PROJECT MANUAL

Lee's Summit, MO

1

3561 SW Market St., Jackson County
Lee's Summit, MO 64082

Property Number: 160085
BSRO Project Number: 906903
SGA Project Number: 1955B71

March 26, 2020

For
GBT Realty Corporation
9010 Overlook Blvd.
Brentwood, TN 37027

Architect of Record:
SGA Design Group, P.C.
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Tulsa, Oklahoma 74119
(918) 587- 8600

DOCUMENT 000107 - SEALS PAGE
PROJECT:

Name: Bridgestone Retail Operations, LLC (BSRO)
Location: 3561 SW Market St.,Jackson County, Lee's Summit, MO 64082
BSRO Project Number: 906983
SGA Project Number: 1955B71

ARCHITECT OF RECORD

SGA Design Group, P.C.
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Mitchel Garrett

04/16/2020
Architect of Record Date

SEALS PAGE

DOCUMENT 00017 – SEALS PAGE

PROJECT:

NAME:	Bridgestone Retail Operations, LLC (BSRO)
Location:	3544 SW Market St., Lee's Summit, MO
BSRO Project No.:	906983
SGA Project No.:	1955B71
Gresham Smith Project No.:	40831.45

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Civil Engineer of Record

4/8/2020
Date

LANDSCAPE ARCHITECT OF RECORD

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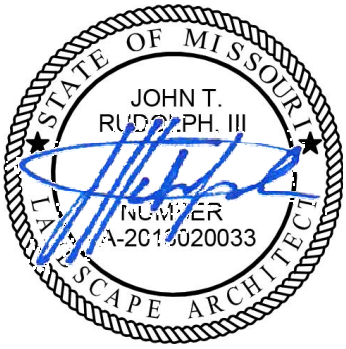

Landscape Architect of Record

4/8/2020
Date

END OF DOCUMENT 000107

DOCUMENT 000107 - SEALS PAGE
PROJECT:

Name:	Bridgestone Retail Operations, LLC (BSRO)
Location:	3544 SW Market St., Lee's Summit, MO
BSRO Project Number:	906983
SGA Project Number:	1955B71

MECHANICAL ENGINEER OF RECORD

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Mechanical Engineer of Record 04/15/2020 Date

ELECTRICAL ENGINEER OF RECORD

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Electrical Engineer of Record 04/15/2020 Date

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END OF SECTION 000110

SECTION 023211 – SITE AND SUBSURFACE INVESTIGATION BY CONTRACTOR

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface reconnaissance and evaluation of existing site conditions.

B. Sub-surface evaluation by Contractor's chosen method of investigation.

1.2 RELATED SECTIONS

A. Section 00 72 00 – General Conditions.

B. Section 00 73 00 – Supplementary conditions.

1.3 REQUIREMENTS

A. Contractor is responsible for having a thorough knowledge of all Drawings, Specifications, General and Supplementary Conditions, and other Contract Documents. Failure to acquaint himself with this knowledge does not relieve him of the responsibility for performing his work in a manner acceptable to Owner. No additional compensation will be allowed because of conditions that occur due to failure by Contractor to familiarize himself and all workers with this knowledge.

B. Contractor shall be responsible for determining the existing conditions of the site and shall thoroughly examine all factors reasonably available to him, including but not limited to the Drawings, Specifications, geotechnical report, site boundary and topography, site conditions, site history, local information, and seasonal weather conditions. Geotechnical report data is not considered all conclusive and it is Contractor's responsibility to further investigate site conditions as he determines necessary. Contractor shall be totally responsible for acceptance of the site and preparation of the site to the proper grade and compaction requirements as indicated by the Contract Documents including Construction Drawings and Specifications. Any construction performed by Contractor on the project will constitute acceptance of the site.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 023211

SECTION 024100 – DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Demolition of designated site structures, retaining walls, and foundations and removal of materials from site.

B. Demolition and removal of pavements, curbs and gutters, drainage structures, utilities, signage, or landscaping.

C. Disconnecting and capping or removal of identified utilities.

D. Filling or removal of underground tanks, piping, and appurtenances.

E. Filling voids in subgrade created as a result of removals or demolition.

F. Hazardous material compliance.

1.2 RELATED SECTIONS

A. Section 02 32 11 – Site and Subsurface Investigation by Contractor

B. Section 31 00 01 – Site Preparation

C. Section 31 00 20 – Earthwork

D. Section 31 05 16 – Aggregate Materials

E. Section 31 25 01 – General Requirements for Erosion and Sediment Control

F. Storm Water Pollution Prevention Plan

G. Construction Drawings

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable local code for demolition of structures, safety of adjacent structures, dust control, and runoff control.

B. Obtain required permits and licenses from appropriate authorities. Pay associated fees including disposal charges.

C. Notify affected utility companies before starting work and comply with their requirements.

D. Do not close or obstruct roadways, sidewalks, or fire hydrants without appropriate permits.

E. Conform to applicable regulatory procedures when hazardous or contaminated materials are discovered.

F. Test soils around buried tanks for contamination.

1.4 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of capped utilities and subsurface obstructions that will remain after demolition.

1.5 PROJECT CONDITIONS

A. Structures to be demolished will be discontinued in use and vacated prior to start of work.

B. Neither Owner nor Owner's Representative assumes responsibility for condition of structures to be demolished.

C. In the event existing site conditions have changed after Contractor has performed his site evaluation described in section 02 32 11, Owner or Owner's Representative shall be consulted prior to start of work.

D. Unless otherwise indicated in the Contract Documents, items of salvageable value to Contractor shall be removed from site and structures. Storage or sale of removed items on site will not be permitted and shall not interfere with other work specified in Contract Documents.

E. Explosives shall not be brought to site or used without written consent of authorities having jurisdiction. Such written consent will not relieve Contractor of total responsibility for injury to persons or for damage to property due to blasting operations. Performance of required blasting shall comply with governing regulations.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Aggregate materials as specified in Section 31 05 16.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide, erect, and maintain erosion control devices, temporary barriers, and security devices at locations indicated on Construction Drawings.

B. Protect existing plant growth, landscaping materials, appurtenances, and structures which are not to be demolished. Replace or repair if damage is caused by demolition operations, at no cost to Owner.

C. Prevent movement or settlement of remaining adjacent structures and provide bracing and shoring as needed.

D. Mark location of existing utilities. Protect and maintain in safe and operable condition utilities that are to remain. Prevent interruption of existing utility service to occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities that are acceptable to governing authorities and utility owners.

3.2 DEMOLITION REQUIREMENTS

A. Conduct demolition operations in a manner that will minimize interference with adjacent structures or pavements.

B. Cease operations immediately if adjacent structures appear to be in danger. Notify authority having jurisdiction. Do not resume operations until directed.

C. Conduct operations with minimum of interference to public or private access. Maintain ingress and egress at all times.

D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon, or limit access to their property.

E. Sprinkle work with water to minimize dust. Provide hoses and water connections for this purpose.

F. Comply with governing regulations pertaining to environmental protection.

G. Clean adjacent roads, streets, highways, structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

3.3 DEMOLITION

A. Demolish buildings completely and remove from site using methods as required to complete work within limitations of governing regulations. Small structures may be removed intact when acceptable to authorities having jurisdiction.

B. Proceed with demolition in systematic manner, from top of structure to ground. Complete demolition work above each floor or tier before disturbing supporting members on lower levels.

C. Relocate demolition equipment and remove materials to prevent excessive loading to supporting walls, floors, or framing.

D. Remove structural framing members and lower to ground by hoists, derricks, or other suitable methods.

E. Demolish concrete and masonry in small sections. Break up concrete slabs-on-grade that are 3 feet or more below proposed subgrade and remove if adequate compaction cannot be obtained. Remove slabs-on-grade and below grade construction within the upper 3 feet of proposed subgrade.

