a maximum percentage loss of 12 percent as determined by the sodium sulfate test, AASHTO T104, and comply to the gradation provided in the table above.
8. Sand Gravel Bedding and Granular Fill Bedding shall conform to the Sand Gravel Fill and Granular Fill gradations, respectively, specified above except that 100% by weight must pass the 1 ½" sieve.
9. 1/2" to 1" crushed stone shall conform to 3/4" crushed stone in the table above.
10. 1" Crushed stone shall conform to 1-1/2" crushed stone in the table above.
11. 2" crushed stone shall conform to 1-1/2" crushed stone in the table above.
12. Gravel Borrow shall conform to the Sand Gravel Fill Gradation in the table above.
13. Coarse sand and clean sand shall conform to ASTM C-33 fine aggregate gradation.

C. Unsatisfactory Soils are defined as soils not conforming to the satisfactory soils criteria unless otherwise approved by the Engineer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Furnish, install, and maintain shoring, sheeting, bracing, and sloping necessary to support the sides of earth and rock excavations, and to keep and prevent any movement which may damage adjacent structures, pavements, and utilities, damage or delay the work, or endanger life and health. Furnish, install, and maintain shoring, sheeting, bracing, and sloping as required by OSHA and other applicable government regulations and agencies.

B. All temporary shoring and bracing shall be designed, detailed, and stamped by a Professional Engineer registered in the State of Rhode Island.

C. Provide excavation support and protection in accordance with Section 315000 – Excavation Support and Protection.

D. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent building area and walkways.

E. The use of onsite, excavated material may require stockpiling to allow the material to dry prior to placement. Provide erosion-control measures as specified in the drawings and as required by

the Owner's Representative to prevent erosion of piles during wet weather periods.

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.
2. Install a dewatering system, specified in Section 312319 – Control of Water, to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required at no additional expense to the Owner.

3.3 ROCK EXCAVATION

A. General

1. Rock excavation includes the removal of rock to the lines and grades shown on the plans and as specified within this Section and the disposal of the Rock off site by legal methods.
2. The Contractor shall obtain all necessary permit and licenses and pay all fees at no additional cost to the Owner.
3. All rock excavation shall be included within the original Contract Sum based upon the quantities provided in Part 4. Payment for rock excavation shall be adjusted in accordance with Part 4.
4. Unit prices for rock excavation include all labor, equipment, and materials required for removal of rock and hauling of rock off-site. Unit prices for rock excavation also include all labor, equipment, and materials required for replacement of rock excavation with approved materials where the rock excavation extends beyond the specified excavation limits. Any excavation beyond the specified excavation limits must be approved by the Owner's Representative prior to removal. Specified excavation limits for rock are specified in Section 3.4 Rock Excavation.
5. Rock capable of removal through standard excavation procedures shall be removed from the excavation, measured by the Contractor, and verified by the Owner's Representative.
6. The dimensions and quantity of the uncovered rock in place and the rock removed from the trench shall be measured by a Licensed Land Surveyor registered in the State of Rhode Island at the Contractor's expense. All survey information shall be supplied to the Owner's Representative for verification of the quantity. Survey information shall include the existing rock surface topography, the removed rock surface topography and the rock removal limits as specified herein.
7. If a change in the work occurs, which includes the excavation of additional rock outside the original contract limits, the Contractor shall uncover all rock to be removed. Upon uncovering rock in excavations that cannot be removed by standard excavation measures, the Contractor shall expose all faces of rock in the area that requires excavation and notify the Owner. The dimensions and quantity of the rock in place and the rock removed from the trench shall be measured by a Licensed Land Surveyor registered in the State of Rhode Island at the Contractor's expense. All survey information shall be supplied to the Owner's Representative for verification of the quantity.
8. Rock shall be removed by mechanical means and methods.

B. Rock Removal Limits

1. The Contractor shall remove rock to elevations, which will allow the installation of all foundations, footings, utilities, structures, trees and plantings, shown on the drawings.
2. The Contractor shall remove rock to a minimum of 30 inches below finished grade in paved areas and a minimum of 24 inches below finished grade in landscaped areas.
3. Around proposed utilities, the Contractor shall remove rock to the lines and subgrade elevations indicated on drawings and as dictated within this specification. The Contractor shall remove sufficient rock to permit the installation of permanent construction without exceeding 6 inches beneath pipe in trench, and the greater of 24 inches wider than pipe or 36 inches wide.

3.4 EXCAVATION, GENERAL

A. Excavate to subgrade elevations. Material to be excavated will be classified as earth or rock. Do not excavate rock until it has been classified and quantified by the Contractor's land surveyor, and verified by the Owner's Representative

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.

B. All topsoil and unsuitable or excess materials shall be stripped from areas of new construction or regrading. Materials suitable for reuse shall be stored in a location approved by the University of Rhode Island that will not interfere with construction operations.

C. Existing topsoil shall be stripped and stored on-site before any underlying excavating is begun. Existing topsoil is the property of the University of Rhode Island and shall not be removed from the campus unless authorized in writing by URI. Contractor shall haul material to a location on campus designated by the Owner's Representative.

D. All excess and unsuitable materials shall be legally disposed of off-site by the Contractor.

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.

B. Over-excavation by the Contractor, excavation below the proposed bottom of excavation, shall be backfilled in 6 inch lifts with compacted Sand Gravel Fill. In wet conditions, overexcavation shall be backfilled in 6-inch lifts with 3/4-inch Crushed Stone and a layer of filter fabric approved by the Engineer and compacted to 95% until the proposed subgrade elevation is reached and the subgrade stabilized.

3.6 SUBGRADE INSPECTION

A. Notify Owner's Representative when excavations have reached required subgrade.

B. If Owner's Representative determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. 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.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Continue this process until the area has been proof-rolled 4-6 times. Limit vehicle speed to 3 mph.
2. Proof-roll with a vibratory roller with a static weight of no less than 10,000 lbs and a

dynamic weight of 20,000 lbs.

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Owner's Representative, and replace with compacted backfill or fill as directed.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner's Representative, without additional compensation.

3.7 EXCAVATION OF UNSUITABLE MATERIALS

A. The Contractor shall notify the Owner's Representative and Engineer when excavations uncover potential unsuitable materials.

B. Payment for all excavation and disposal of Unanticipated Unsuitable Soils within the limit of excavation shall be included as part of the original Contract Sum.

C. Excavation and disposal of Unanticipated Unsuitable Soils outside the limit of excavation shall be paid for in accordance with the Unit Prices included in Part 4 of this specification.

1. Unit prices for unanticipated unsuitable soils excavation include all labor, equipment, and materials required for removal of unsuitable soils, hauling of unsuitable soils off-site, and disposal. Unit prices for unanticipated unsuitable soil also include all labor, equipment, and materials required for replacement of unsuitable soil excavation with approved materials. Any unanticipated unsuitable soil excavation must be approved by the Engineer and Owner's Representative prior to removal.
2. The dimensions and quantity of the Unanticipated Unsuitable Soils excavated shall be measured by a Professional Land Surveyor registered in the State of Rhode Island at the Contractor's expense. The Surveyor shall measure the elevations of the unsuitable materials prior to excavation and the surface topography following excavation. All survey information shall be supplied to the Owner's Representative for verification of the quantity. Survey information shall include the topography of the uncovered suitable soil surface prior to excavation and the topography of the final soil surface following excavation.

3.8 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 Engineer.

B. Concrete required to fill unauthorized excavation shall be furnished and installed at the expense of the Contractor.

3.9 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 in locations approved by the University of Rhode Island. Do not store within drip line of remaining trees.

3.10 BACKFILL GENERAL

A. The contractor shall notify the Owner's Representative a minimum of 2 days prior to backfilling utility trench to schedule inspection.

B. 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. Receiving approval from the respective Utility Company and the Owner's Representative following inspection.

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

3.11 UTILITY TRENCH BACKFILL

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

B. Place and compact initial backfill conforming to the specified material requirements to the height specified on the Drawings over the utility pipe or conduit.

C. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

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

E. Bedding material shall be placed and compacted in maximum 6" lifts.

3.12 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. The Contractor shall furnish water for compaction. Water for compaction from sources other than potable sources shall be as approved by the Owner's Representative.

3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 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. Compaction shall be completed with a vibratory roller having a static weight of 10,000 lbs and a dynamic weight of 20,000 lbs.

C. The Contractor shall use caution when compacting near existing utilities including electric and communications duct banks. Any damage to existing utilities or structures resulting from compaction operations shall be repaired at the expense of the Contractor.

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

E. The Contractor is allowed to re-use excavated On-Site Common Borrow as fill in accordance with this specification. All On-Site Common Borrow used as backfill shall be compacted to the

required percentage of maximum dry density included in the Minimum Compaction Requirements Table below.

F. Compact soil materials to not less than the following percentages of maximum dry density:

Table 2: Minimum Compaction Requirements

Location	Percent of Maximum Dry Density[1]
Backfill within pavement base and sub base layers	95
Backfill below pavement sub base layers	92
Around and above utilities in paved areas	92
Backfill within landscaped areas	85

[1] Maximum dry density as determined by the Modified Proctor test (ASTM D 1557)

3.14 SUBBASE AND BASE COURSE

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

B. Place subbase and base course on subgrade in 6-inch lifts and compact as specified.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: The Contractor shall engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

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

C. 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 1 test for every 2000 sq. ft. or less of paved area, but in no case fewer than 3 tests.
2. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.
3. Non-Paved Areas: At each compacted fill and backfill layer, at least 1 test for every 5000 sq. ft. or less of non-paved area, but in no case less than 2 tests.

D. 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 to depth required; recompact and retest until specified compaction is obtained.

3.16 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 specify 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 Owner's Representative; reshape and recompact.

C. Where settling occurs 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.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Topsoil is the property of the University of Rhode Island and shall not be removed from the site without the Owner's written permission. Contractor shall haul material to a location on campus designated by the Owner's Representative.

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

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

PART 4 - MEASUREMENT AND PAYMENT

4.1 GENERAL

A. Payment for earthwork as outlined in this Section or shown on the Drawings, including, but not limited to, all design, submittals, materials, labor, equipment, and all other incidentals associated with this work shall be included in the Contractor's Base Bid.

B. Unit prices for rock excavation include all labor, equipment, and materials required for removal of rock and hauling of rock off-site. Unit prices for rock excavation also include all labor, equipment, and materials required for replacement of rock excavation with approved materials where the rock excavation extends beyond the specified excavation limits. Any excavation beyond the specified excavation limits must be approved by the Owner's Representative prior to removal. Specified excavation limits for rock are specified in Section 3.4.

C. Unit prices for unanticipated unsuitable soils excavation include all labor, equipment, and materials required for removal of unsuitable soils, hauling of unsuitable soils off-site, and disposal. Unit prices for unanticipated unsuitable soil also include all labor, equipment, and materials required for replacement of unsuitable soil excavation with approved materials. Any unanticipated unsuitable soil excavation must be approved by the Owner's Representative prior to removal.

1. Quantities and Payment of Unanticipated Unsuitable Soil Conditions:

a. If unanticipated unsuitable materials are encountered beyond the limits of excavation as specified on the Drawings and Specifications, the Contractor shall notify the Owner's Representative in writing. The Contractor shall carry excavation deeper and replace the excavated material with appropriate specified material or concrete as directed by the Owner's Representative or Geotechnical Engineer.
b. Removal of topsoil, subsoil, and rock layer as specified in this specification will not be considered as unanticipated unsuitable soil conditions. Similarly, removal of these materials within paved areas as specified herein will not be considered unanticipated unsuitable soil conditions.
c. The test pits and boring logs indicate unsuitable materials within the limit of disturbance. Removal of these materials will not be considered as unanticipated unsuitable soils. Similarly, removal of these materials within paved areas as specified herein that lie within 3 feet of the proposed final grade shall be removed prior to filling and will not be considered unanticipated unsuitable soil conditions.
d. Only changes in the work authorized in advance by the Owner's Representative in writing shall constitute an adjustment in Contract Price.
e. Material that is too wet or too dry for compaction of the particular material in place

as determined by the Owner's Representative or the Geotechnical Engineer and/or Soil Testing Company and is disturbed by the Contractor during construction operations so that proper compaction cannot be reached shall be removed and replaced with approved material as directed by the Owner's Representative or Geotechnical Engineer at no additional cost to the Owner.

f. The Contractor shall follow a construction procedure, which permits visual identification of firm natural ground.

g. The Contractor shall carry in the Base Bid 200 cubic yards for removal of unanticipated unsuitable materials and replacement with suitable compacted fill material in place, as directed herein. The Base Bid shall cover all costs related to such excavation, removal off site, and replacement with compacted fill of approved material, overhead, and profit. No amount other than the Unit Price provided by the Contractor will be paid by the Owner for excavation herein defined.

1) If the total quantity of unanticipated unsuitable materials and its replacement with compacted fill exceeds the amount included in the Contract as listed above, the Owner shall pay the excess excavation and replacement at the unit price of $50.00 per cubic yard.

2. Quantities and Payment of Rock Excavation

a. The Contractor shall include in his base bid 30 cubic yards of Bulk Rock Excavation, its removal from site, and replacement with a compacted fill of approved material.

1) The Unit Price for Bulk Rock Excavation as specified herein shall not exceed $70.00 per cubic yard.

b. The Contractor shall include in his base bid 30 cubic yards of Trench Rock Excavation, its removal from site, and replacement with a compacted fill of approved material.

1) The Unit Price for Trench Rock Excavation as specified herein shall not exceed $160.00 per cubic yard.

D. All quantities of unanticipated unsuitable soils and rock excavated are to be measured in place by a Professional Land Surveyor registered in Rhode Island as described above and verified by the Owner's Representative prior to removal.