3.4 FILLING BASEMENTS AND VOIDS

A. Completely fill below grade areas and voids resulting from demolition or removal of structures, underground fuel storage tanks, wells, cisterns, etc., using approved select fill materials consisting of stone, gravel, and sand free from debris, trash, frozen materials, roots, and other organic matter.

B. Ensure that areas to be filled are free of standing water, frost, frozen or unsuitable material, trash, and debris prior to fill placement.

C. Place fill materials in accordance with Section 31 00 20 unless subsequent excavation for new work is required.

D. Grade surface to match adjacent grades and to provide flow of surface drainage after fill placement and compaction.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove from site debris, rubbish, and other materials resulting from demolition operations.

B. No burning of any material, debris, or trash on-site or off-site will be allowed, except when allowed by appropriate governing authority and Owner. If allowed, burning shall be performed in manner prescribed by governing authority. Attend burning materials until fires have completely burned out or have been completely extinguished.

C. Transport materials removed from demolished structures with appropriate vehicles and dispose off-site to areas which are approved for disposal by governing authorities and appropriate property owners.

END OF SECTION 024100

SECTION 033160 – MISCELLANEOUS CONCRETE WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cast in place concrete and reinforcing steel used in the construction of manholes, drainage structures, thrust blocks, sidewalks, concrete pads around valve and meter boxes, concrete encasement, and any other uses listed.

1.2 RELATED WORK

A. Quality control is specified in Section 01 45 01. Testing laboratory services are specified in either Section 01 45 23 or 01 45 24, whichever is in the Project Manual.

B. Concrete pavement is specified in Section 32 13 13.

C. Pipe laying and encasement is specified in Section 33 02 00.

D. Sanitary sewer manholes are specified in Section 33 39 00.

E. Storm sewer structures are specified in Section 33 49 00.

1.3 REFERENCES

A. ASTM Standards

1. A 185, "Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
2. A 615, "Deformed and Plain Billet Steel for Concrete Reinforcement
3. C 31, "Standard Method of Making and Curing Concrete Test Specimens in the Field"
4. C 33, "Concrete Aggregates"
5. C 39, "Standard Test Method for Compressive Strength of Concrete"
6. C 143, "Standard Test Method for Slump of Portland Cement Concrete"
7. C 150, "Standard Specification for Portland Cement"
8. C 172, "Standard Method of Sampling Fresh Concrete"
9. C 231, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method"
10. C 260, "Air Entraining Admixtures for Concrete"

1.4 QUALITY ASSURANCE

A. Concrete shall be provided by a ready mix plant that has been in operation sufficient time to have a proven record of supplying concrete mixtures that perform satisfactorily. Ready mix plant shall have a current State Department of Transportation approval.

B. Concrete work, including formwork and reinforcing steel placement, shall be accomplished by workers experience in the type of work being performed.

PART 2 - PRODUCTS

2.1 CEMENT

A. Cement shall be Portland cement conforming to the requirements of ASTM C 150, Type I or IA. Type III or IIIA Portland cement, high early strength, may be used if approved by Owner or Owner’s Representative, at no extra cost to Owner.

2.2 AGGREGATE

A. Coarse aggregates shall be no larger than 1-1/4 inches. The designated range of coarse aggregate shall be 1-1/4 inch to No. 4 sieve. Fine aggregates shall consist of clean, sound, sand conforming to ASTM C 33, and graded as follows.

Sieve	**Percent Passing**
3/8 inch	100
#4	95-100
#8	70-95
#16	45-85
#30	20-60
#50	5-30
#100	0-5

2.3 WATER

A. Water used in mixing concrete and mortar shall be potable water and shall be free from injurious amounts of acids, alkalies, oils, sewage, and organic matter.

2.4 REINFORCING STEEL

A. Reinforcing steel shall be either deformed bars or welded wire fabric, as indicated on the Drawings. The steel shall conform to the following.

Deformed bars	ASTM A 615, Grade 60
Welded wire fabric	ASTM A 185, Grade 65

2.5 CURING COMPOUND

A. Sonneborn liquid Kure-N Seal, or equal

2.6 CONCRETE COMPOSITION AND STRENGTH REQUIREMENTS

A. Concrete shall be either Class A or Class B, and shall be composed of Portland cement, fine and coarse aggregate, and water proportioned in keeping with the following.

	Class "A" Concrete	**Class "B" Concrete**
Minimum Sacks of Cement (per cubic yard)	6	5
Maximum Water (gallons per sack)	6-1/2	6
Slump (inches)	2-4 (w/vibration) 4-6 (w/o vibration) 1-2 (for construction with extrusion machine)	2-4 (w/vibration) 4-6 (w/o vibration) 1-2 for construction with extrusion machine)
Air Entrainment (percent)	6	Not applicable

B. Water-cement ratio shall not exceed 0.49.

C. Air-entraining agents, if used, shall conform to ASTM C 260. The total air content (entrained and entrapped air) shall be 6 percent plus or minus 1 percent.

D. Proportioning of concrete shall be by weight except that water may be measured by volume. A one cubic foot sack of Portland cement will be considered as weighing 94 pounds.

E. Class A concrete made with ordinary Portland cement shall have a minimum compressive strength at 28 days of 4000 psi. Class B concrete made with ordinary

Portland cement shall have a minimum compressive strength at 28 days of 2500 psi. If made with high early strength cement, those strengths shall be attained at the end of 7 days.

2.7 EXPANSION JOINT MATERIALS

A. Expansion joints: asphalt impregnated fiberboard, meeting requirements of AASHTO M 213.

B. Contraction (i.e. saw cut) joints: one part silicone formulation that does not require a primer for bond to concrete. Compound shall be compatible with concrete. Acetic acid cure sealants are not acceptable. Provide product of a manufacturer listed on the State DOT approved materials provider list.

PART 3 - EXECUTION

3.1 REINFORCING STEEL

A. Steel reinforcing shall be free from rust, scale, and from mortar, dirt, or other objectionable coatings. It shall be placed accurately in accordance with details shown on the Drawings and with rebar detail drawings, and properly secured in position.

3.2 READY-MIX CONCRETE

A. Ready-mix concrete shall be delivered and placed within one hour after all materials, including mixing water, shall have been placed in the mixing drum. Each batch shall be accompanied by a load ticket with a copy for Owner or Owner's Representative showing the concrete type, mixing proportions, and time mixing began.

3.3 VIBRATION

A. Structural concrete shall be compacted by vibration as it is placed. The use of form vibrators is not acceptable. Internal vibrators shall be capable of transmitting vibration to the concrete at frequencies not less than 4,500 impulses per minute. Duration of vibration shall be limited to the time necessary to provide satisfactory consolidation without causing segregation. The vibrator shall not be inserted into lower courses previously vibrated. Vibrators shall be applied in a substantially vertical position and at uniformly spaced points not further apart than the visible effectiveness of the vibrator. Vibration shall be supplemented by such spading as Owner or Owner's Representative may require. Concrete in pipe foundations need not be vibrated if other methods produce satisfactory results. Slump of concrete shall be the minimum practical. When vibration is used to consolidate concrete, slump shall not exceed 4 inches; otherwise, slump shall not exceed 6 inches.

3.4 FINISHING

A. Provide formed concrete surfaces to be left exposed with smooth rubbed finish. Sidewalk, drive, and street repairs shall be finished to match existing sidewalks, drives, and streets.

B. Patch form ties and honeycombing in structural concrete.

3.5 CURING

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Cure concrete for at least 7 consecutive days. Cure unformed surfaces by one of the following methods.
   1. Cover surface with moist fabric so that a film of water remains on the surface throughout the curing period.
   2. Cover surface with curing paper and seal with tape.
   3. Apply a uniform coat of liquid curing and sealing compound in accordance with manufacturer's instructions.

3.6 CURB AND GUTTERS

A. Curb and gutter shall be installed at the locations and to the lines and grades indicated on the Drawings. Gutters shall provide smooth flow of water to low points (such as curb inlets or flumes). Curb and gutters that do not provide for continuous, smooth flow of water to collection points will be rejected, and shall be replaced or corrected at no expense to Owner.

B. The Drawings generally indicate where gutters are intended to catch water or to spill water. Curb and gutter shall be installed to achieve this result. However, Contractor should be aware of the intended function of the gutter (catch water or spill water), and shall install gutters to achieve the intended result. If Contractor cannot determine the intention of the Drawings in this regard, contact Owner or Owner’s Representative for clarification.

C. Shape subgrade to required depth below finished surface, and compact to a firm, even surface. Remove soft and yielding areas and replace with suitable material and compact. Proof roll as specified in section 31 00 20. Spread and compact base course material as indicated on the Drawings.

D. Construct forms of metal or wood, free from warp, and of sufficient strength to resist springing during concrete pouring. Stake and brace and hold firmly to required lines and grades. Clean and oil forms before concrete is placed. Face forms or templates matching the shape of the planned curb are required when an extrusion machine is not used.

E. Curb and gutters shall be poured as a monolithic structure, according to the lines and grades and details indicated on the Drawings. A combination of extrusion machine and hand pouring shall be used as best suits the Work. Extrusion machine shall be the type that can be adjusted to provide the types and dimensions of curbs indicated on the Drawings.

F. Vibrate and spade until mortar entirely covers the surface. Finish smooth and even by means of a wooden float. Round edges as indicated on the Drawings while concrete is still plastic. Remove face forms as soon as practicable. Finish face by rubbing with a wood float until it is smooth, then brush finish with a broom. Plastering will not be permitted. Fill minor defects with cement mortar applied with a wood float.

G. Install expansion joints in curb and gutters at stationary structures and at ends of curb returns. Expansion joints shall be 1/2 inch thick and shall be filled with joint filler shaped to the cross section of the curb and constructed at right angles with the curb line.

H. Saw cut contraction joints every 15 feet, to be 1/8 to 3/8 inch by 1-1/2 inches. Saw cut at right angles to curb line. Fill with joint seal.

I. Cure as described elsewhere in this section.

J. Maximum variation from indicated grades shall be 1/4 inch in 10 feet, except that this allowed variation does not allow creation of pockets that do not drain run-off as intended by the Drawings, or gutters that fail to catch or spill water as intended.

3.7 SIDEWALKS

A. Excavate or fill subgrade to the required grade. Remove soft and yielding material and replace with suitable material and compact entire subgrade. Proof roll as specified in Section 31 00 20.

B. Construct forms of metal or wood, free from warp, and of sufficient strength to resist springing during concrete pouring. Stake and brace and hold firmly to required lines and grades. Clean and oil forms before concrete is placed. Face forms or templates matching the shape of the planned curb are required when an extrusion machine is not used.

C. Construct concrete sidewalks according to the lines, grades, and details indicated on the Drawings. As far as practical, sidewalks shall be continuously poured. Consolidate concrete material to prevent honeycombing. Strike off top with a straightedge and tamp or vibrate sufficiently to bring mortar to surface.

D. Sidewalks shall have a non-slip brush finish.

E. Sidewalks may be constructed with an extrusion machine if approved by an Owner or Owner's Representative.

F. Provide tool joints, saw joints, and expansion joints where indicated on the Drawings. Expansion joints shall be at least 1/2 inch wide, spaced as indicated on the Drawings and between sidewalk and all stationary structures. Fill with joint filler.

G. Concrete sidewalks are called for on the Drawings to be reinforced and have a 4-inch aggregate base course.

3.8 FIELD QUALITY CONTROL

A. Testing of concrete in the field, either as poured or after setting or curing shall be as required by Owner or Owner's Representative. The cost of all testing to demonstrate compliance with the specifications shall be as indicated in Section 01 45 23 or Section 01 45 24, whichever is included in the Project Manual.

B. Cooperate with testing laboratory personnel to take and properly handle field samples.

C. Composite samples shall be obtained in accordance with ASTM C 172

D. Mold three specimens from each test required in accordance with ANSI/ASTM C 31; cure specimens in laboratory.

E. Measure air content in Class A concrete in accordance with ASTM C 231.

F. Test the specimens in accordance with ANSI/ASTM C 39. Two specimens shall be tested at 28 days for acceptance and one specimen shall be tested at 7 days for information.

G. The slump of the normal-weight concrete sample for each strength test shall be determined in accordance with ANSI/ASTM C 143.

H. Failure of concrete is defined as the average compressive strength of the two cylinders tested at 28 days not being equal to or greater than the specified 28 day compressive strength. In addition, a low compressive strength of the cylinder tested at 7 days may be considered as concrete failure if it is so low as to indicate that the specified 28 day strength will not be achieved.

I. Should the test cylinders fail to demonstrate compliance with the specifications, reconstruct the concrete structure at no additional cost to Owner. Contractor shall then be responsible for the expenses involved in re-testing the concrete.

J. Testing will be performed for every 50 cubic yards of concrete placed or as directed by Owner or Owner's Representative. The cost of all testing made at the request of Owner will be as indicated in Section 01 45 23, unless that section is not in the Project Manual. In that case provisions of another section will apply. Owner's Representative shall furnish Owner with copies of concrete testing required by Owner's Representative during the course of the Work.

3.9 CLEANING

A. Clean work areas and all concrete formwork and waste. Waste concrete shall not be disposed of on site except as approved by Owner or Owner's Representative.

3.10 SCHEDULE

A. Cast-in-place concrete class is generally indicated on the Drawings for each type of usage. The following schedule will govern where no concrete class is indicated on the Drawings.

	Class A		Class B
Curb and Gutter	x		
Sidewalks	x		
Drainage Structures	x		
Signage post holes			x
Flared end section end wall			x
Thrust blocking		x	
Fence post holes		x	

END OF SECTION 033160

SECTION 133419 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal roof panels.
   2. Metal wall panels.
   3. Accessories.

1.2 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at the project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component.

B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and attachments to other work.

C. Samples: For units with factory-applied finishes.

D. Delegated-Design Submittal: For metal building systems.

   1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

   1. Name and location of Project.
   2. Order number.
   3. Name of Manufacturer.
   4. Name of Contractor.
   5. Building dimensions including width, length, height, and roof slope.
   6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
   7. Governing building code and year of edition.
   8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).

9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
10. Building-Use Category: Indicate category of building use and its effect on load importance factors.

C. Material test reports.

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified Manufacturer.

1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to Manufacturer.

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

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 WARRANTY

A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 25 years from date of Substantial Completion.

B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - EXECUTION

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements and to the extent specified hereinafter, provide products by the below Manufacturer:

1. Nucor Building Systems – 704.366.7000
2. ~~Varco Pruden Buildings – 205.907.8176~~
3. Inland Buildings – 256.739.6827

1

B. Substitutions: Substitutions are not allowed.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Manufacturer shall engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal building system.

B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."

1. Design Loads: As indicated on Drawings.
2. Deflection and Drift Limits: As indicated on Drawings.

C. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined as indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.

F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 60.

2.3 ACCESSORIES

A. General: Provide accessories as standard with metal building system Manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by Manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inchnominal uncoated steel thickness, pre-painted with coil coating; finished to match adjacent metal panels.