E. The Contractor shall submit signed slips showing quantities of Unanticipated Unsuitable Soils and Rock removed from excavations at the end of each workday, with a total quantity mutually agreed upon. Slips shall be signed by the Owner's on-site representatives at the end of each day signifying that the quantities are accurate. The Owner has the right to inspect individual loads, slips and quantities as they arrive at or leave from the site and as they are weighed out at the stone quarry. These quantities are for reference only and will not be used to calculate payment with the unit prices above.

END OF SECTION

6372-01-01-03-n2718-spec 310000 Earthwork

SECTION 311100

SITE PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 REFERENCES

A. All work specified in this Section shall conform to “Standard Specifications for Road and Bridge Construction” of the Rhode Island Department of Transportation, latest revision, herein referred to as “State Standards”.

1.3 SUMMARY

A. The work of this Section includes the following:

1. Provisions for protection of all existing utilities from damage particularly at heavy construction vehicle crossings.
2. Removal and disposal of flexible pavement, curbing, and bituminous concrete walks at the locations specified on the drawings.
3. Resetting catch basins, manholes, utility structures.
4. Removal of trees
5. Cleaning and maintenance of the site.

B. Related Sections include the following:

1. Section 310000 Earthwork

1.4 DEFINITIONS

A. Cleaning as described in Subsection 212.01.2a of the State Standards.

B. Maintenance as described in Subsection 212.01.2b of the State Standards.

C. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

D. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.5 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain on the Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

B. The Owner reserves the right to claim ownership over any materials removed from the site, including earthwork. The materials claimed by the Owner shall be stockpiled on the site as directed.

C. Stripped Topsoil is the property of the University of Rhode Island and shall not be removed from the site. Contractor shall haul topsoil to a location designated by the Owner.

1.6 SUBMITTALS

A. Shop Drawings:

1. Submit drawings or details indicating proposed provisions for protection of existing gas line and utilities as the work requires. These utilities must be protected from damage particularly by heavy construction equipment driving over the top of them.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner or Owner’s Representative not less than two weeks in advance of proposed utility interruptions in writing. Renotify in writing 72 hours in advance of proposed utility interruptions.
   a. Notification should be made to David Lamb – URI Utilities Director at (401) 874-7896.
2. Do not proceed with utility interruptions without Owner’s written permission.
   a. All power shut downs shall be coordinated with the Owner and shall be on week-ends between 6:30 a.m. and 7:00 p.m.
3. Underground utilities were compiled from available record plans and aboveground locations and are approximate. The Contractor shall contact “Dig-Safe” at 1-888- DIGSAFE and David Lamb, URI Utilities Engineer at (401) 874-7896 72 hours to mark existing utilities prior to commencing work on any part of the site.

B. The Contractor is responsible to schedule the work and determine any required temporary utility lines and connections required to keep the existing facilities in operation. The cost to furnish and install temporary utility lines and connections shall be included in the Contactor’s base bid.

C. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with the University, David Lamb – URI Utilities Director, and utility companies to shut off services if lines are active.

D. Contractor shall not operate existing water gate valves and hydrants. All operation of the water distribution system must be completed by URI personnel.

E. All abandoned underground utilities shall be designated on as-built drawings by the Contractor of record and provided to the Owner and Engineer in AutoCad electrical format prior to completion of the project. All as-built drawings, (underground and above ground) shall be dimensioned from permanent benchmarks such as existing buildings and include depths at various points throughout the extent of the work, and invert elevations at all structures.

F. Do not commence site operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Contractor shall provide all materials and equipment in suitable and adequate quantity as required to accomplish the work shown and specified

PART 3 - EXECUTION

3.1 REMOVE AND DISPOSE FLEXIBLE PAVEMENT, CURBING, CONCRETE RAMPS, AND CONCRETE WALKS

A. In accordance with Subsections 201.03.7, and 201.03.10 of the Standard Specifications.

3.2 DISPOSAL

A. Disposal: Remove surplus soil material, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property. Any potentially contaminated soil material encountered, as specified by the State of Rhode Island Department of Environmental Management rules and regulations, shall be brought to the Rhode Island Resource Recovery Corporation or another appropriately licensed waste facility for legal disposal.

B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

3.3 SALVAGE

A. All materials designated to be removed and salvaged shall be removed from the project limits and transported to the location designated by the Owner. Materials that are damaged during construction shall be replaced at no additional expense to the owner.

3.4 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction. The Contractor shall employ a Professional Land Surveyor registered in the State of Rhode Island to perform a benchmark and field verification survey prior to commencing work. The Contractor is responsible to provide horizontal and vertical layout of all proposed work.

B. Locate and clearly flag trees and vegetation to remain or to be relocated. Review trees with Owner and Landscape Architect prior to removal.

C. Protect existing site improvements to remain from damage during construction.

D. Restore damaged improvements to their original condition, as acceptable to Owner.

3.5 CLEANING AND MAINTENANCE OF STORM DRAIN SYSTEM

A. The Contractor shall remove sediment and debris from the existing drainage system prior to commencing work.

B. During construction the Contractor shall be responsible to clean sediment and debris from the

existing and recently installed drainage system.

C. Prior to project completion the complete drainage system shall be cleaned of all debris and sediment.

END OF SECTION

6372-01-01-03-n2718-spec 311100 Site Preparation

SECTION 312319

CONTROL OF WATER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 of the Rhode Island Department of Transportation Standard Specifications Sections, apply to this Section.

1.2 REFERENCES

A. All work specified in this Section shall conform to “Standard Specifications for Road and Bridge Construction” of the Rhode Island Department of Transportation, latest revision, herein referred to as “State Standards”.

1.3 SUMMARY

A. This Section includes requirements for dewatering, control, handling, treatment, and disposal of groundwater, surface runoff water, construction water, and any other water that may be encountered during the course of work.

B. Related Sections include the following:

1. Section 310000 – Earthwork.
2. Section 315000 – Excavation Support and Protection.

1.4 PERFORMACE REQUIREMENTS

A. Control, handle, and treat water continuously during the course of construction.

B. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrades.

C. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.

D. Prevent surface water from entering excavations by grading, dikes, or other means.

E. Accomplish dewatering without damaging existing buildings adjacent to excavation.

F. Remove dewatering system if no longer needed.

1.5 SUBMITTALS

A. Shop Drawings for Information:

1. For dewatering system. Show arrangement, locations, and details of dewatering locations; and locations of erosion controls and dewatering basins.
2. Include a written report outlining control procedures to be adopted if dewatering problems arise.

B. Record drawings at Project closeout identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions performed during dewatering.

C. Field Test Reports: Before starting excavation, submit test results and computations demonstrating that dewatering system is capable of meeting performance requirements.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

1. At no time is discharge to be allowed to an existing drainage structure without sedimentation controls. Any damage caused by dewatering will be repaired in full to match existing conditions at the Contractor's expense.
2. At no time is discharge allowed to existing sanitary sewer system.

1.7 PRODUCT CONDITONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by the Owner's Representative and then only after arranging to provide temporary utility services according to requirements indicated.

B. Make additional test borings and conduct other exploratory operations necessary for dewatering.

PART 2 - GENERAL

2.1 GENERAL

A. The Contractor shall provide any equipment and materials necessary for dewatering at this own expense.

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 dewatering operations.

B. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.

C. Protect subgrades and foundation soils from softening, undermining, washout, and damage by rain or water accumulation.

D. 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.

E. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

F. Do not close or obstruct streets, walks, 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.

G. Provide erosion controls in accordance with the Rhode Island Soil Erosion and Sediment Control Handbook.

H. Dewatering basins capable of handling the flows directed to them shall be supplied whenever dewatering is completed.

I. Reroute runoff from site into appropriate drainage facilities.

3.2 INSTALLATION

A. The Contractor shall intercept and divert surface drainage away from the work sites by the use of dikes, berms, swales, or other means. The Contractor shall design surface drainage systems so that they do not cause erosion on or off the site. Surface runoff shall be controlled to prevent entry of water into excavations. The Contractor shall remove drainage systems when no longer needed.

B. Install dewatering system utilizing pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

C. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, utilities, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

D. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of drains, sewers, utilities and other excavations.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids inconvenience to others.

F. Provide sumps, dewatering basins, sedimentation tanks, and other flow-control devices to avoid erosion and sedimentation.

G. Direct discharges to storm drains will be unacceptable unless proper sediment and siltation removal devices are installed prior to discharge to the storm water conveyance system.

H. Any discharge of water, generated from a dewatering operation, into wetlands or an open water body will not be permitted.

I. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

J. Remove dewatering system from Project site on completion of dewatering.

K. Damage including, but not limited to erosion or sedimentation, resulting from untreated dewatering discharges shall be restored to meet or exceed the existing condition. All remedial work shall be completed in accordance with local and State Environmental Regulations and Requirements.

3.3 PROPERTY LOSSES FROM REMOVAL OR DISTURBANCE OF GROUNDWATER

A. Any structure, including but not limited to embankments, buildings, streets, and utilities that become unstable or vulnerable to settlement due to removal or disturbance of groundwater will be supported immediately by the Contractor. Support shall include but not be limited to bracing, underpinning, or compaction grouting.

B. All loss or damage arising from removal or disturbance of groundwater, including but not limited to claims for subsidence and the loss of structure support, that may occur in the prosecution of the work shall be sustained and borne by the Contractor. If the Contractor needs to correct the damage resulting from his operations, the Owner may, 30 days after notifying the Contractor in writing, proceed to repair, rebuild or otherwise restore such damaged property as may be deemed necessary, and the cost thereof shall be deducted from compensation which may be or become due the Contractor under this Contract.

END OF SECTION

6372-01-01-03-n2718-spec 312319 Control of Water

SECTION 313211

EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 REFERENCES

A. All work specified in this Section shall conform to “Standard Specifications for Road and Bridge Construction” of the Rhode Island Department of Transportation, latest revision, herein referred to as “State Standards”.

1.3 SUMMARY

A. The work of this Section includes the following:

1. Provision of erosion controls specifically compost filter socks, construction entrances, temporary diversions, temporary sediment traps, and catch basin inlet protection as indicated on the drawings or as directed by the Owners Representative.
2. Maintenance and cleaning of erosion and sedimentation controls specifically compost filter socks, baled hay erosion checks, temporary diversions, temporary sediment traps, and catch basin inlet protection as necessary or as directed by the Owner’s Representative.

B. Related Sections include the following:

1. Section 310000 Earthwork.

1.4 DEFINITIONS

A. Cleaning as described in Subsection 212.01.2a of the State Standards.

B. Compost Filter Sock: Three-dimensional tubular filtration device constructed by filling a mesh tube with a compost filter media.

C. Maintenance as described in Subsection 212.01.2b of the State Standards.

1.5 SUBMITTALS

A. Shop Drawings:

1. Product information depicting that the products furnished meet the project specifications.
2. Provide a construction sequence plan depicting the following:
   a. portions of the site that will be exposed
   b. areas that will be temporarily seeded
   c. construction entrances
   d. laydown areas
   e. general temporary grading scheme
   f. temporary diversions or swales

g. perimeter sediment barriers,
h. dewatering areas
i. concrete washout areas
j. designated fueling areas

1.6 PROJECT CONDITIONS

A. Do not commence operations which disturb the ground surface until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 EROSION AND SEDIMENTATION CONTROL MEASURES

A. Compost Filter Sock.

1. Materials shall be in accordance with AASHTO Designation: MP 9-06. Compost material shall meet applicable Federal and State Regulations.
2. For compost filter socks 18” or less in diameter, wooden stakes shall be 1 inch by 1 inch, at 10-foot intervals on center, and of a length that shall project into the soil 1 foot leaving 3 to 4 inches protruding above the filter sock.
3. For compost filter socks greater than 18” in diameter, wooden stakes shall be 2 inch by 2 inch, at 10-foot intervals on center, and of a length that shall project into the soil 1 foot leaving 3 to 4 inches protruding above the filter sock.

B. Filter Fabric

1. See Geotextiles in Division 2 Section 310000 -Earthwork for specification.

C. Temporary Seeding

1. Provide RIDOT Standard Specification L.02 Type 3 Temporary Seeding.

D. Construction Accesses

1. Construction Accesses shall comply with RIDOT Standard Specification Section 211.

E. Temporary Sediment Traps, Swales, and Diversions

1. Refer to Section 310000 - Earthwork for soil materials and excavation.
2. Provide temporary seeding.
3. Provide temporary turf reinforcement mat as required to stabilize side slopes.

PART 3 - EXECUTION

3.1 PROVISION OF COMPOST FILTER SOCKS

A. Trenching is not required for typical installation; therefore, soil should not be disturbed upon installation. Compost filter socks shall be placed over the top of ground and wooden stakes shall be driven through the center of the filter socks to anchor them to the ground. To ensure optimum performance, heavy vegetation shall be cut down or removed and extremely uneven surfaces shall be graded to ensure that the compost filter sock uniformly contacts the ground surface.

B. Compost filter socks may be vegetated by incorporating seed into the compost prior to placing it in the tube.

C. The ends of the compost filter sock shall be directed upslope, to prevent stormwater from running around the end of the sock.

3.2 MAINTENANCE AND CLEANING OR EROSION AND POLLUTION CONTROLS

A. In accordance with Subsection 212.03 of the State Standards.

B. Repair all erosion controls at substantial completion and get inspection and approval of the condition of the protection from the Owner's Representative.

3.3 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the Drawings.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Following stabilization of the site and the receipt of permission from the Owner's Representative, the Contractor shall remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal at no additional cost to the Owner.

3.4 DISPOSAL

A. Disposal: Remove surplus soil material, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property. Any potentially contaminated soil material encountered, as specified by the State of Rhode Island Environmental Management rules and regulations, shall be brought to the Rhode Island Resource Recovery Corporation or another appropriately licensed waste facility for legal disposal.