E. Gutters: Provided as shown on drawings.

F. Roof Curbs: Provided as shown on drawings

G. Pipe Flashing: Provided as shown on drawings.

2.4 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by Manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

PART 3 - PART 3 EXECUTION

3.1 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to Manufacturer's written instructions and drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system Manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with Manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.

a. Joint Type: Snug tightened or pretensioned as required by Manufacturer.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit openings such as doors and windows.
3. Provide supplemental framing at entire perimeter of openings, including doors, windows, ventilators, and other penetrations of roof and walls.

H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.2 METAL PANEL INSTALLATION, GENERAL

A. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

    a. Field cutting of metal panels by torch is not permitted unless approved in writing by Manufacturer.

2. Install metal panels perpendicular to structural supports unless otherwise indicated.
3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Locate metal panel splices over structural supports with end laps in alignment.
6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

B. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel Manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel Manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel Manufacturer.

3.3 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

1. Install ridge caps as metal roof panel work proceeds.

2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by Manufacturer.

1. Install clips to supports with self-drilling or self-tapping fasteners.
2. Install pressure plates at locations indicated in Manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with Manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Pre-drill panels for fasteners.
6. Provide metal closures at rake edges, rake walls and each side of ridge caps.

C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by Manufacturer.

1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
4. At metal panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.4 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When two rows of metal panels are required, lap panels 4 inches minimum.
4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Pre-drill panels.
6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners in pre-drilled holes.
8. Install flashing and trim as metal wall panel work proceeds.

9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by Manufacturer.

3.5 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by Manufacturer.

B. Flashing and Trim: Comply with performance requirements, Manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using Manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.

E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by Manufacturer.

3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.

B. Product will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 133419

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Interior solid-state luminaires that use LED technology.
   2. Lighting fixture supports.

B. Related Requirements:
   1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaires.
   4. Include emergency lighting units, including batteries and chargers.
   5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
   6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Lighting luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
4. Structural members to which equipment and or luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:
a. Other luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
7. Moldings.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For each type of luminaire.

F. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
   1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
   2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
   3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with project requirements, provide products as manufactured by the following to the extent as specified hereinafter:
   1. Cree Lighting, Durham, NC. Contact: Jeffrey Sabrin, Director – Strategic National Accounts; Telephone: (330) 757-3554 Cell: (330) 402-4777. Email: jeff.sabrin@cree.com

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
   1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

2.3 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. Recessed Fixtures: Comply with NEMA LE 4.

E. Bulb shape complying with ANSI C79.1.

F. Lamp base complying with ANSI C81.61 or IEC 60061-1.

G. Lamps dimmable from 100 percent to 0 percent of maximum light output.

H. Internal driver.

2.4 CYLINDER

A. Subject to compliance with requirements, provide cylinders with integral mounting provisions by Cree Lighting.

2.5 DOWNLIGHT

A. Subject to compliance with requirements, provide downlight fixtures with universal mounting bracket and integral junction box with conduit fittings by Cree Lighting.

2.6 HIGHBAY, LINEAR

A. Subject to compliance with requirements, provide highbay, linear fixtures by Cree Lighting.

2.7 HIGHBAY, NONLINEAR

A. Subject to compliance with requirements, provide highbay, non-linear fixtures with universal mounting brackets and integral junction boxes with conduit fittings, by Cree Lighting.

2.8 LINEAR INDUSTRIAL

A. Subject to compliance with requirements, provide linear industrial fixtures by Cree Lighting. Provide the following housing and heat sink rates:
   1. Class 1, Division 2 Group(s) A B C and D.
   2. IP 54.
   3. IP 66.
   4. CSA C22.2 No 137.

2.9 LOWBAY

A. Subject to compliance with requirements, provide lowbay fixtures with universal mounting brackets, by Cree Lighting.

2.10 RECESSED LINEAR

A. Subject to compliance with requirements, provide recessed linear fixtures with integral junction boxes with conduit fittings, by Cree Lighting.

2.11 STRIP LIGHT

A. Subject to compliance with requirements, provide strip light fixtures with integral junction boxes with conduit fittings, by Cree Lighting.

2.12 SURFACE MOUNT, LINEAR

A. Subject to compliance with requirements, provide surface-mounted linear fixtures with integral junction boxes with conduit fittings, by Cree Lighting.

2.13 SURFACE MOUNT, NONLINEAR

A. Subject to compliance with requirements, provide surface-mounted non-linear fixtures with integral junction boxes with conduit fittings, by Cree Lighting.

2.14 SUSPENDED, LINEAR

A. Subject to compliance with requirements, provide linear suspended fixtures by Cree Lighting.

2.15 SUSPENDED, NONLINEAR

A. Subject to compliance with requirements, provide non-linear, suspended fixtures with integral junction boxes with conduit fittings, by Cree Lighting.

2.16 MATERIALS

A. Metal Parts:
   1. Free of burrs and sharp corners and edges.
   2. Sheet metal components shall be steel unless otherwise indicated.
   3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
   1. Prismatic acrylic.
   2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   3. Glass: Annealed crystal glass unless otherwise indicated.
   4. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Housings:
   1. Extruded-aluminum housing and heat sink.
   2. Clear, anodized finish.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   1. Label shall include the following lamp characteristics:
      a. "USE ONLY" and include specific lamp type.
      b. Lamp diameter, shape, size, wattage, and coating.
      c. CCT and CRI for all luminaires.

2.17 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.18 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Construction Manager, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:
1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:
1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:
1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:
1. Ceiling mount with two 5/32-inch- (4-mm-) diameter aircraft cable supports.
2. Ceiling mount with pendant mount with 5/32-inch- (4-mm-) diameter aircraft cable supports.

3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:
1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Construction Manager.

END OF SECTION 265119

CONTRACTOR'S RECORD LETTER OF CONFORMANCE
SECTION 265119 – LED INTERIOR LIGHTING

Project Location: _____ Date: _____

_____
(City & State)

Project Number: _____ Store Number: _____

Statement of Conformance:
This Record Letter of Conformance is provided as a Record Document in accordance with Section 017700 – Closeout Procedures. The undersigned hereby declares that the LED interior lighting is installed and is in general conformance with the Contract Documents, applicable Codes, and shop drawings. The LED interior lighting has been provided and placed in operational condition in accordance with the manufacturer's published instructions and the Contract Documents. To be accepted, all signatures must be original ink signatures (copies are not allowed).

LED INTERIOR LIGHTING INSTALLER:

_____
(Subcontractor Signature)

_____Phone Number: ( )_____
(Subcontractor name and address)

CONTRACTOR:

_____
(Contractor Signature)

_____ Phone Number: ( )_____
(Contractor name and address)

SECTION 31 0010 - SITE WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cleaning site of debris, grass, trees, and other plant life in preparation for site or building earthwork.

B. Protection of existing structures, trees, or vegetation that are indicated in Contract Documents to remain.

C. Stripping topsoil from areas that are to be incorporated into limits of project or as otherwise indicated on Construction Drawings.

1.2 RELATED SECTIONS

A. Section 02 32 11 – Site and Subsurface Investigation by Contractor

B. Section 02 41 00 – Demolition

C. Section 31 00 20 – Earthwork

D. Section 31 25 01 – General Requirements for Erosion and Sediment Control

E. Storm Water Pollution Prevention Plan

F. Construction Drawings

1.3 ENVIRONMENTAL REQUIREMENTS

A. Construct temporary erosion control systems as shown on Construction Drawings or as directed by "Storm Water Pollution Prevention Plan" (SWPPP) to protect adjacent properties and water resources from erosion and sedimentation.

B. In event that sitework on this project will disturb 1 or more acres, do not begin construction without posting on site the "National Pollution Discharge Elimination System" (NPDES) permit governing discharge of storm water from site for entire construction period. NPDES permit requires SWPPP to be in place during construction.

C. Contractor is responsible for conducting storm water management practices in accordance with NPDES permit and for enforcement action taken or imposed by Federal or State agencies, including cost of fines, construction delays, and remedial actions resulting from Contractor's failure to comply with provisions of NPDES permit.