B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

3.5 PREPARATION

A. Restore damaged improvements to their original condition, as acceptable to Owner.

3.6 TEMPORARY SEEDING

A. In accordance with Subsection L.02 for Type 3 Temporary Seeding of the State Standards.

3.7 CONSTRUCTION ACCESSES

A. In accordance with Section 211 Construction Accesses of the State Standards.

END OF SECTION

6372-01-01-03-n2718-spec 313211 Erosion and Sedimentation Control

SECTION 315000

EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 REFERENCES

A. All work specified in this Section shall conform to “Standard Specifications for Road and Bridge Construction” of the Rhode Island Department of Transportation, latest revision, herein referred to as “State Standards”.

1.3 SUMMARY

A. This Section includes temporary excavation support and protection systems.

B. Related Sections include the following:

1. Section 312319 - Dewatering.
2. Section 310000 - Earthwork.

1.4 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Provide professional engineering services needed to assume engineering responsibility, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

B. The Contractor assumes all responsibility for the excavation support systems used. In the event of a failure, all resulting damages are the responsibility of the Contractor.

1.5 SUBMITTALS

A. Shop Drawings for Information: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.

1. Include Shop Drawings signed and sealed by a qualified Registered Professional Engineer licensed in the State of Rhode Island.
2. Working drawings and details on the excavation support proposed by the Contractor shall be provided along with detailed calculations showing the design of the bracing and sheeting proposed also stamped by a Registered Professional Engineer licensed in the State of Rhode Island.
3. Working Drawings and design calculations, at a minimum, shall indicate the following:
   a. Design criteria.

b. Details, arrangement and method of assembly and disassembly of proposed system and sequence of construction.
c. Connection details.
d. Method of preloading the bracing.
e. Full excavation depth.
f. Loads on support system for various stages of excavation and bracing removal.
g. Expected equipment loads.
h. Maximum design load carried by various members of support system, and preload values.
i. Depths below main excavation to which support system will be installed.
j. Methods of resolving difficulties arising from misalignment of soldier piles or steel sheetpiling exposed during excavation, and criteria for implementing procedures.
k. Design calculations, for various stages of excavation and bracing removal.
l. Existing utility facilities. After checking locations by field investigations, revise drawings to show actual locations of facilities and excavation supports interference with proposed Work, and measures proposed to overcome such interferences.
m. Manufacturer's product data.

4. Design Computations: The Contractor shall also submit complete computations for the design of the sheeting and bracing system(s) proposed to be installed.
   a. The design shall be in accordance with sound engineering practice and modern, accepted principles of soil mechanics.
   b. The design shall include the effects of all surcharge which may be reasonably anticipated.
   c. The minimum factor of safety for each of the design conditions required to be considered shall be 1.50.

B. Qualification Data for Installer and Professional Engineer.

C. Submittal Review:

1. The design and layout will be reviewed by the Engineer as to type and suitability, providing that the arrangements presented by the Contractor are satisfactory, but such review will not relieve the Contractor of the sole responsibility for the adequacy of the system, nor shall it be construed as a guarantee that the Contractor's proposed equipment, materials and methods for sheeting and bracing will be adequate for the work required at the locations of and for the work required by this contract.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated.

B. The Contractor may make test borings and conduct other exploratory operations necessary for excavation support and protection.

C. Survey adjacent structures and improvements adjacent to the excavation support system to monitor settlement. Employ a qualified professional engineer or land surveyor to establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations during construction.

D. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Owner's Representative if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

1.7 QUALITY CONTROL

A. Provide in accordance with the requirement as specified in Division 01 Specification Sections.

B. Support of Excavation shall be of sufficient strength to safely sustain all loads from the sides of the excavations, together with all water pressure and reasonable surcharge.

C. The Contractor shall, at all times, be entirely responsible for the adequacy of sheeting and bracing used:

1. to permit the satisfactory and safe installation and construction of the work;
2. to provide adequate protection against damage to all existing utilities, structures, and completed portions of the work; and
3. to prevent injury to persons.

D. The Contractor shall control, and pitch, the grading to prevent water from running into the excavated areas of the structures, or to prevent damage to other structures or work already accomplished.

E. Welding Operations – in accordance with AWS D1.1

1.8 DESIGN CRITERIA

A. This design criteria applies where the Contractor is responsible for design of the excavation support:

1. Design the excavation support system in accordance with the earth pressures and other detailed criteria indicated.
2. Design the excavation support system to support the earth pressures, decking system and AASHTO HS20 traffic loads if any, utility loads, equipment and construction loads, and other surcharge loads to allow the safe and expeditious construction of the permanent structures without movement or settlement of the ground, and to prevent damage to, movement or settlement of, adjacent buildings, structures, or utilities.
3. Design sheet pile and soldier pile and lagging excavation support systems to penetrate to a depth below the bottom of excavation adequate to prevent lateral and vertical earth movement, and permit lowering of the indicated bottom of excavation at least two feet without any change in the support system as installed except for additional lagging and bracing for soldier pile and lagging systems.
4. Design the bracing system to furnish sufficient reaction against the side banks to maintain stability in such banks. Obtain such reaction by timely stressing to predetermined locations until the necessary reaction is produced against the banks, or by such other methods that may be necessary to prevent displacement of ground and movement of structures.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel:

1. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
2. Steel sheet piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

C. Lagging:

1. Timber Lagging: use sound, well-seasoned Douglas Fir of rectangular cross section, Grade 2 or better. Timber shall be stamped and certified ALOPB LP-22 by the American Preserves Bureau.
2. Moisture Content shall not exceed 20%.
3. Minimum fiber stress in bending perpendicular to the grain shall be 1200 psi.

D. Timber Sheeting:

1. Any species of wood sheets that will satisfactorily withstand all driving and construction stresses and the loads, to which the members will be subjected, may be used for sheeting and bracing.
2. Wood sheeting shall not be less than three (3) inches nominal thickness.
3. All timber sheeting and bracing shall be free from worm holes, windshakes, loose knots, decayed or unsound portions of other defects which might impair its strength or tightness.

E. Other Materials:

1. The Contractor shall provide all hardware and fastenings necessary to accomplish satisfactory installation of all sheeting and bracing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Sheeting and bracing shall be of sufficient strength to sustain all loads from the sides of the excavations, together with all water pressure and surcharge.

B. The Contractor shall be entirely responsible for adequacy of sheeting and bracing used and shall take all precautions necessary to prevent movement of material along the sides of excavations, and to prevent the intrusion of water beyond that which his pumping or well point system can control.

C. Sheeting shall be permanently left in place where indicated or directed.

D. It is expressly understood and agreed that whenever sheeting and bracing is used, it shall not relieve the Contractor of the sole responsibility for any damages, delays, or injury due to installation or failure of the sheeting or bracing, or the settling of the backfill, the pipeline, or the adjacent ground.

3.2 TIMBER SHEETING

A. Sheeting shall be driven to sufficient depth below the deepest excavation level to maintain sufficient restraint of the adjacent soil and to prevent movement of the sheeting or excessive intrusion of groundwater.

B. If voids occur behind the sheeting, they shall be filled immediately with proper material from earth excavation or other sources to the satisfaction of the Engineer.

C. Withdrawal of sheeting shall be carefully performed to prevent movement of material along the sides of the backfilled excavations, to prevent damage to utilities, structures, or the work, and to avoid injury to persons.

D. Unless otherwise permitted, sheeting shall be withdrawn in lifts of not more than four (4) feet, and all voids shall be filled immediately with selected materials and thoroughly compacted.

3.3 STEEL SHEET PILING

A. Install in plumb position with each pile interlocked with adjoining piles for its entire length so as to form a continuous diaphragm throughout the length of each run of wall, being tightly against original ground. Use vibratory pile driver to install sheeting to depth required for design. The equipment and methods of installation, cutting, and splicing shall conform to the approved Working Drawings.

B. Steel sheet piling located within a one to one slope from the bottom of the foundation element shall not be removed.

3.4 SOLDIER PILES AND LAGGING

A. Provide bored holes for soldier piles adequate to accommodate pile sections shown on approved Working Drawings. Extend holes to necessary depth below level of subgrade. When pre-boring is to occur within two feet of a utility, uncover utility and install a steel drill casing to a level at least six inches below bottom of utility prior to pre-boring.

B. Carry bottom of sheeting system to a depth below main excavation adequate to prevent lateral movement and to obtain adequate vertical support. In areas where additional excavation is required below main excavation subgrade, prevent movement of main excavation supports.

C. Encase soldier piles with 2500 psi concrete up to lowest point of excavation adjacent to pile location. Fill remainder of hole with lean concrete, completely encasing pile.

D. Use timber lagging secured in place to soldier piles.

E. Follow excavation closely with placement of lagging. Do not allow height of unlagged face of excavation to exceed five feet in rock and predominately clayey soils, or three feet in sandy soils. Extend lagging to final subgrade. Decrease height as required to prevent ground movement.

F. Do not permit height of unlagged face to exceed 15 inches if water flows from face of excavation, or if soil (of any type) in face moves towards excavation area. Decrease unlagged face height as required to prevent ground movement.

G. Carefully perform excavation for installation of lagging to minimize formation of voids. Separate lagging members only as necessary to permit packing behind them.

H. Pack behind lagging as installation progresses; establish tight contact between excavation face and lagging. Pack openings between lagging members with straw or other suitable material to allow free drainage of water without loss of soil or sand packing.

I. If unstable material is encountered during excavation, take suitable measures to contain unstable material in place and prevent ground displacement, which may cause damage.

J. Maintain sufficient quantity of material on hand for lagging, bracing and other operation for protection of Work and for use in case of accident or emergency.

3.5 SUPPORT SYSTEMS WITH INTERNAL BRACING

A. Use walers, struts, and rakers as necessary to provide internal support of excavation faces retained by soldier piles. Internal columns are unacceptable.

B. When walers are used, obtain tight bearing between wales and wall, and ample bearing area with starpack for load transfer.

C. Provide struts as indicated and intermediate bracing as needed to enable struts to carry maximum design load without distortion or buckling.

D. Provide diagonal bracing as needed for stability of system.

E. Include web stiffeners, plates or angles as needed to prevent rotation, crippling or buckling of connections and points of bearing between structural steel members. Allow for eccentricities caused by field fabrication and assembly.

F. Install and maintain internal bracing support members in tight contact with each other and with surface being supported. Attach struts to wales using direct end bearing vertical plate (shimmed) connections at all levels.

G. Design internal bracing support members for maximum forces occurring during excavation or removal stages.

H. Preloading:

1. Preload internal bracing members, including struts, (except deck beams), shores and similar members, to 50 percent of design compression load occurring during excavation phase.
2. Use procedures that produce uniform loading on bracing members without inducing appreciable eccentricities or overstressing and distortion.
3. Make provisions for permanently fixing each member with steel shims or wedges welded into place.
4. Accomplish preloading by jacking supports in place against soldier piles or wales.
5. Do not use wooden wedges to preload bracing member.
6. Include in preloading system means to determine, within five percent, amount of preload induced into bracing members.

I. If decking beams are not required, or if decking beams are not designed to support excavation loads, install uppermost tier of bracing at vertical distances not more than eight feet below top of excavation.

J. Install tiers of internal bracing with a vertical distance between them and level of excavation below of not greater than 15 feet. Reduce maximum vertical distance to nine feet where ground movement and settlement shall be minimized to prevent damage, where indicated or as directed.

K. Excavate below point of support as indicated. Install bracing, and preload immediately after installation and before continuing excavation.

L. When removing struts, increase vertical spacing provided invert slab has been place for at least ten days and support system is adequate to support, safely, adjacent structures and works.

M. Vertical spacing of bracing may be increased when removing struts, provided support system is adequate to support adjacent structures and works.

3.6 REMOVAL OF SUPPORTING SYSTEM

A. When removing excavation support system, do not disturb or damage adjacent buildings structures, construction, or utility facilities. Fill voids immediately with lean concrete or with approved backfill compacted to the density as specified in Section 310000 - Earthwork.

B. Except as specified herein and below, remove sheeting system to a depth of at least six feet below the ground surface.

C. Remove material of supporting system from the Worksite immediately.

END OF SECTION

6372-01-01-03-n2718-spec 315000 Excavation Support and Protection

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 321217

HOT MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 REFERENCES

A. All work specified in this Section shall conform to “Standard Specifications for Road and Bridge Construction” of the Rhode Island Department of Transportation, latest revision, herein referred to as “State Standards”.

1.3 SUMMARY

A. This Section includes the following:

1. Hot Mix Asphalt paving.
2. Heavy-duty bituminous concrete paving
3. Bituminous concrete patching.
4. Asphalt surface treatments

B. Related Sections include the following:

1. Section 310000 - Earthwork for aggregate subbase and base courses

1.4 DEFINITIONS

A. DOT: Rhode Island Department of Transportation

B. HMA: Hot Mix Asphalt

1.5 DESIGN REQUIREMENTS

A. Use all means necessary to protect pavement materials before, ongoing, and after installation, and to protect the installed work and materials of all other trades.

B. In the event of damage, immediately make all repairs and replacements necessary as directed by the Owner’s Representative at no additional expense to the Owner.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated include technical data, gradation, and composition of materials proposed.

B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

C. Qualification Data: For manufacturer.

D. Material Test Reports: For each paving material.

E. Conformance Certificates: For each paving material, signed by manufacturers.

F. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international graphics symbol, spaces dedicated to people with disabilities.

1.7 QUALITY ASSURANCE

A. Manufacturer shall be a paving-mix manufacturer registered with and approved by the Rhode Island Department of Transportation.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.

C. Regulatory Requirements: Comply with the State Standards.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
3. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) at time of placement.