1.4 PROJECT CONDITIONS

A. In the event demolition operations are not part of the project and existing site conditions have changed after Contractor has performed his site evaluation described in Section 02 32 11, the Owner or Owner’s Representative shall be consulted prior to start of work.

PART 2 - PRODUCTS

2.1 OFF-SITE MATERIALS

A. Off-site materials shall be transported to project using well maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify existing plant life that is to remain and that clearing limits are clearly tagged, identified, and marked in such manner as to ensure their safety throughout construction **operations.**

3.2 PROTECTION

A. Locate and identify existing utilities that are to remain and protect from damage.

B. Protect trees, plant growth, and features designated to remain as part of final landscaping.

C. Conduct operations with minimum interference to public or private accesses and facilities. Maintain ingress and egress at all times and clean or sweep roadways daily as required by SWPPP or governing authority. Provide dust control with sprinkling systems or equipment.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

E. Provide traffic control as required, in accordance with the U.S. Department of Transportation's "Manual on Uniform Traffic Control Devices" and applicable state highway department and/or local municipal requirements.

3.3 CLEARING

A. Clear areas required for access to site and execution of work.

B. Unless otherwise indicated on Construction Drawings, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out stumps and roots. Depressions caused by clearing and grubbing operations shall be filled to subgrade elevation to avoid ponding of water. Satisfactory fill material shall be placed in accordance with Section 31 00 20.

C. Remove grass, trees, plant life, stumps, and other construction debris from site to dump site that is suitable for handling such material according to applicable laws and regulations.

3.4 TOPSOIL EXCAVATION

A. Topsoil shall consist of organic surficial soil found in depth of not less than 6 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over 2 inches in diameter, weeds, roots, and other objectionable material.

B. Cut heavy growths of grass from areas before stripping and remove cuttings with remainder of cleared vegetative material.

C. Strip topsoil from areas that are to be filled, excavated, landscaped, or re-graded to such depth that it prevents intermingling with underlying subsoil or questionable material.

D. Stockpile topsoil in storage piles in areas shown on Construction Drawings in a manner that will freely drain surface water. Cover storage piles as required to prevent windblown dust. Dispose of unsuitable topsoil as specified in section 02 41 00. Remove excess topsoil from site unless specifically noted otherwise on Construction Drawings.

END OF SECTION 310010

SECTION 310020 - EARTHWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Protection of utilities as sitework progresses with particular attention to grade changes and necessary staging or phasing of work.

B. Cutting, filling, and grading to required lines, dimensions, contours, and elevations for proposed improvements.

C. Scarifying, compacting, drying, and removal of unsuitable material to ensure proper preparation of areas for fills or proposed improvements.

1.2 RELATED SECTIONS

A. Section 02 41 00 – Demolition

B. Section 31 00 10 – Site Preparation

C. Section 31 05 16 – Aggregate Materials

D. Section 31 23 01 – Excavation, Backfill, and Compaction for Structures

E. Section 31 23 02 – Excavation, Backfill, and Compaction for Utilities

F. Section 31 23 03 – Excavation, Backfill, and Compaction for Pavement

G. Section 31 23 09 – Rock Removal

H. Section 31 32 13 – Soil Stabilization

I. Section 31 25 01 – General Requirements for Erosion and Sediment Control

J. Section 32 90 00 – Landscaping

K. Geotechnical Report for boring locations and findings of subsurface materials and conditions

L. Storm Water Pollution Prevention Plan

M. Architectural Plans and Specifications as they relate specifically to earthwork beneath buildings, where architectural requirements are more stringent than civil requirements

N. Construction Drawings

1.3 REFERENCE STANDARDS

A. ASTM International (ASTM) latest edition.

1. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN.m/m^3)
2. D 2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
3. D 2487 Classification of Soils for Engineering Purposes

4. D 2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
5. D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
6. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
1. T 88 Particle Size Analysis of Soils

1.4 QUALITY ASSURANCE

A. Unless otherwise indicated in the Contract Documents, an independent testing laboratory, selected by Owner or Owner's Representative and contracted directly with the Owner, will perform construction testing on site based on following:
1. Building Subgrade Areas, including 10 feet outside of Exterior Building Lines: In cut areas, not less than 1 compaction test equally spaced for every 2,500 square feet. In fill areas, same rate of testing for each 8 inch lift, measured loose.
2. Areas of construction exclusive of Building Subgrade Areas: In cut areas, not less than 1 compaction test equally spaced for every 10,000 square feet. In fill areas, same rate of testing for each 8 inch lift, measured loose.

B. If compaction requirements are not complied with at any time during construction process, remove and re-compact deficient areas until proper compaction is obtained at no additional expense to Owner.

C. In areas that support pavement, California Bearing Ratio (CBR) or Limerock Bearing Ratio (LBR) test shall be performed for each type of material that is imported from off-site.

D. The following tests shall be performed as part of construction testing requirements on each type of on-site or imported soil material used as compacted fill:
1. Moisture and Density Relationship: ASTM D 698
2. Mechanical Analysis: AASHTO T 88
3. Plasticity Index: ASTM D 4318

E. Field density tests for in-place materials shall be performed as part of construction testing requirements according to Nuclear Method: ASTM D 2922 (Method B-Direct Transmission)

F. An independent testing laboratory shall prepare test reports that indicate test location, elevation data, and test results. Owner, Owner's Representative, other design professionals employed by Owner, and Contractor shall be provided with copies of reports within 96 hours of time that test was performed. In event that test performed fails to meet Specifications, the Owner or Owner's Representative and Contractor shall be notified immediately by the independent testing laboratory.

G. All costs related to retesting due to test failures shall be paid for by Contractor at no additional expense to Owner. Owner reserves right to employ an additional independent testing laboratory to obtain a second opinion when deemed necessary. Contractor shall provide free access to site for testing activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Excavated and re-used material for subsoil fill as specified herein.

B. Aggregate fill as specified in Section 31 05 16.

C. Imported fill material approved by the Owner or Owner's Representative and specified herein.

D. Topsoil fill as specified in Section 31 00 10.

E. Acceptable stabilization fabrics and geogrids as specified in Section 31 32 13.

F. Filter and drainage fabrics as specified in Section 31 25 01.

G. Rip rap: Stone for rip-rap shall consist of field stone or rough unhewn quarry stone as nearly uniform in section as is practical. Stones shall be dense, resistant to action of air and water, and suitable for purpose intended. Unless otherwise specified, stones used as rip-rap shall weigh between 50 pounds and 150 pounds each, and at least 60 percent of stones shall weigh more than 100 pounds each.

2.2 EQUIPMENT

A. Off-site materials shall be transported to project using well maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify required lines, spot elevations, contours, and benchmark datum.

B. Locate and identify existing utilities that are to remain and protect from damage.

C. Notify utility companies to remove or relocate utilities that are in conflict with proposed improvements.

D. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs from damage by excavating equipment and vehicular traffic.

E. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

F. Remove from site material encountered in grading operations that, in opinion of Owner or Owner's Representative, is unsuitable or undesirable for backfilling, subgrade, or foundation purposes. Dispose of material in manner satisfactory to governing authorities and backfill areas with layers of suitable material and compact as specified.

G. Prior to placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:
   1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain same results.
   2. After drainage of low area is complete, remove mulch, mud, debris, and other unsuitable material by using acceptable equipment and methods that will keep natural soils underlying low area dry and undisturbed.
   3. If muck, mud, and other materials removed from low areas is proposed for fill, it shall be dried on-site by spreading in thin layers for observation. Material shall be inspected and, if found to be suitable for use as fill material, shall be incorporated

into lowest elevation of site filling operation, but not under building subgrade areas defined in section 1.04A or within the upper 10 feet of paving subgrade. If, after observation the material is found to be unsuitable, the material shall be removed from site.