PART 2 – PRODUCTS

2.1 AGGREGATES

A. Conform to State Standards.

2.2 HOT MIX ASPHALT SURFACE COURSE

A. HMA: RIDOT HMA Class 9.5 mix; Conform to Subsection 401.02 and Item M.03 of the State Standards.

B. Surface course shall not include reclaimed asphalt pavement materials.

2.3 HOT MIX ASPHALT BASE COURSE

A. HMA: RIDOT HMA Class 12.5 mix; Conform to Subsection 401.02 and Item M.03 of the State Standards.

B. HMA: RIDOT HMA Class 19.5 mix; Conform to Subsection 401.02 and Item M.03 of the State Standards.

2.4 TACK COAT

A. Conform to Asphalt Emulsion Tack Coat as specified in Section 403 of the State Standards

2.5 GRAVEL SUBBASE COURSE

A. Refer to plans and Section 310000 – Earthwork.

2.6 SUBGRADE

A. Reuse on-site material, or Common Borrow, as specified in Section 310000 – Earthwork.

2.8 COARSE AGGREGATE

A. ASTM D 692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.

2.9 FINE AGGREGATE

A. ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

2.10 TEMPORARY TRENCH PATCHING

A. Conform to Section 410.02 of the State Standards.

PART 3 - EXECUTION

3.1 CONTRACTOR REQUIREMENTS

A. The Contractor shall perform and complete the construction work within the limits indicated in a continuous manner so that the pavement placement work may proceed without delay.

B. The Contractor shall, at all times, prior to acceptance of the work by the Engineer, maintain the completed work in a safe and satisfactory condition. All maintenance and repairs to the completed work shall be subject to the approval of the Engineer and the controlling municipal and State authorities. All maintenance and repairs of the completed work shall be provided by the Contractor at no additional cost to the Owner.

C. Equipment used in the work will be subject to approval by the Engineer and shall be maintained in a satisfactory condition at all times. Unless otherwise permitted, compaction shall be performed by use of suitable power rollers. Finished surfaces of new asphaltic surface courses shall finish even with adjacent existing pavement surfaces and be free from surface irregularities.

D. It shall be the responsibility of the Contractor to obtain from the controlling municipal authorities all required permits for cutting roadway pavements and to perform the work in accordance with all customs and requirements of the controlling authorities, in addition to those specified herein, and at no additional expense to the Owner.

E. Existing pavements outside of the indicated work limits which are damaged as a result of the Contractor's operations, including base courses, tack coats and surface courses, shall be replaced by the Contractor in accordance with the requirements specified herein for the respective type of pavement; in a satisfactory manner and at no additional cost to the Owner.

F. In case of settlement or other defects in new or replaced pavements, the Contractor shall cut out, replace, restore or repair the damaged pavements at no additional expense to the Owner. This requirement shall remain in effect for 2 years after the acceptance of the work by the Owner. The pavement area to be replaced, repaired or restored, shall extend from edge of pavement to edge of pavement, a minimum of 20 feet on either side of the defect; final pavement course shall be feathered to provide a smooth finish detail.

G. The Contractor shall furnish a bond for the 2-year duration to the Owner insuring that the corrective repairs will be performed if necessary.

H. This contract shall not be considered complete until the replacement, restoration and repair of pavements has been provided in a manner satisfactory to the Owner's Representative, and in accordance with the requirements specified herein.

3.2 SUBGRADE PREPARATION

A. Prepare subgrade by shaping and compacting to proper grade. Remove all soft and yielding material from the subgrade and replace with suitable material. Compact thoroughly using approved types of rollers or tampers. Insure that all areas are stable and dry.

B. Saw cut edges of existing pavement along even lines to obtain undisturbed, clean and sound vertical edges of original pavement.

C. Do not store or stockpile materials on the subgrade.

3.3 GRAVEL SUB-BASE COURSE PLACEMENT

A. Place materials in the proper lift depths and perform compaction as specified in the earthwork section. Make proper allowance for asphalt courses.

B. All compaction shall be performed with approved equipment well suited to location and material being compacted. Use heavy vibratory rollers where heavy equipment is authorized.

C. Do not operate heavy equipment closer to a foundation than a horizontal distance equal to height of backfill above bottom of foundation. Compact remaining area with hand tampers suitable for material being compacted. Place and compact backfill around pipes with care to avoid damage.

3.4 HOT MIX ASPHALT BASE COURSE

A. Provide a HMA Base Course in the compacted thickness as shown on the drawings.

B. The HMA Base Course shall be provided in accordance with the applicable requirements of the State Standards, Section 401, Subsection 401.02 and Item M.03 for materials; and Item 401.03 for construction methods.

3.5 HOT MIX ASPHALT SURFACE COURSE

A. Place HMA Surface Course in compacted thickness as shown on drawings. The finished pavement surface shall conform to the proposed grades of the roadway or as directed, and shall be flush with all existing pavements unless otherwise indicated.

B. The HMA Surface Course shall be provided in accordance with the applicable requirements of the State Standards, Section 401, Subsection 401.02, and Item M.03 for materials, and Subsection 401.03 for construction methods.

C. A tack coat conforming to the Rhode Island State Standards shall be applied to the base course prior to the placement of the surface course.

3.6 COMPACTION

A. The Contractor shall conform to the State Standards for pavement operations, including compaction (401.03.10).

B. Immediately after the HMA mixture has been spread, struck off, and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. The surface shall be rolled when the mixture is in the proper condition and when rolling does not cause undue

displacement, cracking and shoving.

C. The number, weight and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. Rolling shall be continued until all roller marks are eliminated and the minimum densities have been obtained based upon 95 percent of theoretical maximum laboratory densities made in the proportions of the job-mix formula and will be determined using nuclear density gauge or in-place cores per State Standards.

D. Steel-Tired, Static Weight Rollers: The maximum roller speeds for steel-tired static-weight rollers for various operations shall not exceed three miles per hour. The wheels of steel-wheel rollers shall be kept moist and clean to prevent adhesion of the fresh material, but an excess of water will not be permitted.

E. Vibratory Rollers: The maximum roller speed for vibratory rollers shall be that which provides impact spacing less than the compacted lift thickness. When vibratory rollers are used in the static mode, roller speed shall not exceed three miles per hour.

F. When an approved vibratory roller is used for breakdown rolling in a vibratory mode, intermediate rolling will not be required. When the vibratory roller is used for finish rolling it shall be used in the static mode. Rolling shall progress continuously until the specified density of the corresponding theoretical maximum density obtained at the plant has been attained. Finish rolling shall continue until all roller marks are eliminated.

G. Unless otherwise directed, rolling shall start longitudinally at the sides and gradually progress toward the center of the pavement except on super-elevated curves where the rolling shall begin on the low side and progress to the high side, overlapping on successive trips by at least one-half the width of tandem rollers and uniformly lapping each preceding track.

H. The motion of the rollers shall be slow enough at all times to avoid displacement of the hot mixture. Any displacement resulting from reversing the direction of the rollers or from any other cause shall be satisfactorily corrected.

I. When the base course fails to comply with the density requirements herein specified additional compaction might be applied when permitted and as directed, to attain the required density. If satisfactory density cannot be attained the Contractor shall be required to remove and replace, at his own expense, any affected area that is proven to be structurally inadequate and/or incapable of maintaining material integrity.

J. Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective, shall be removed and replaced with fresh hot mixture, which shall be compacted to conform to the surrounding area. Any area showing an excess or deficiency of material shall be removed and replaced.

K. In the event of dispute as to the creditability of the results, density shall be determined from cores taken from the pavement.

3.7 TACK COAT

A. Tack coat shall be installed in accordance with Section 403 of the State Standards except that the tack coat should be applied to the base course prior to the placement of the surface course regardless of the time elapsed between placement of the base and surface course.

3.8 TEMPORARY TRENCH PATCHING

A. Install temporary trench patch in accordance with Section 410 of the State Standards.

END OF SECTION

SECTION 32 13 30
COLORIZED CONCRETE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes colorized concrete pavement for the following:

1. Integrally colored concrete slabs-on-grade
2. Integrally colored concrete walkways
3. Curing of integrally colored concrete

B. Related Sections

1. Section 03 30 01 – Site Concrete Work
2. Section 32 13 13 – Concrete Paving and Curbing
3. Section 32 13 73 – Concrete Paving Joint Sealants

1.3 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 301 "Specification for Structural Concrete for Buildings."
2. ACI 302 IR "Recommended Practice for Concrete Floor and Slab Construction."
3. ACI 303.1 "Standard Specification for Cast-In-Place Architectural Concrete."
4. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing of Concrete."
5. ACI 305R "Recommended Practice for Hot Weather Concreting."
6. ACI 306R "Recommended Practice for Cold Weather Concreting."

B. American Society for Testing Materials (ASTM):

1. ASTM C309 "Liquid Membrane-Forming Compounds for Curing Concrete."
2. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
3. ASTM C979 "Standard Specification for Pigments for Integrally Colored Concrete."

C. American Association of State Highway and Transportation (AASHTO):

1. AASHTO M194 "Chemical Admixtures."

D. The Portland Cement Association (PCA):

1. PCA PA124 - Finishing Concrete Slabs with Color and Texture.

2. PCA SP021 - Color and Texture in Architectural Concrete.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's complete technical data sheets for the following:

1. Colored admixture
2. Curing compound
3. Sealing compound

B. Design Mixes: For each type of integrally colored concrete.

C. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available.

D. Qualification Data: For firms indicated in "Quality Assurance" Article, including list of completed projects.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with 10 years of experience in the production of specified products.

B. Installer Qualifications: An installer with a minimum of 5 years of experience with work of similar scope and quality.

C. Comply with the requirements of ACI 301.

D. Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.

E. Notification of manufacturer's authorized representative shall be given at least 1-week before start of Work.

F. Integrally Colored Concrete Mockups and Field Samples:

1. Provide under provisions of Division 1 Section "Quality Control."
2. At location on Project selected by Architect and/or Landscape Architect, place and finish a 10 foot by 10 foot (3 by 3 m) mock up panel for approval.
3. For accurate color, the quantity of concrete mixed to produce the sample should not be less than 3 cubic yards (or not less than 1/3 the capacity of the mixing drum on the ready-mix truck) and should always be in full cubic yard increments. Excess material shall be discarded according to local regulations.
4. Construct mockup panel using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in sample panels. Mockup shall be produced by the individual workers who will perform the work for the Project.
5. Retain samples of cements, sands, aggregates, and color additives used in mockup for comparison with materials used in remaining work.
6. Accepted mockup provides visual standard for work of Section.

7. Mockup shall remain through completion of work for use as a quality standard for finished work.
8. Remove mockup when directed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Colored Admixture: Comply with manufacturer's instructions. Deliver colored admixtures in original, unopened packaging. Store in dry conditions.

1.7 PROJECT CONDTIONS

A. Integrally Colored Concrete Environmental Requirements:

1. Schedule placement to minimize exposure to wind and hot sun before curing materials are applied.
2. Avoid placing concrete if rain, snow, or frost is forecast within 24 hours. Protect fresh concrete from moisture and freezing.
3. Comply with professional practices described in ACI 305R and ACI 306R.

B. Schedule delivery of concrete to provide consistent mix times from batching until discharge. Mix times shall meet manufacturer's written recommendations.

1.8 PRE-JOB CONFERENCE

A. One week prior to placement of integrally colored concrete a meeting will be held to discuss the Project and application materials.

B. It is suggested that the Architect, Landscape Architect, Engineer, General Contractor, Construction Manager, Subcontractor, Ready-Mix Concrete Representative, and a Manufacturer's Representative be present.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. L.M. SCOFIELD COMPANY, Douglasville, Georgia (800) 800-9900. Local Contact: Northeast Regional Sales and Service Representative John D Glover (508) 353 0709.

2.2 MATERIALS

A. Colored Admixture for Integrally Colored Concrete: CHROMIX P® Admixture and CHROMIX L®; L.M. SCOFIELD COMPANY.

1. Admixture shall be a colored, water-reducing, admixture containing no calcium chloride with coloring agents that are limeproof and ultra-violet resistant.
2. Colored admixture shall conform to the requirements of ACI 303.1, ASTM C979, ASTM C494 and ASSHTO M194.

B. Curing and Sealing Compound: Cureseal™ Semi Gloss; L.M. SCOFIELD COMPANY. Curing and sealing compound shall comply with ASTM C309 and be of same manufacturer as colored admixture, for use with integrally colored concrete.

C. SUBSTITUTIONS: The use of products other than those specified will be considered providing that the Contractor requests its use in writing within 14 days prior to bid date. This request shall be accompanied by the following:
   1. A certificate of compliance from material manufacturer stating that proposed products meet or exceed requirements of this Section, including standards ACI 303.1, ASTM C979, ASTM C494 and AASHTO M194.
   2. Documented proof that proposed materials have a 10-year proven record of performance, confirmed by at least 5 local projects that the Landscape Architect can examine.

2.3 COLORS

A. Concrete Color[s]:

   1. Cement: Color shall be gray.
   2. Sand: Color shall be locally available natural sand.
   3. Aggregate: Concrete producer's standard aggregate complying with State of Connecticut, Department of Transportation, Standard Specifications, Form 816, 2004 Edition.
   4. Colored Admixture: As selected by Architect and/or Landscape Architect from Scofield Color Chart A-312.

B. Curing Compound: Color to match integrally colored concrete.

2.4 CONCRETE MIX DESIGN

A. Minimum Cement Content: 5 sacks per cubic yard of concrete.

B. Slump of concrete shall be consistent throughout Project at 4 inches or less. At no time shall slump exceed 5-inches. If super plasticizers or mid-range water reducers are allowed, slump shall not exceed 8-inches.