3.2 EXCAVATION FOR FILLING AND GRADING

A. Classification of Excavation: By submitting bid, Contractor acknowledges that site has been investigated to determine type, quantity, quality, and character of excavation work to be performed. Excavation shall be considered unclassified excavation, except as specifically indicated by the Contract Documents.

B. When performing grading operations during periods of wet weather, provide adequate drainage and ground water management to control moisture of soils.

C. Shore, brace, and drain excavations as necessary to maintain excavation as safe, secure, and free of water at all times.

D. Excavated material containing rock or stone greater than 6 inches in largest dimension is unacceptable as fill within proposed building subgrade and paving subgrade.

E. Rock or stone less than 6-inches in largest dimension is acceptable as fill to within 24 inches of surface of proposed subgrade when mixed with suitable material.

F. Rock or stone less than 2 inches in largest dimension and mixed with suitable material is acceptable as fill within the upper 24 inches of proposed subgrade.

3.3 FILLING AND SUBGRADE PREPARATION

A. Fill areas to contours and elevations shown on Construction Drawings with acceptable materials. Use of frozen or frost containing materials is not acceptable for filling operations.

B. Place fill in continuous lifts as specified herein.

C. Refer to Section 31 23 01 for filling requirements for structures.

D. Refer to Section 31 23 02 for filling requirements for utilities.

E. Refer to Section 31 23 03 for filling requirements for pavements.

F. Refer to Section 31 23 09 for rock excavation.

G. Areas exposed by excavation or stripping and on which subgrade preparations are to be performed shall be scarified to minimum depth of 8 inches and compacted to minimum of 95 percent of optimum density, in accordance with ASTM D 698 at a moisture content of not less than 1 percent below and not more than 3 percent above optimum moisture content. These areas shall then be proof-rolled to detect areas of insufficient compaction. Proof-rolling shall be accomplished by making a minimum of 2 complete passes with fully-loaded tandem-axle dump truck, or approved equal, in each of 2 perpendicular directions while under the supervision and direction of the independent testing laboratory. Areas of failure shall be excavated and re-compacted as specified.

H. Fill materials used in preparation of subgrade shall be placed in lifts or layers not to exceed 8 inches loose measure and compacted to minimum density of 95 percent of optimum density, in accordance with ASTM D 698 at a moisture content of not less than 1 percent below and not more than 3 percent above optimum moisture content.

I. Material imported from off-site shall have CBR or LBR value equal to or above pavement design subgrade CBR or LBR value indicated on Construction Drawings.

3.4 MAINTENANCE OF SUBGRADE

A. Finished subgrades shall be verified to ensure proper horizontal and vertical controls have been complied with and compacted conditions are satisfactory for construction above subgrade.

B. Use any methods necessary to protect the compacted subgrade from erosion, excessive moisture or drying conditions and wheel loading damage during construction from concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material equal to or better than best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.5 BORROW SITES

A. Upon completion of borrow operations, clean up borrow areas as indicated on Construction Drawings in neat and reasonable manner to satisfaction of the borrow area property owner.

3.6 RIP-RAP

A. Place rip-rap in areas where indicated on Construction Drawings.

B. Slopes and other areas to be protected shall be dressed to line and grade shown on Construction Drawings prior to placing of rip-rap. Undercut areas to receive rip-rap to elevation equal to final elevation less average maximum dimension of stones before placing rip-rap.

C. Filter fabric and bedding stone shall be installed prior to placement of rip-rap stones if so indicated on Construction Drawings. Bedding stone shall be quarried and crushed angular limestone in accordance with Section 31 05 16 and shall be 6 inches in depth. Filter fabric shall be as specified in Section 31 25 01 and as detailed on Construction Drawings.

D. Place rip-rap so that greater portion of weight is carried by earth and not by adjacent stones. Place stones in single layer with close joints. Upright areas of stone shall make an angle of approximately 90 degree with embankment slope. Place courses from bottom of embankment upward, with larger stones being placed in lower courses. Fill open joints with spalls. Embed stones in embankment as necessary to present uniform top surface such that variation between tops of stones shall not exceed 3 inches.

3.7 FINISH GRADING

A. Grade areas where finish grade elevations or contours are indicated on Construction Drawings, other than paved areas and buildings, including excavated areas, filled and transition areas, and landscaped areas. Graded areas shall be uniform and smooth, free from rock, debris, or irregular surface changes. Finished subgrade surface shall not be more than 0.10-ft above or below established finished subgrade elevation. Ground surfaces shall vary uniformly between indicated elevations. Finish ditches shall be graded to allow for proper drainage without ponding and in manner that will minimize erosion potential. For topsoil application, refer to Section 32 90 00 or Section 32 90 01.

B. Correct settled and eroded areas within 1 year after date of completion at no additional expense to Owner. Bring grades to proper elevation. Replant or replace grass, shrubs, bushes, or other vegetation that appears dead, dying, or disturbed by construction activities. Refer to Section 31 25 01 for slope protection and erosion control.

END OF SECTION 310020

SECTION 310516 – AGGREGATE MATERIALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aggregate materials for use as specified in other Sections.

1.2 RELATED SECTIONS

A. Section 02 41 00 – Demolition

B. Section 31 00 10 – Site Preparation

C. Section 31 00 20 – Earthwork

D. Section 31 23 01 – Excavation, Backfill, and Compaction for Structures

E. Section 31 23 02 – Excavation, Backfill, and Compaction for Utilities

F. Section 31 23 03 – Excavation, Backfill, and Compaction for Pavement

G. Section 31 32 13 – Soil Stabilization

H. Section 31 25 01 – General Provisions for Erosion and Sediment Control

I. Construction Drawings

1.3 REFERENCE STANDARDS

A. ASTM International (ASTM) latest edition.

1. D 698 - Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN.m/m^3))
2. D 1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 Kn.m/m^3))
3. D 2216 - Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
4. D 2487 - Classification of Soils for Engineering Purposes
5. D 2922 - Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
6. D 3017 - Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
7. D 4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition

1. T 88 - Particle Size Analysis of Soils

1.4 QUALITY ASSURANCE

A. Tests and analysis of aggregate materials will be performed in accordance with ASTM and AASHTO procedures specified.

1.5 SUBMITTALS

A. If required by Owner or Owner's Representative, submit 100 lb. sample of each aggregate or mixture that is to be incorporated into project in air-tight containers to the independent testing laboratory for testing or submit gradation and certification of aggregate material that is to be incorporated into the project to the independent testing laboratory for review and recommended approval.

B. Submit name of each material supplier including the specific type and source of each material. Any change in material source requires an additional submittal to the Owner or Owner's Representative for approval.

PART 2 - PRODUCTS

2.1 GRANULAR BASE COURSE MATERIALS

A. Aggregate base course shall be crushed stone so proportioned as to meet the requirements for Class 7 material as specified in Table 1.

B. Granular material for over-excavation areas shall be either crushed stone and/or gravel so proportioned to meet the requirements for either Class 1 or Class 2 material as specified in Table 1.

C. Percent of wear for Class 7 material, measured by AASHTO T 96, shall not be greater than 45.

D. When it is necessary to blend two or more materials, each material shall be proportioned separately through mechanical feeders to ensure uniform production. Premixing or blending to avoid separate feeding will not be permitted. Blending materials on the roadway in order to obtain a mixture that will comply with the requirements specified will not be permitted.

E. Shale and slate are not considered to be gravel or stone. Material furnished shall be reasonably free from shale, slate, and other objectionable, deleterious, or injurious matter.

F. For Class 1 and Class 2 material, the fraction passing the #200 sieve shall not be greater than 3/4 of the fraction passing the #40 sieve. For Class 7 material, the fraction passing the #200 sieve shall have a liquid limit not greater than 25.