C. Do not add calcium chloride or any chlorides to mix.

D. Supplemental admixtures shall not be used unless approved by manufacturer.

E. Do not add water to the mix in the field.

F. Add colored admixture to concrete mix according to manufacturer's written instructions.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install concrete according to requirements of Division 3 Section "Cast-In-Place Concrete."

B. Do not add water to concrete mix in the field.

C. Surfaces shall be finished uniformly with the following finish:

1. Broomed: Pull broom across freshly floated and troweled concrete to produce medium coarse texture in straight lines perpendicular to main line of traffic. Do not dampen brooms.
2. Swirl: Float concrete. Work float flat on surface using pressure in swirling manner to produce series of uniform arcs and twists. Use aluminum or magnesium float to produce medium texture.
3. Trowel: Precautions should be taken to ensure that the surface is uniformly troweled so that it will not be slippery. Do not over-trowel or burnish the surface.

3.2 CURING

A. Integrally Colored Concrete: Apply curing or curing and sealing compound for integrally colored concrete according to manufacturer's instructions using manufacturer's recommended application techniques. Apply curing or curing and sealing compound at consistent time for each pour to maintain close color consistency.

B. Curing and sealing compound shall be same color as the colored concrete and supplied by same manufacturer of the colored admixture.

C. Precautions shall be taken in hot weather to prevent plastic cracking resulting from excessively rapid drying at surface as described in CIP 5 *Plastic Shrinkage Cracking* published by the National Ready Mixed Concrete Association.

D. Do not cover concrete with plastic sheeting.

3.3 TOLERANCES

A. Minor variations in appearance of integrally colored concrete, which are similar to natural variations in color and appearance of uncolored concrete, are acceptable.

END OF SECTION

6372-01-01-03-n2718-spec 321330 Colorized Concrete

SECTION 321613

CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 REFERENCES

A. All work specified in this Section shall conform to “Standard Specifications for Road and Bridge Construction” of the Rhode Island Department of Transportation, latest revision, herein referred to as “State Standards”.

B. Refer to Milone and MacBroom Drawings SD-1 and SD-2 for University or Rhode Island standard details

1.3 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Sidewalks
2. Site wall foundations
3. Precast unit paving

B. Related Sections include the following:

1. Section 310000 Earthwork for subgrade preparation, grading, and subbase course.

1.4 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.

1.5 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated. Indicate name, source, and description of each material and product.

B. Design Mixtures:

1. Submit prior to start of Work written reports of each proposed mix for each class of concrete. Do not begin concrete production until mixes have been approved by the Engineer.
2. For each concrete pavement mixture, include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Qualification Data: For testing agency.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results

for compliance of the aggregates and concrete mix with requirements indicated.

E. Batch Ticket Information: Provide concrete delivery tickets showing job name and location, date and time of delivery, quantity of concrete, quality and type of concrete, admixtures, amount of water added, and all other relevant information as described in ASTM C-94. Submit original batch tickets and 2 copies at the end of each week.

F. Field quality-control test reports.

G. Sample of Detectable Warning Paver for review by Owner.

H. Shop drawings specific to each cast bronze marker.

I. Shop drawings for reinforcing steel shall be submitted. Drawings shall indicated bar sizes, locations, spacings, quantity required, bending and cutting schedules, and supporting and spacing devices.

1. Shop drawing schedule shall allow adequate time for reviews. Reinforcing steel shall not be fabricated or placed before the shop drawings have been reviewed by the Architect and is returned.

J. Shop drawings for proposed construction joint, control joint, and expansion joint placement.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

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

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

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

E. Mockups: Cast mockups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.

1. Build mockups of approximately 100 square foot size in the location as directed by the Owner's Representative.
2. Notify Owner's Representative a minimum of seven days in advance of dates and times when mockups will be constructed.
3. Obtain Owner's Representative's approval of mockups before starting construction.
4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
5. Demolish and remove approved mockups from the site when directed by Owner's Representative.
6. Approved mockups may become part of the completed Work if approved by the Owner's Representative.

F. Design Requirements

1. Design formwork to support vertical loads and lateral pressures resulting from placement and vibration of concrete in accordance with the requirements of ACI 301 and ACI 347,

and as specified herein.

2. Camber the formwork to compensate for anticipated deflections due to the weight and pressure of the fresh concrete and due to construction loads.
3. Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations. Use wedges or jacks, individually or in combination for adjustment.
1. Design forms and falsework to include assumed values of live loads, dead load, weight of moving equipment operated on formwork, concrete mix, height of drop, vibrator frequency, ambient temperature, lateral stability, and other factors pertinent to the safety of the structure during construction.
2. Provide and design forms to conform with expansion and construction joint locations.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Order concrete from batching plant so that trucks arrive at discharge locations when concrete is required. Avoid excessive mixing of concrete or delays in placing successive layers of concrete in forms.

C. Deliver concrete to discharge locations in watertight agitator or mixer trucks without altering the water-cement ratio, slump, air entrainment, temperature, and homogeneity.

D. Concrete not conforming to specification, unsuitable for placement, exceeding the time or temperature limitations or not having a complete delivery batch ticket will be rejected.

1.8 PROJECT CONDITIONS

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

B. Weather: Protect concrete from damage and reduced strength or performance due to weather extremes during mixing, placing and curing.

C. Cold Weather: Unless special precautions are taken to protect concrete, do not Work when temperatures are below 40°F or when temperatures are expected to fall below 40°F within 72 hours after placing concrete.

1. Comply with ACI 306 in cold weather.
2. Maintain concrete temperature of at least 60°F. Reinforcement, forms and ground in contact with concrete shall be free of frost.
3. Keep concrete and formwork at least 50°F for at least 96 hours after placing concrete.
4. The use of calcium chloride in any form is not permitted. Non-chloride accelerator shall be used when ambient temperature is below 50°F.
5. Admixture manufacturer shall provide technical assistance at no additional cost. A manufacturer's representative shall be available for consultation by phone or on site upon 72-hour notice.

D. Hot Weather: Concrete, when deposited, shall be less than 85°F. Cool the mix in a manner acceptable to the Engineer if the concrete temperature is higher.

1. Comply with ACI 305 in hot weather.
2. Retarder shall be used when ambient temperature exceeds 80°F.

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, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

C. Forms for Exposed Finish Concrete: Construct formwork for exposed concrete surfaces with smooth faced undamaged plywood or metal, metal-framed plywood faced or other acceptable panel-type facing materials approved by Owner's Representative, to provide continuous, straight, smooth as-cast surfaces, and produce a uniform and consistent texture and pattern on the surfaces. Metal patches on forms for these surfaces will not be permitted. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on the drawings.

1. Use overlaid plywood complying with U.S. Product PS-1 "A-C or B-B High Density Overlaid Concrete Form", Class I.
2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
3. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

D. Form Ties:

1. Form Ties: For concrete structures, which will not be in view or buried below finish grade, use carbon steel factory-fabricated, removable or stay in place snap-off type form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units, which will leave no metal closer than 1-1/2" to surface. Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface. Patch all holes with non-shrink grout.
2. Form ties and spreaders for walls in areas exposed to view shall be Stainless Steel Cone–Tight Tyscru by Richmond Screw Anchor Co.; Dayton Sure-Grip and Shore Co.; or substitute approved by Engineer with Plastic cone-tight type cones having a 1" setback and a taper from 1" to 1-1/4". Tycone holes shall be sealed with plastic set back plugs, color as selected by Engineer from manufacturer's standard color selection or filled with non-shrink grout. Tyscru ties shall be sized to satisfy loading requirements.
3. In lieu of form ties specified above, fiberglass form tie systems shall be used. Fiberglass form ties shall be standard gray color. The concrete structure shall be finished by grinding the fiberglass form tie flush with the finish surface of the concrete structure.
   a. If tapered architectural holes are required, dummy tapered cones having a 1" setback and a taper from 1" to 1-1/4 shall be fastened to the interior of the formwork to achieve the specified pattern on the finish structure.
4. Form Releasing Agents: Provide commercial formulation form-releasing agents that will not bond with, stain, nor adversely affect concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds. Volatile organic compound emissions of form coating agent shall not exceed 2.09 pounds per gallon (350 mg/L grams per liter).

E. Chamfer Strips: Provide ¾-inch triangular fillets to form all exposed concrete corners. Material shall be rubber or polyvinyl chloride type, or smooth clear, sealed softwood.

F. Sleeves: Sleeves for wall and floor penetrations shall be pre-engineered Century-Line sleeves as manufactured by Thunderline Corporation or Engineer approved substitute. Sleeves shall be constructed of high impact thermoplastic with waterstop collar, reinforcing ribs and nailer end

caps for positioning forms. Sleeve shall be designed to work with modular mechanical seal for through wall penetrations. Size of sleeves shall be selected according to manufacturer's recommendations for pipe sizes indicated on drawings.

G. Seals: Sleeve/pipe seals shall be Link-Seal modular mechanical seals as manufactured by Thunderline Corporation or approved equivalent. The seal shall be modular, mechanical; type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall be sized and selected per manufacturer's recommendations and have the following properties as designated by ASTM:

1. For standard service applications: (-40°F to 250°F) EPDM – ASTM D2000 M3 BA510.
2. For hydrocarbon service applications: (-40°F to 210°F) Nitrile – ASTM D2000 M1BF510.
3. For high temperature or fire seal applications: (-60°F to 400°F) Silicone – ASTM D2000 M1GE505.

2.2 STEEL REINFORCEMENT

A. Steel reinforcement required for the construction of sidewalks, walkways, and concrete apron shall conform to the requirements of the State Standards.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

D. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.

E. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

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

2.3 CONCRETE MATERIALS

A. The Contractor shall insure that the final appearance of the sidewalks is consistent throughout the whole project. Any difference in color, texture, or finish will not be accepted by the Engineer.

1. Any portion of sidewalk or walkway that does not match the color, texture, or finish of previously constructed sidewalks will be removed and replaced with a sidewalk that matches the recently poured sidewalks at the expense of the Contractor.

B. Cementitious Materials conforming to the State Standards shall be provided for the construction of the proposed sidewalks.

1. The cement factor shall be between 658 lbs/cy and 799 lbs/cy.
2. The maximum water/cementitious ratio is 0.42.
3. The slump shall be between 1 and 3 inches.
4. The minimum compressive strength after 7 days shall be 2,400 lbs with a 28-day compressive strength of 4,000 lbs.

C. Aggregate shall conform to the requirements and gradations specified in the State Standards.

D. Water: ASTM C 94/C 94M.

E. Air-Entraining Admixture: ASTM C 260.

F. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain no 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.

G. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

H. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

I. Water: Potable.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

2.5 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to the State Standards, for each type and strength of normal-weight concrete required.

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete mixes of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete mixes larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

2.7 PREMOLDED JOINT FILLER

A. Provide premolded–joint filler conforming to ASTM D1752, Type I or Type II.

B. Provide Type III self-expanding cork where specifically indicated.

C. Provide joint filler of same thickness as expansion joint width indicated.

D. Provide maximum length filler manufactured to minimize field splicing.

2.8 JOINT COMPOUNDS

A. Provide joint compound for expansion joints in horizontal surfaces and surfaces inclined less than 30 degrees from the horizontal conforming to ASTM C920, Type S or M, Grade P, Class 25. Use type T in pedestrian and vehicular traffic areas and use type NT in non-vehicular areas.

B. Provide joint compound for expansion joints in walls and surfaces inclined greater than 30 degrees from the horizontal conforming to ASTM C920, Type S or M, Grade NS, Class 25.

C. Provide compatible joint compounds as recommended by manufacturer when they abut each other.

D. Provide compound intended for continuous submergence in liquid containing structures.

2.9 BOND BREAKER FOR JOINT COMPOUNDS

A. Provide polyethylene tape, coated tape or metal foil.

2.10 BACK-UP MATERIAL FOR JOINT COMPOUNDS

A. Provide polyethylene foam or polychloroprene foam rubber.

B. Do not use material impregnated with oil, bitumen, or similar substances.

C. Provide back-up material as recommended by joint compound manufacturer that is compatible with the joint compound and has the same expansion/contraction capability as joint compound.

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 pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph (5 km/h).
2. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) require correction according to requirements in Section 310000 Earthwork.

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

D. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and

so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

C. General:

1. Construct forms as designed and in accordance with Contractor's approved working drawings conforming to ACI 347, to the exact sizes, shapes, lines, and dimensions shown, and as required to obtain accurate alignment, location, grades, level, and plumb work in finished structures.
2. Provide for openings, offsets, keyways, recesses, moldings, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features required. Use selected materials to obtain required finishes.
3. Forms for concrete which accommodate work of other trades, fabricated before the opportunity exists to verify the measurements of adjacent construction, shall be accurately sized and located as dimensioned on the Drawings. In the event that deviation from the Drawing dimensions results in problems in the field, the Contractor shall be responsible for resolution of the conditions as approved by the Engineer, at no cost to the Owner.

D. Fabrication:

1. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage concrete surfaces.
2. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to temporary openings on forms in as many inconspicuous locations as possible, commensurate with design requirements. Form intersecting planes to provide true, clean cut corners.

E. Falsework:

1. Erect falsework and support, brace, and maintain it to safely support vertical, lateral, and asymmetrical loads applied until complete structure has attained design strength. Construct falsework so that adjustments can be made for take-up and settlement, and access is provided for inspection.
2. Provide wedges, jacks or chamfer strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to product work of required dimensions.

F. Forms for Exposed Concrete:

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes
2. Provide sharp clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or grits to maintain true, square intersections.
3. Use extra studs, walers, and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material, which will produce bow.

G. Corner Treatment:

1. Unless shown otherwise, form chamfers with ¾-inch by ¾-inch strips, accurately formed and surfaced to produce uniformly straight lines and tight edge joints on exposed concrete. Extend terminal edges to required limit and miter chamfer strips at changes in

direction.

H. Control Joints: Locate as indicated on the Drawings.

1. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Verify size and location of openings, recesses and sleeves with the trade requiring such items. Accurately place and securely support items to be built into forms.
2. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove encrusted mortar and grout, chips, wood, sawdust, dirt, and other debris just before concrete is placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

3.3 REMOVAL OF FORMS

A. Formwork not supporting concrete, such as sides of walls, columns, and similar parts of the Work, may be removed after cumulatively curing at not less than 50 degrees F for 72 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operation, and provided that curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as elevated beams, joists, slabs and other structural elements may not be removed until concrete has attained 70% of its design minimum 28-day compressive strength and has cumulatively cured for no less than 7 days. Concrete shall have sufficient strength to safely support its own weight and construction live loads and lateral pressures. Determine potential compressive strength of in-place concrete testing field-cured specimens representative of the concrete location or members in accordance with State Standards.

C. Form facing material may be removed one day after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

D. Form ties: The concrete structure shall be finished by grinding the fiberglass form ties flush with the finish surface of the concrete structure.

3.4 REUSE OF FORMS

A. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. When forms are reused for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Apply new form releasing agent to all form areas that will be in contact with concrete.

B. Do not reuse forms if there is any evidence of surface wear and tear, splits, fraying, delamination or other damage which would impair the quality of the concrete surface or prevent obtaining the specified concrete finish.

3.5 STEEL AND WELDED WIRE FABRIC REINFORCEMENT

A. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

B. Place steel or welded wire fabric in conformance with the construction methods specified within the State Standards.

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.

3.6 CONSTRUCTION JOINTS

A. Locate and install construction joints as indicated or, if not indicated, locate so as not to impair the strength and appearance of the structure. Submit proposed construction joint locations for approval.

B. The Contractor shall score the concrete sidewalks in conformance with the scoring pattern shown on the Drawings where specified.

C. Where the scoring pattern is not specified, the Contractor shall score the concrete sidewalk in conformance with the State Standards.

D. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints.

E. Key groove all construction joints unless otherwise indicated. Wall horizontal joints need not be keyed except where specifically indicated.

F. Key grooves shall be one-third the thickness of the thinner member and 1-1/2-in. deep unless otherwise indicated.

G. Use tapered key groove forms to permit form removal without damage to the groove. Taper not to exceed 2 inches per foot.

H. Center waterstops in construction joints unless otherwise indicated. Secure waterstops in position by tie wire to adjacent reinforcing every 12 inches.

I. Consolidate concrete during placement in the vicinity of key groove without damaging or dislodging waterstop.

J. Remove all key groove forms.

K. Clean key groove of laitance, curing compound, foreign materials and protrusions of hardened concrete. Roughen by bush hammer or lightly sandblast to expose coarse aggregate. Blow out debris and dust with oil-free compressed air.

L. Protect exposed key groove and waterstop from damage.

3.7 EXPANSION JOINTS

A. Install expansion joints in accordance with the manufacturers printed instructions and as indicated.

B. Center waterstops in expansion joints unless otherwise indicated. Secure waterstops in position by tie wire to adjacent reinforcing every 12 inches.

C. Consolidate concrete during placement in vicinity of expansion joint without damaging premolded joint filler and waterstop.

3.8 PREMOLDED JOINT FILLER

A. Treat cut surface of premolded joint filler in conformance with manufacturer’s printed instructions.

B. Place premolded joint filler against the bulkhead form and fasten to the inside of the form with

noncorrosive fasteners. Remove all fasteners when bulkhead form is removed.

C. Prevent disturbance of or damage to premolded joint filler.

D. Fill expansion joint completely with premolded joint filler, except as specified below.

E. Secure wood strips to expansion joint surfaces, which are to receive joint compound.

F. Use tapered wood strips with the smaller width being the same width as the expansion joint and of depth necessary to install the joint compound and back-up materials.

G. Use materials to secure the premolded joint filler and wood strips that will not harm concrete or affect the joint compound bond to concrete.

H. Do not remove wood strips until forms are removed as specified in the Concrete Formwork section.

I. Clean groove of laitance, curing compound, foreign materials and protrusions of hardened concrete. Blow out debris and dust with oil-free compressed air.

3.9 JOINT COMPOUND

A. Seal the dry clean concrete in expansion joints in conformance with manufacturer's printed instruction.

B. Install back-up and bond breaker materials.

C. Prime concrete, fill flush with joint compound or required thickness, tool to concave shape and seal in conformance with manufacturer's printed instructions and ASTM C1193.

D. Prevent spilling joint compound over adjoining surfaces. Use tape adjacent to joint as required. Remove all tape completely from concrete surface after installing joint.

E. Do not prime concrete or install joint compound when compound, air or concrete temperature is less than 40 deg. F. or as required by manufacturer.

3.10 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site.

F. Do not add water to fresh concrete after testing.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer or use bonding agent if approved by Owner's Representative.

J. Screed pavement surfaces with a straightedge and strike off.

K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

L. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

M. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

N. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

O. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.11 FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

C. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

D. Coordinate special finishes with Owner.

3.12 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
2. Water.
3. Continuous water-fog spray.
4. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
5. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
6. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.13 PAVEMENT TOLERANCES

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

1. Elevation: 1/4 inch (6 mm).
2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
3. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/4 inch (6 mm).
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch (25 mm).
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch (6 mm).
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch (13 mm).
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length

of dowel 1/4 inch per 12 inches (6 mm per 300 mm).

8. Joint Spacing: 3 inches (75 mm).
9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
10. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

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 1 composite sample for each 5000 sq. ft. (465 sq. m) or fraction thereof of each concrete mix placed each day.
2. 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.
3. 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 mix. Perform additional tests when concrete consistency appears to change.
4. 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 mix.
5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
8. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3-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 (3.4 MPa).

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

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.15 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section at no expense to the Contractor.

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

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321613

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SECTION 329119

LANDSCAPE GRADING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Provide all equipment and materials and do all work necessary to complete the site grading as indicated on the Drawings and as specified.

1.3 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 015639, TEMPORARY TREE AND PLANT PROTECTION; Protection for plants to remain.
2. Section 310000, EARTHWORK; Excavation, backfill, establishment of subgrade elevations.
3. Section 329222, LAWNS AND GRASSES.
4. Section 329300, PLANTING.

1.4 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM):

D 1556	Density of Soil in Place by the Sand-Cone Method
D 2167	Density and Unit Weight of Soil In Place by the Rubber-Balloon Method

1.5 EXISTING CONDITIONS

A. By submitting a bid, the Contractor affirms that he has carefully examined the site and all conditions affecting work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.

1.6 QUALITY CONTROL

A. The Architect reserves the right to perform on-site observation during the grading operations. The observations may include, but not be limited to the following:

1. Observation of subgrade preparation for slab-on-grade and paved areas.
2. Observation of rough and finish grading operations.

B. All grade breaks shall be staked with grade stakes at each end, any change of direction, and at 20' centers along the length for Architect's review during grading operations.

C. Stake out and indicate finish grades at all spot elevations, 25 ft. intervals along all grade break lines, and in a 25 ft. x 25 ft. grid for the quad lawn for Architect's review and approval during grading operations.

D. Perform field density tests in accordance with ASTM D 1556 or ASTM D 2167.

1. Make at least one field density test of the subgrade for every 2000 sq. ft. of paved area, but in no case less than three tests.
2. In each compacted fill layer, make one field density test for every 2000 sq. ft. of overlaying paved area, but in no case less than three tests.
3. Make at least one field density test of the planting soil for every 2000 sq. ft. of plant bed area, but in no case less than three tests.
4. Make at least one field density test of the planting soil for every 2000 sq. ft. of lawn area, but in no case less than three tests.

E. If, in the opinion of the Architect, based on reports of the testing service and inspection, the subgrade or fills which have been placed are below the specified density, additional compaction and testing will be required until satisfactory results are obtained.

1. The results of density tests of soil-in-place will be considered satisfactory if the average of any four consecutive density tests which may be selected are in each instance equal to or greater than the specified density, and if not more than one density test out of five has a value more than 2% below the required density.

F. The Architect's presence does not include supervision or direction of the actual work by the Contractor, his employees, or agents. Neither the presence of the Architect, nor any observations and testing performed by him shall excuse the Contractor from defects discovered in his work.

1.7 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. The work shall be executed in such manner as to prevent any damage to adjacent property and any other property and existing improvements such as, but not limited to: streets, curbs, paving, utility lines and structures, monuments, bench marks and other public and private property.

B. In case of any damage or injury caused in the performance of the grading work, the Contractor shall, at his own expense, make good such damage or injury to the satisfaction of, and without cost to the Owner. Existing roads, sidewalks, and curbs damaged during the grading work shall be repaired or replaced to their original condition at the completion of operations. The Contractor shall replace, at his own cost, existing bench marks, monuments, and other reference points which are disturbed or destroyed.

1.8 COORDINATION

A. Prior to start of grading operations, the Contractor shall arrange an on-site meeting with the Architect for the purpose of establishing Contractor's schedule of operations and scheduling inspection procedures and requirements.

B. As construction proceeds, the Contractor shall be responsible for notifying the Architect prior to start of grading operations requiring inspection and/or testing.

C. The Contractor shall be responsible for obtaining test samples of soil materials proposed to be used and transporting them to the site sufficiently in advance of time planned for use of these materials for testing of materials to be completed. Use of these proposed materials by the Contractor prior to testing and approval or rejection, shall be at the Contractor's risk.

PART 2 - PRODUCTS

2.1 SOURCE OF MATERIALS

A. Material shall be obtained from required on-site excavation, to the extent that suitable material is available, and from off-site sources, to the extent that suitable material is not available from on-site excavation.

B. Refer to following Sections for preparation and placement of planting soils.

1. Section 329222, LAWNS AND GRASSES.
2. Section 329300, PLANTING.

PART 3 - EXECUTION

3.1 GRADING - GENERAL

A. Uniformly grade areas within the limits of site grading under this section, including adjacent transition areas. Smooth finished surfaces within specified tolerances, and between points where elevations are shown, or between such points and existing grades.

B. The degree of finish required will be that ordinarily obtainable from either blade-grader or scraper operations.

1. Ditches: Finish ditches to ensure proper flow and drainage. Conduct final rolling operations to produce a hard, uniform, and smooth cross-section.
2. Grade Breaks located on the plans indicate crisp transitions, not blended or rounded edges. These should be clean, sharp, and uniform in line and curve as indicated on the plans

3.2 ROUGH GRADING

A. General: Rough grading shall include the shaping, trimming, rolling and refinishing of all surfaces of the subbase, shoulders, earth embankments and the preparation of grades as shown on the Drawings. The grade of shoulders and sloped areas may be done by machine methods.

B. Do all cutting, filling and grading to lines and grades indicated on the Drawings. Grade evenly to within the dimensions required for grades shown on the Drawings and specified herein. No stones larger than 4 in. shall be placed in upper 6 in. of fill. Fill shall be left in compacted state at the end of work day and sloped to drain.

1. Architect may make such adjustments in grades and alignments as are found necessaryto avoid special conditions encountered.
2. Provide a smooth transition between adjacent existing grades and new grades.
3. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

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

1. Lawn or Unpaved Areas: Plus or minus 1 inch (25 mm).
2. Walks: Plus or minus 1 inch (25 mm).
3. Pavements: Plus or minus 1/2 inch (13 mm).
4. Up to 2 in. in 10 ft tolerance shall be permitted on slopes provided the slopes are uniform in appearance and without any abrupt changes.
5. Traffic of men and equipment across soil subgrade areas shall be prohibited following excavation to the required lines and grades.

3.3 FINE GRADING

A. General: Uniformly grade areas to a smooth surface, free from 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. Finish Grading:

1. Lawn or Unpaved Areas: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
2. Walks: Shape the surface of areas under walks to line, grade and cross-section, with the finish surface not more than 0.00 ft. above or 0.10 ft. below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains.
3. Pavements: Shape the surface of the areas under pavement to line, grade and cross-section, with the finish surface not more than 1/2 in. above or below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains. Include such operations as plowing, discing, and any moisture or aerating required to provide the optimum moisture content for compaction. Fill low areas resulting from removal of unsatisfactory soil materials, obstructions, and other deleterious materials, using satisfactory soil material. Shape to line, grade, and cross-section as shown on the Drawings.

3.4 MAINTENANCE

A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and rutted areas to the specified tolerances.

C. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, re-shape, and compact to the required density prior to further construction.

3.5 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Remove waste materials, including excavated material classified as unsatisfactory soil material, trash and debris, and dispose of it legally off the Owner's property.

END OF SECTION

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SECTION 329222

LAWNS AND GRASSES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Provide all materials and equipment, and do all work required to complete the seeding of lawns, including furnishing and placing planting soil, as indicated on the Drawings and as specified.

1.3 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 311300, SELECTIVE TREE REMOVAL
2. Section 329119, LANDSCAPE GRADING
3. Section 329300, PLANTING; New plantings
4. Section 329700, LANDSCAPE MAINTENANCE

1.4 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM):

C 136	Sieve Analysis of Fine and Coarse Aggregates
D 422	Particle-Size Analysis of Soils
E 11	Wire-Cloth Sieves for Testing Purposes

1.5 SUBMITTALS

A. Samples: The following samples shall be submitted:

Material	Quantity (lb.)
Fertilizer	1
Lime	1
Compost	1
Loam borrow	1

B. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following materials:

Fertilizer

C. Certificates: Labels from the manufacturer's container certifying that the product meets the specified requirements shall be submitted for the following materials:

Commercial fertilizer
Ground limestone

1.6 OWNER'S INSPECTION AND TESTING

A. Work will be subject to inspection at all times by the Architect. The Owner reserves the right to engage an independent testing laboratory to analyze and test materials used in the construction of the work. Where directed by the Architect, the testing laboratory will make material analyses and will report to the Architect whether materials conform to the requirements of this specification.