G. When the material contains aggregate larger than that specified for the class required, it must be removed by screening or by screening and crushing. Removal of large size aggregate by hand methods will not be permitted.

Table 1
Classes of Granular Material
Grading and Crushing Requirements

SIEVE	Percent Passing		
	Class 1	Class 2	Class 7
3 inch	100	100	
2 inch	95-100	95-100	
1½ inch			100
3/4 inch	60-100	60-100	50-90
3/8 inch	40-80	40-80	
#4	30-60	30-60	25-55
#10	20-50	20-50	
#40	10-35	10-35	10-30
#200	3-15	3-15	3-10
Max Plasticity Index (minus #40 material)	13	10	6
Minimum percent crusher-run material			90

2.2 SOURCE QUALITY CONTROL

A. Granular materials for aggregate base course and filling over-excavation areas shall be obtained from a quarry permanently established to furnish the materials specified, having a standard quality control and testing procedure in place.

B. If requested, provide reports of standard quality control tests for the types of materials being furnished, such reports to include gradation of the completed mixture, Los Angeles hardness, plasticity index, and liquid limit.

C. If requested by Owner or Owner's Representative, provide source quality control testing of the actual material being furnished. Such tests will be requested if material as delivered on site does not appear to match the specifications, or if the compacted material does not seem to compact as specified. Such tests will include any which measure the properties specified, and will be required for every 1,000 cubic yards of granular material.

2.3 EQUIPMENT

A. Off-site materials shall be transported to project using well maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger any improvements by rutting, overloading, or pumping.

2.4 EQUIPMENT

A. Off-site materials shall be transported to project using well maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger any improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 STOCKPILING

A. Stockpile on-site at locations indicated by the Owner or Owner's Representative in such manner that there will be no standing water or mixing with other materials.

3.2 BORROW SITES

A. Upon completion of borrow operations, clean up borrow areas as indicated on the Drawings in a neat and reasonable manner to the satisfaction of the property owner of the borrow area.

END OF SECTION 310561

SECTION 312301 - EXCAVATION, BACKFILL, AND COMPACTION FOR STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation to lines, grades, and configuration as shown on Drawings for proposed structures.

B. Fill to lines, grades, and configuration as shown on Drawings for proposed structures.

C. Compacting of materials in acceptable manner as specified.

1.2 RELATED SECTIONS

A. Section 31 00 20 – Earthwork

B. Section 31 05 16 – Aggregate Material

C. Geotechnical Report (if available) for boring locations and findings of subsurface materials and conditions

D. Department of Transportation standard specifications for highway construction, latest edition – section concerning Structures.

E. Drawings

1.3 REFERENCE STANDARDS

A. See Section 31 00 20 for a listing of reference standards.

1.4 QUALITY ASSURANCE

A. An independent testing laboratory, selected by and contracted directly with the Owner, will be retained to perform construction testing on filling operations and subgrade analysis as specified in Section 31 00 20 and as specified within this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill material from on-site as specified in Section 31 00 20.

B. Fill material from off-site as specified in Section 31 00 20.

C. Aggregate material as specified in Section 31 05 16.

2.2 EQUIPMENT

A. Off-site materials shall be transported to project using well maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Establish lines, elevations, and grades necessary to construct structure subgrades as shown on Drawings.

B. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

C. Locate and identify utilities that have previously been installed and protect from damage.

D. Locate and identify existing utilities that are to remain and protect from damage.

E. Over-excavate and properly prepare areas of subgrade that are not capable of supporting proposed structures. These areas shall be backfilled with an engineered fill.

3.2 EXCAVATION AND BACKFILLING

A. Excavate structure foundation areas to lines and grades as shown on Drawings being careful not to over-excavate beyond elevations needed for structure footings unless required to obtain proper compaction. Excavation and backfilling for structures shall comply with State highway specifications concerning excavation and backfilling for structures.

B. Place suitable material into project fill areas as specified in Section 31 00 20.

C. Dispose of unsuitable excavated material in a manner and location that is acceptable to local governing authorities.

D. Perform excavation using capable, well maintained equipment and methods acceptable to Owner or Owner’s Representative and local governing authorities.

3.3 COMPACTION

A. Maintain optimum moisture content as specified to attain required compaction density.

B. Materials shall be tested in accordance with Section 31 00 20.

C. If compaction requirements are not complied with at any time during construction process, remove and re-compact deficient areas until proper compaction is obtained at no additional expense to Owner.

3.4 MAINTENANCE OF SUBGRADE

A. Finished subgrades shall be verified to ensure proper horizontal and vertical controls have been complied with and compacted conditions are satisfactory for construction above subgrade.

B. Use any methods necessary to protect the compacted subgrade from erosion, excessive moisture or drying, and wheel loading damage during construction from concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of materials equal to or better than best subgrade material on site. Surface of

subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.5 FINISH GRADING

A. Finish grading shall be in accordance with Section 31 00 20 and as specified elsewhere.

END OF SECTION 312301

SECTION 312302 - EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation of trenches for installation of utilities.

B. Backfilling trenches with bedding material as specified and filling trenches with suitable material to proposed subgrade.

C. Compacting backfill materials in acceptable manner.

1.2 RELATED SECTIONS

A. Section 02 41 00 – Demolition

B. Section 31 00 20 – Earthwork

C. Section 31 05 16 – Aggregate Materials

D. Section 33 11 00 – Water Service

E. Section 33 31 00 – Sanitary Sewer Service

F. Section 33 41 00 – Storm Sewer Systems

G. Geotechnical Report (if available) for boring locations and findings of subsurface materials and conditions

H. Construction Drawings

1.3 REFERENCE STANDARDS

A. ASTM D 2321 Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

B. AASHTO T 180 Moisture-Density Relations of Soils Using a 10 lb (4.54 kg) Rammer and an 18 inch (457 mm) Drop

C. NFPA Chapter 70 National Electric Code

D. AWWA C600 Installation of water lines and appurtenances

1.4 QUALITY ASSURANCE

A. An independent testing laboratory selected by Owner or Owner's Representative and contracted directly with Owner will perform testing at intervals recommended by Owner or Owner's Representative. Compact backfill as specified within this section and in accordance with the Drawings and Section 31 00 20.

1.5 SUBMITTALS

A. Contact utility companies and determine if additional easements will be required to complete project. Provide written confirmation of status of easements to Owner or Owner's Representative prior to installation of utilities.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of subsurface utilities, structures, and obstructions encountered or installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bedding Material: Provide Class I-A or I-B granular material per construction drawings, and in accordance with ASTM D 2321, which is free from clay lumps, organic, or other deleterious material.

B. Haunching Material: Provide Class I-A, I-B or Class II granular material per Construction Drawings, and in accordance with ASTM D 2321, which is free from clay lumps, organic, or other deleterious material. Haunching is considered the zone from the bottom of the pipe to the spring line of the pipe.

C. Initial Backfill Material: Provide Class I-A, I-B or Class II granular material per Construction Drawings, and in accordance with ASTM D 2321, which is free from clay lumps, organic, or other deleterious material. Initial backfill is considered the zone from the spring line of the pipe to 6 inches above the top of the pipe.

D. Backfill material from the site shall be as specified in Section 31 00 20.

E. Backfill material from off-site shall be as specified in Section 31 00 20.

2.2 EQUIPMENT

A. Off-site materials shall be transported to project using well maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Establish lines, elevations, and grades for proposed utility systems.

B. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

C. Maintain in operating condition all existing utilities, previously installed utilities, and drainage systems encountered during utility installation. Repair or replace surface or subsurface improvements concurrently with utility installation.

D. Verify location, size, elevation, and other pertinent data required to make connections to existing utilities and drainage systems as indicated on Construction Drawings.