1. Cost of tests and material analyses made by the testing laboratory will be borne by the Owner when they indicate compliance with the specification, and by the Contractor when they indicate non-compliance.
2. Testing equipment will be provided by and tests performed by the testing laboratory. Upon request by the Architect, shall provide such auxiliary personnel and services needed to accomplish the testing work.
3. Gradation of granular materials shall be determined in accordance with ASTM C 136. Sieves for determining material gradation shall be as described in ASTM E 11.

1.7 CONTRACTOR'S INSPECTION AND TESTING

A. The Contractor shall engage an independent testing agency, experienced in the testing of agricultural soils and acceptable to the Architect, to perform the topsoil/planting soil tests and analyses specified herein. All costs associated with testing shall be the Contractor's responsibility.

1. Particle size analyis shall include the following gradient of mineral content:

USDA Designation	Size in mm
Gravel	+ 2 mm
Very coarse sand	1-2 mm
Coarse sand	0.5-1 mm
Medium sand	0.25-0.5 mm
Fine sand	0.1-0.25 mm
Very fine sand	0.05-0.1 mm
Silt	0.002-0.05 mm
Clay	< 0.002 mm

2. Chemical analysis shall include the following:
   a. pH and buffer pH
   b. percentage of organic content by oven-dried weight
   c. Nutrient levels by parts per million, including phosphorus, potassium, magnesium, manganese, iron, zinc, and calcium. Nutrient test shall include testing laboratory recommendations for supplemental additions to the soil, if necessary, based on the requirements for ornamental horticultural plants. Recommendations shall include rates at which additives are to be applied.
   d. Soluble salt by electrical conductivity of a 1:2 soil/water sample.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver seed in original sealed containers, labeled with analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, location of packaging, and name of seed grower. Damaged packages will not be accepted.

B. Seed shall be stored under cool and dry conditions so that the endophytic seed in the mixture is capable of maintaining a high level of endophytes

1.9 PLANTING SEASON

A. Planting season shall be as follows:

Material	Planting Season Spring	Fall
Seeding	3/15 to 5/15	8/15 to 10/15

B. Planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.

C. Planting season may be extended with the written permission of the Architect.

1.10 ACCEPTANCE

A. Acceptance:

1. The Architect will inspect all work for Substantial Completion upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.
2. Acceptance of material by the Architect will be for general conformance to specified requirements, and shall not relieve the Contractor of responsibility for full conformance to the Contract Documents.
3. Upon completion and reinspection of all repairs or renewals necessary in the judgement of the Architect, the Architect will recommend to the Owner that the work of this Section be accepted.

B. Seed areas will be accepted when in compliance with all the following conditions:

1. Roots are thoroughly knit to the soil;
2. All areas show a uniform stand of specified grass in healthy condition;
3. At least 60 days have elapsed since the completion of work under this Section.

PART 2 PRODUCTS

2.1 SEED

A. ~~Seed Mixture for Lawns: See plan.~~ “Contractor to consult URI on standard lawn mix.”

2.2 PLANTING SOIL

A. Existing Topsoil

1. Existing topsoil from on-site source(s) may be used for planting soil, to the extent available, if it meets the requirements of this Section for planting soil, or if approved by the Architect.
2. Planting soil shall be composed of a natural, fertile, friable soil typical of cultivated topsoils of the locality, suitable for the germination of seeds and support of vegetative

growth, with additives, if required, to achieve particle distribution and organic content specifications . Topsoil shall be taken from a well-drained, arable site, free of subsoil, large stones, earth clods, sticks, stumps, clay lumps, roots, other objectionable, extraneous matter or debris nor contain toxic substances. Planting soil shall have a pH value between 5.5 and 6.5 and organic matter content of 5 to 10% of total dry weight.

3. Planting soil shall have the following mechanical analysis (see paragraph 1.7 for particle sizes):

Approximate Particle Distribution	
Gravel	Less than 10%
Coarse to medium sand	55 – 65%
Fine to very fine sand	15 – 25%
Silt	10– 20%
Clay	15 – 20%

4. Minimum planting soil nutrient levels shall be: Nitrogen @ 5% average of organic matter, Phosphorus @ .02 to .05% average of total soil content, Potassium @ 1.2% average of total soil content.
5. The Contractor shall provide the Architect with planting soil test results, as specified in Paragraph 1.7, before the start of planting operations. If planting soil does not fall within the required particle distribution, organic content, or pH range, it shall be adjusted to meet the specifications through the addition of sand, compost, limestone, or aluminum sulfate to bring it within the specified limits.

2.3 COMPOST

A. Compost shall be derived from organic wastes such as food and agricultural residues, animal manures, mixed solid waste and biosolids (treated sewage sludge) that meet all State Environmental Agency requirements. The product shall be well composted, free of viable weed seeds and contain material of a generally humus nature capable of sustaining growth of vegetation, with no materials toxic to plant growth.

1. Compost shall have the following properties:

Parameters	Range
pH	5.5 – 8.0
Moisture Content	35% - 55%
Soluble Salts	≤ 4.0 mmhos (dS)
C:N ratio	15 – 30:1
Particle Size	< 1”
Organic Matter Content	> 50%
Bulk Density	< 1000 lbs./cubic yard
Foreign Matter	< 1% (dry weight)

2. Compost generator shall also provide minimum available nitrogen and other macro and micro nutrients to determine fertilizer requirements.
3. Compost shall be “AllGro”, distributed by AllGro, 4 Liberty Lane West, Hampton, NH 03842; “Agresoil”, distributed by Agresource, 100 Main Street, Amesbury, MA 01913; or approved equal.
4. Guidelines for quantity of compost required to achieve suitable soil organic content in soil mixes for ornamental horticultural planting shall be as recommended by the compost manufacturer.

2.4 LIMESTONE

A. Ground limestone shall be an agricultural limestone containing a minimum of 85% total carbonates, by weight. Ground limestone shall be graded within the following limits:

Sieve Size	% Passing by Weight
No. 10	100
No. 20	90
No. 100	60

2.5 WATER

A. Water shall be suitable for irrigation and free from ingredients harmful to seeded areas.

B. Water shall be free of chlorine and other additives that kill soil microbes.

2.6 FERTILIZER

A. Soil amendments shall meet all RIDEM requirements for use within the site, which prohibits broadcast application of chemical fertilizers within the 200' Riverfront Area. Biological soil amendments such as compost, compost tea, and organic microbial inoculants shall be applied as needed to meet the requirements listed under Paragraph 2.3, "Planting Soil."

B. Starter fertilizer shall be HD Scotts Starter Fertilizer or approved equal.

C. Fertilizer shall conform to the following:

1. When applied as a topsoil amendment, fertilizer shall have an analysis that will deliver appropriate amounts of nitrogen, phosphorus, and potassium as required to remedy deficiencies revealed by testing the topsoil.
   a. 50% of nitrogen shall be derived from natural organic source of ureaform.
   b. Available phosphorus shall be derived from superphosphate, bone meal, or tankage.
   c. Potassium shall be derived from muriate of potash containing 60% potash.

D. Fertilizer shall be delivered in manufacturer's standard container printed with manufacturer's name, material weight, and guaranteed analysis.

2.7 SUPERPHOSPHATE

A. Superphosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes and containing not less than 20% available phosphoric acid. The superphosphate shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any superphosphate which becomes caked or otherwise damaged making it unsuitable for use, will be rejected.

2.8 WEED CONTROL

A. Weed control for stockpiled topsoil shall be a non-selective weed killer for control of grassy and broadleaf weeds; weed control shall have short residual, allowing seeding operations to occur within 7 days of application.

PART 3 EXECUTION

3.1 PREPARATION OF SUBGRADE

A. Subgrade shall be examined to ensure that rough grading and all other subsurface work in

lawn areas and other areas to be seeded is done prior to start of seeding.

B. Existing subgrade shall be loosened or scarified to a minimum depth of 4 in. prior to spreading planting soil Subgrade shall be brought to true and uniform grade and shall be cleared of stones greater than 3 in., sticks, and other extraneous material.

3.2 SPREADING OF PLANTING SOIL

A. Planting soil shall not be spread until it is possible to follow immediately or within 24 hours with seeding operations. If topsoil is spread prior to this time it shall be cultivated to loosen soil prior to seeding.

B. Planting soil shall not be placed when subgrade or topsoil material are frozen, excessively wet, or excessively dry.

C. Planting soil shall be spread in a uniform layer, to a thickness which will compact to the depth required to bring final lawn and grass surfaces to required elevation. Unless otherwise indicated minimum depth of topsoil shall be 6 in..

1. Place approximately 1/2 the thickness of planting soil mixture required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil mixture.

D. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1-1/2 inches (38 mm) in any dimension, and other objects that may interfere with planting or maintenance operations.

E. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.

3.3 APPLICATION OF FERTILIZER AND CONDITIONERS

A. Fertilizer and conditioners shall be applied at the following rates:

1. Compost - as required by test results of topsoil.
2. Limestone - as required by test results of topsoil.
3. Fertilizer - as required by test results of topsoil.

B. Mixing with planting soil:

1. Fertilizer and conditioners shall be spread over the entire lawn areas at the application rates indicated above.
2. Materials shall be uniformly and thoroughly mixed into the top 4 in. of planting soil by discing, rototilling, or other approved method.

3.4 FINISH GRADING

A. Contractor shall set grade lines for Architect's review and approval.

1. Final surface of topsoil immediately before seeding and seeding shall be within $\pm$ 1/2 in. of required elevation, with no ruts, mounds, ridges, or other faults, and no pockets or low spots in which water can collect. Stones, roots, and other debris greater than 1 in. in any dimension, which are visible at the surface, shall be removed and the resulting holes

filled with topsoil, leaving a uniform planar surface.

B. Finish grade surface with a drag or rake. Round out all breaks in grade, smooth down all lumps and ridges, fill in all holes and crevices. Rolling with a light roller is acceptable, if the surface is scarified afterward.

1. Lawn: Compaction of topsoil for finish grade shall be 85% to 88%.

C. In the event of settlement, the Contractor shall readjust the work to required finished grade.

3.5 SEEDING

A. Seed shall be applied in two applications; by mechanical spreader.

B. First Application: Seed shall be broadcast by means of an approved mechanical spreader, to give a uniform application at the following rates:

Seed	Application Rate lb./1,000s.f.
Seed Mixture for Lawn	4.0

1. Seed shall be applied in two equal applications for uniform coverage; direction of travel of spreader for second pass shall be perpendicular to that of the first pass. Seeding shall not be done when it is raining or snowing, or when wind velocity exceeds 5 mph.
2. Following seeding the area shall be lightly raked to mingle seed with top 1/8 to 1/4 in. of soil. Area shall then be fine graded. Stones and other debris greater than 1 in. in any dimension which are visible on surface shall be removed.

C. Following seeding and raking, entire area shall be rolled with a hand roller having a weight of 60 to 90 lb./ft. of width, and a minimum diameter of 2 ft. Entire area shall then be watered by use of lawn sprinklers, or other approved means. Initial watering shall continue until the equivalent of a 2 in. depth of water has been applied to entire seeded surface, at a rate which will not dislodge the seed. Watering shall be repeated thereafter as frequently as required to prevent drying of the surface, until the grass attains an average height of 1/4 in. Watering methods and apparatus which may cause erosion of the surface shall not be permitted.

D. Rope off entire seeded area to prevent vehicles and pedestrians from entering area.

3.6 CONTRACTOR MAINTENANCE

A. Maintenance shall include all operations required to produce an established lawn, including but not limited to:
Fertilizing
Mowing
Replanting
Watering
Weeding

C. Maintenance shall comply with Section 329700, LANDSCAPE MAINTENANCE.

END OF SECTION

6372-01-01-03-n2718-spec 329222 Lawns and Grasses

DIVISION 33 – UTILITIES

SECTION 334000

STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 REFERENCES

A. All work specified in this Section shall conform to “Standard Specifications for Road and Bridge Construction” of the Rhode Island Department of Transportation, latest revision, herein referred to as “State Standards”.

1.3 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:

1. Pipe
2. Area Drains
3. Precast concrete manholes
4. Precast concrete catch basins

1.4 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

B. HDPE: High Density Polyethylene.

C. RCP: Reinforced Concrete Pipe

D. PE: Polyethylene

E. DI: Ductile Iron

1.5 SUBMITTALS

A. The Contractor shall submit for approval, manufacturer’s printed recommendations for the storage, protection, handling, installation and testing of stormwater piping, fittings and appurtenances, which shall be strictly adhered to by the Contractor.

B. Shop Drawings: For the following:

1. Manholes: Include plans, elevations, sections, details, and frames and covers. Include design calculations, and concrete design-mix report for cast-in-place manholes.

2. Catch Basins: Include plans, elevations, sections, details, and frames, covers, and grates.
3. Area Drain: Include plans, elevations, sections, details, and frames, covers, and grates.
4. Pipe of all materials.

C. Conformance Certificate: Each shipment of castings and concrete manholes and catch basins shall be accompanied with the manufacturer's notarized certification and cylinder testing results that materials meet specified requirements.

D. Record Drawings: All installed underground utilities shall be designated on as-built drawings by the contractor of record and provided to the Owner and Engineer in AutoCad electrical format prior to completion of the project. All as-built drawings, (underground and above ground) shall be dimensioned from permanent benchmarks such as existing buildings and include depths at various points throughout the extent of the work, and invert elevations at all structures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

B. Handle catch basins and manholes according to manufacturer's written rigging instructions.

C. Use only nylon-protected slings to handle pipe. The use of hooks or bare cables will not be permitted.

D. Avoid damage to castings from impact, abrasion, or corrosion during handling and storage.

E. Do not store PVC piping and fittings in the sunlight for extended periods of time. Store pipe in accordance with manufacturer's recommendations.

F. Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct rays of the sun.

G. Use all means necessary to protect precast concrete units and materials before, during and after installation and to protect the installed work and materials for all other trades.

H. In case of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative at the Contractor's expense.

I. Pipe, pipe fittings, and other associated appurtenances damaged during deliver handling or storage shall be replaced at no additional cost to the Owner.

1.7 PROJECT CONDITIONS

A. The Contractor shall provide means of stormwater management during construction to control runoff and protect downstream areas from damage resulting from stormwater runoff.

B. The Contractor is responsible for any damage resulting from stormwater runoff during construction, including damage from flooding.

1.8 QUALITY CONTROL

A. All precast concrete shall be the product of a manufacturer who has demonstrated capability to produce precast concrete products of the quality specified. A manufacturer must be able to show that he has experienced personnel, physical facilities, established quality control procedures, and a management capability sufficient to execute the work of this contract. When

requested by the Owner's Representative, the Contractor shall submit written evidence of the above requirements.

B. Experienced plant personnel shall closely supervise the manufacturing process, and daily records of concrete strength shall be kept and submitted to the Owner's Representative for control.

C. Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly trained and experienced in the installation of the precast concrete structures and shall direct all work performed under this Section.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends.

B. The pipe and fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusion or other injurious defects. The pipe shall be as uniform as commercially practical in color, capacity, density and other physical properties.

C. Joints shall be bell and spigot. For SDR-35 PVC pipe, the bell shall consist of an integral wall section with a solid cross section rubber ring factory-assembled, securely locked in place to prevent displacement. Joints shall conform to ASTM Standard D 3212. For SCH 40 PVC piping, joints shall be glued with PVC cement approved by the manufacturer.

D. All fittings and accessories shall have dimensions as recommended by the manufacturer and have bell and/or spigot configurations compatible with that of the pipe.

E. Pipe shall pass impact resistance test in accordance with ASTM D 2444 and minimum pipe stiffness test at 5% deflection in accordance with ASTM D 2412.

F. The normal length of 12-inch size and smaller pipe shall be 12.5 feet.

G. Pipe and fittings shall be manufactured in the United States of America and shall be accompanied by the manufacturer's certificate of compliance, in addition to meeting the performance tests specified hereinafter.

H. PVC pipe shall be SCH 40 where pipe has less than 2 feet of cover or as directed by the Owner's Representative.

I. PVC perforated pipe shall conform to ASTM/ANSI D 2759 or ASTMF 810. Perforations shall be 5/8" holes on 5" centers.

2.2 HIGH-DENSITY POLYETHYLENE PIPE AND FITTINGS

A. High-Density Polyethylene Pipe and fittings shall be ADS N-12 IB ST Smooth Interior Pipe, ADS N-12 IB ST High Capacity Large Diameter Pipe or approved equivalent. Joints shall be soil-tight and include a rubber gasket on the spigot end of the pipe. When installed into the bell end, the joint shall be sealed.

B. Pipe shall conform to AASHTO M294 (Type 'S') for the specified diameters and strength classes.

C. Pipe shall be rated to withstand H-20 Loading Criteria with 18” of cover.

2.3 REINFORCED CONCRETE PIPE

A. Reinforced-Concrete Pipe and Fittings: ASTM C 76 (ASTM C 76M), with bell-and-spigot ends and sealant joints with ASTM C 990 (ASTM C 990M), bitumen or butyl-rubber sealant.

B. Pipe shall conform to AASHTO M170 for the specified diameters and strength classes. The minimum cement content shall be 564 pounds per cubic yard.

C. Strength class of reinforced concrete pipe shall be Class III unless specified otherwise on the drawings.

D. Joint of reinforced concrete pipe shall be made with flexible watertight rubber gaskets and the remaining exterior void of the joint shall be sealed with Portland cement mortar.

2.4 DUCTILE IRON PIPE

A. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end used where no connection to fittings is required.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile iron standard pattern or AWWA C153, ductile iron compact pattern.
2. Piping shall have a working pressure rating of 200 psi minimum.
3. Gaskets: AWWA C111, rubber. Gaskets must be in their original packaging.

B. Ductile Iron Pipe shall be Class 52 and shall conform to AWWA C150 and C151, latest revision. Pipe shall have a petroleum-asphaltic on all exterior surfaces.

C. Interior pipe surfaces shall be covered with a double cement-mortar continuous lining not less than 1/16" thick, of materials, and applied in accordance with, ANSI/AWWA C104/A21.4 standards.

D. Ductile Iron Pipe shall be manufactured by one of the following.

1. Pacific States Cast Iron Pipe Company
2. United States Pipe Company
3. Griffin Pipe Products Company
4. American Cast Iron Pipe Company

2.5 FLEXIBLE PIPE COUPLINGS

A. Flexible Couplings: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end as manufactured by Fernco Inc. or approved equivalent.

2.6 AREA DRAINS AND DRYWELLS

A. Area drains and drywells shall be formed of PVC pipe stock meeting ASTM D1784 utilizing a thermoforming process to reform the pipe stock to the specified configuration. Drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system.

B. Joints shall use elastomeric seals and conform to ASTM D3212, latest revision. Flexible elastomeric seals shall conform to ASTM F477.

C. Area drain frame and grate shall be 24” dia. ductile iron grate made specifically for each 24” diameter area drain. Casting shall conform to ASTM A536 grade 70-50-05.

D. Drywell frame and grate shall be 12” dia. ductile iron grate made specifically for each 12” diameter drywell.

E. Area drains and drywells shall be rated to withstand HS-20 loading criteria and construction traffic.

F. Area drains shall be equipped with a sump and outlet tee as specified on the plans and details.

2.7 MANHOLE AND CATCH BASIN MATERIALS

A. Cement shall be Portland cement conforming to ASTM C150, Type III, high early strength.

B. Aggregate: shall conform to ASTM C330 and shall be graded, crushed stone with a resulting unit weight of concrete of up to one hundred fifty five (155) pounds per cubic foot, and a minimum unit weight of not less than one hundred forty-eight (148) pounds.

C. Water: shall be clear and free of injurious and deleterious substances.

D. Concrete: shall have a minimum strength of 5000 psi at twenty eight (28) days and a strength of 3000 psi at the time of form release.

E. During the process of manufacturing of the units not less than two (2) test cylinders shall be tested at time release of the form and two (2) at age twenty-eight (28) days.

F. All compression test cylinders shall be made, cured and stored in accordance with ASTM C31. Cylinders shall be tested in accordance with ASTM C39.

G. All concrete shall be air entrained as specified per RIDOT Standard Specifications.

H. Admixtures shall only be used after prior approval of the Engineer.

I. All reinforcing bars shall conform to the requirements of ASTM designation: A615, Grade 60.

J. Welded wire fabric shall conform to the requirements of ASTM designation: A185.

2.8 PRECAST CONCRETE MANHOLES, CATCH BASINS AND BRICK

A. Precast Concrete Manhole and Catch Basin sections shall be equal to that shown on the drawings and shall conform to ASTM Specifications C-478 and C-76 Class IV Wall “B”. The horizontal joints between sections shall be sealed using a flexible butyl resin sealant and shall conform to Federal Specifications SS-S-210A and AASHTO M-198B. In addition, the horizontal joints on the inside and outside of the manhole and catch basin shall be sealed with a “Quick Plug” as manufactured by Parson or approved equal.

B. Brick shall conform to ASTM Specification C-32 for sewer brick, except that the table therein is amended to provide that the required minimum compressive strength in pounds per square inch shall be for any individual brick 3,000 or 5,000 for the average of five bricks selected at random. The maximum absorption of water by five-hour boiling test shall not exceed 16% for any individual brick or 12% for the average of any five bricks selected at random.

C. Openings for pipe insertions shall be round and shall be precast or cored only. The diameter of the opening shall be adequate to install a rubber boot seal. The cored or precast opening shall maintain a minimum undisturbed distance of 6” from manhole section joints. Flexible rubber

boot shall be neoprene with stainless steel clamps and bands.

D. Weirs for diversion manholes may be constructed with concrete block joined with mortar or cast into the structure. Contractor shall form each weir as depicted on the plans. Provide a watertight seal with no gaps between weir wall and structure wall. Weirs shall be connected to structure wall using epoxy coated steel rebar reinforcement.

2.9 MANHOLE FRAMES AND COVERS

A. Manhole Frames and Covers shall be cast iron and conform to the details on the drawings. Cast iron shall conform to ASTM A-48, Class 25. The underside of the cover and upper side of lip frame must present parallel plane surfaces, and at these points of contact, the frames and covers shall be machined to prevent covers from rocking in the frames under traffic.

B. Covers shall bear evenly in the frame and both frame seats and covers shall be accurately fabricated so that covers are interchangeable for use with any and all frames. Where indicated, frames and covers shall be watertight, and locked. The sizes and weights (medium duty, heavy duty, etc.) are shown on the detail sheets for special manholes.

C. Mortar shall consist of one-part cement and two parts clean sand. No lime shall be used.

D. Covers shall have a non-slip surface and shall have the word “DRAIN”, inscribed.

E. Frames and covers shall be installed on the manholes as indicated on the drawings. They shall be well bedded and encased in cement mortar and accurately set to the grades indicated or as directed. Red clay brick with cement mortar shall be used to adjust grade of frame and cover. One half inch of cement mortar plaster cast shall be applied to exterior of red clay bricks.

2.10 CATCH BASIN FRAMES AND GRATES

A. Catch Basin Frames and Grates shall be cast iron and conform to the details on the drawings. Cast iron shall conform to ASTM A-48, Class 25. The underside of the grate and upper side of lip frame must present parallel plane surfaces, and at these points of contact, the frames and grates shall be machined to prevent grates from rocking in the frames under traffic.

B. Grate shall bear evenly in the frame and both frame seats and grates shall be accurately fabricated so that grate is interchangeable for use with any and all catch basin frames.

C. Mortar shall consist of one part cement and two parts clean sand. No lime shall be used.

D. Gratings shall have a non-slip surface.

E. Gratings shall be installed on the catch basins as indicated on the drawings. They shall be well bedded and encased in cement mortar and accurately set to the grades indicated or as directed. Red clay brick with cement mortar shall be used to adjust frame and grate. One half inch of cement mortar plaster cast shall be applied to exterior of red clay bricks.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 310000 – Earthwork.

3.2 PIPE INSTALLATION

A. Reinforced Concrete Pipe: The method of joining reinforced concrete pipe sections shall be such that the ends are fully entered and the inner surfaces are reasonably flush and even. Joints shall be made with rubber gaskets and Portland Cement grout. The completed joints

shall be protected against rapid drying by suitable covering material.

B. Use only nylon-protected slings to handle pipe. The use of hooks or bare cables will not be permitted.

C. PVC Piping: No machinery shall directly contact the PVC pipe to push the pipe into place. The pipe shall be pushed into place by hand. The use of a hammer or mallet is permitted, with the use of a board to shield the end of the pipe being struck by the hammer. The pipe shall not be directly contacted with a hammer or mallet. Any pipe damaged while being pushed into place or while being laid in the trench shall be removed from the site and replaced at the expense of the Contractor.

D. Pipe shall be inspected before any backfill is placed. Any pipe determined by the Owner's Representative to be out of alignment, unduly settled, or damaged shall be taken up and re-laid or replaced at no additional cost to Owner.

E. General Locations and Arrangements: Drawing plans and details indicate location and arrangement of underground storm drainage piping. Install piping as indicated, following piping manufacturer's written instructions.

F. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

G. If conflicts between utilities, the Contractor shall stop work on the utilities, contact the Engineer, and await direction from the Engineer.

H. Install piping with 36-inch minimum cover unless otherwise specified on the Drawings.

I. Install piping with a minimum slope as specified on Drawings.

J. Install PVC piping according to ASTM D 2321, ASTM F 1668, and manufacturer's recommendations.

K. Install reinforced-concrete piping according to ASTM C 1479 and manufacturer's recommendations.

3.3 AREA DRAIN INSTALLATION

A. Area drains shall be stored out of direct sunlight until they are ready to be installed.

B. Excavation and backfilling requirements for installation of the structures shall be in accordance with the requirements as specified in Section 310000 - Earthwork. Use sand gravel fill bedding with no stones larger than 1 ½" dia. Compact backfill uniformly.

C. The area drains shall be set level and set so as to be vertical and in true alignment.

D. Joints: Pipe joints into area drains shall be constructed in accordance with the details shown on the plans. Complete details of the boot manufacture and installation shall be submitted for approval.

E. Area drain body shall be cut at the time of final grade. No brick, stone, or concrete block will be required to set the grate to the final grade height.

3.4 IDENTIFICATION

A. Materials and their installation are specified in Section 310000 - Earthwork. Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.5 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
2. The Contractor shall, at his own expense, replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
3. The Contractor shall repair any defects or corrections required by the Owner's Representative.

3.6 CLEANING

A. The Contractor shall clean interior of piping and structures of dirt, debris, and superfluous materials prior to commencing work, during construction and prior to acceptance of stormwater drainage system.

B. The Contractor shall also clean downstream portions of the stormwater conveyance system which recovered silt deposits from the construction activity.

3.7 RECORD DRAWINGS

A. All installed underground utilities shall be designated on as-built drawings by the contractor of record and provided to the Owner and Engineer in AutoCAD electrical format prior to completion of the project. All as-built drawings, (underground and above ground) shall be dimensioned from permanent benchmarks such as existing buildings and include depths at various points throughout the extent of the work, and invert elevations at all structures.

END OF SECTION

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APPENDICES