E. Over-excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems. These areas shall be stabilized by using acceptable structural fill or additional bedding material placed and compacted as specified in Section 31 00 20.

F. Install dewatering systems that will be required to construct proposed utilities in manner that is specified herein.

3.2 EXCAVATION

A. Local utility companies shall be contacted before excavation begins. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks vertical, if possible, and remove stones from bottom of trench as necessary to avoid point-bearing. Over-excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding.

B. Trench excavation side walls greater than 5 feet deep shall be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to exit ladder or steps shall not be greater than 25 feet in trenches 4 feet deep or deeper.

C. Perform excavation as indicated on Drawings for specified depths. During excavation, stockpile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.

D. Remove excavated materials not required or not suitable for backfill or embankments and waste as specified in Section 31 00 20. Structures discovered during excavation shall be disposed of as specified in Section 02 41 00.

E. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches or other excavations by pumping or other acceptable methods.

F. Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill. Dispose of unsuitable material and provide other suitable material at no additional cost to Owner.

G. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length, except where necessary to excavate for bell holes and proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.

H. Trench width on each side and below top of pipe shall not be less than 12 inches or more than 18 inches wider than outside surface of pipe or conduit that is to be installed to designated elevations and grades. Other trench width for pipe, conduit, or cable shall be the least practical width that will allow for proper cover and compaction of trench backfill.

I. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances, whichever is more stringent:

1. Water Mains: 30 inches to top of pipe barrel or 6 inches below frost line, established by local building official, whichever is deeper.
2. Sanitary Sewer: Elevations and grades as indicated on the Drawings.
3. Storm Sewer: Elevations and grades as indicated on the Drawings.

3.3 PIPE BEDDING

A. Accurately cut trenches for pipe or conduit that is to be installed to designated elevations, 4 inches below bottom of pipe and to width as specified herein. Place a minimum of 4 inches of bedding material, compact in bottom of trench, and accurately shape to conform to lower portion of pipe barrel.

3.4 BACKFILLING

A. Criteria: Do not backfill trenches until required tests are performed and utility systems comply with and are accepted by applicable to governing authorities. Backfill trenches as specified herein. If improperly backfilled, reopen to depth required to obtain proper compaction. Backfill and compact, as specified herein, to properly correct condition in acceptable manner.

B. Backfilling: After pipe or conduit has been installed, bedded, and tested as required, backfill trench or structure excavation with specified material placed as shown on Construction Drawings and in accordance with Section 31 00 20.

C. Backfill trenches to contours and elevations shown on the Drawings with acceptable materials.

D. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

3.5 COMPACTION

A. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

B. Maintain optimum moisture content of fill materials, as specified in Section 31 00 20, to attain required compaction density.

C. Materials used for backfill shall comply with requirements of ASTM D 2321 and Section 31 00 20.

END OF SECTION 312302

SECTION 312303 - EXCAVATION, BACKFILL, AND COMPACTION FOR PAVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Excavation to lines, grades, and configuration as shown on Construction Drawings for proposed pavement areas.

B. Fill to lines, grades, and configuration as shown on Construction Drawings for proposed pavement areas.

C. Compacting of materials in acceptable manner as specified.

1.2 RELATED SECTIONS

A. Section 31 00 20 – Earthwork

B. Section 31 05 16 – Aggregate Materials

C. Section 31 23 12 – Pavement Subgrade Preparation

D. Section 32 11 24 – Pavement Base Course [Parking Lots]

E. Section 32 12 21 – Asphaltic Cement Paving

F. Section 32 13 13 – Portland Cement Concrete Paving

G. Geotechnical Report for boring locations and findings of subsurface materials and conditions.

H. Construction Drawings

1.3 REFERENCE STANDARDS

A. See Section 31 00 20.

1.4 QUALITY ASSURANCE

A. The independent testing laboratory, selected by Owner or Owner's Representative and contracted directly with the Owner, will be retained to perform construction testing on filling operations and subgrade analysis in accordance with the Construction Drawings and as specified in Section 31 00 20 and within this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill material from on-site as specified in Section 31 00 20.

B. Fill material from off-site as specified in Section 31 00 20.

C. Aggregate material as specified in Section 31 05 16.

2.2 EQUIPMENT

A. Transport off-site materials to project using well maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Establish lines, elevations, and grades necessary to construct pavements, curb, curb and gutter, bases, sidewalk, and roadways as shown on Construction Drawings.

B. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

C. Locate and identify site utilities that have previously been installed and protect from damage.

D. Locate and identify existing utilities that are to remain and protect from damage.

E. Over-excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems. These areas shall be stabilized by using acceptable structural fill or aggregate material placed and compacted as specified in Section 31 00 20.

3.2 EXCAVATION

A. Excavate roadway and pavement areas to line and grade as shown on Construction Drawings.

B. Place suitable material into project fill areas as specified in Section 31 00 20.

C. Dispose of unsuitable excavated material in a manner and location that is acceptable to local governing authorities.

D. Perform excavation using capable, well maintained equipment and methods acceptable to local governing authorities.

3.3 FILLING AND SUBGRADE PREPARATION

A. Areas exposed by excavation or stripping shall have a minimum 10 inch thick layer of select fill placed and compacted. After which, all area where subgrade preparations for paving are to be performed shall be scarified to minimum depth of 9 inches and compacted to a minimum of 95 percent of optimum density, in accordance with ASTM D 698 at a moisture content of not less than 1 percent below and not more than 3 percent above optimum moisture content. These areas shall then be proof-rolled to detect areas of insufficient compaction. Proof-rolling shall be accomplished by making a minimum of 2 complete passes with fully-loaded tandem-axle dump truck weighing 25 tons minimum, or approved equal, in each of 2 perpendicular directions under supervision and direction of the independent testing laboratory. Areas of failure shall be excavated and recompacted as specified.

B. Fill materials used in preparation of the subgrade shall be placed in lifts or layers not to exceed 8 inch loose measure and compacted to a minimum density of 95 percent of optimum density, in accordance with ASTM D 698 at a moisture content of not less than 1 percent below and not more than 3 percent above optimum moisture content.

C. The following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of suitable fill materials to be used in specified areas, unless specifically stated otherwise on Construction Drawings:

	PI	LL
*Paving Area, below upper 2 feet	18	45
*Paving Area, upper 2 feet	18	45

*References to depth are to proposed subgrade surface elevations.

3.4 COMPACTION

A. Maintain optimum moisture content as specified to attain required compaction density.

B. Materials shall be tested in accordance with Section 31 00 20.

C. If compaction requirements are not complied with at any time during construction process, remove and re-compact deficient areas until proper compaction is obtained at no additional expense to Owner.

3.5 MAINTENANCE OF SUBGRADE

A. Finished subgrades shall be verified to ensure proper horizontal and vertical controls have been complied with and compacted conditions are satisfactory for construction above subgrade.

B. Use any methods necessary to protect the compacted subgrade from erosion, excessive moisture or drying conditions and wheel loading damage during construction from concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material equal to or better than best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.6 FINISH GRADING

A. Finish grading shall be in accordance with Construction Drawings and as specified in Section 31 00 20.

B. Check grading of paving areas by string line from grade stakes and/or blue tops set at not more than 50-foot centers. Tolerances of not more than 0.10-feet, will be permitted. Contractor shall provide engineering and field staking necessary for verification of lines, grades, and elevations.

END OF SECTION 312303

SECTION 31 2309 – ROCK REMOVAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Removal of identified and discovered rock during excavation.

B. Use of explosives to assist rock removal.

C. Incorporating removed rock into fills and embankments.

1.2 RELATED SECTIONS

A. Section 31 00 20 – Earthwork

B. Section 31 23 01 – Excavation, Backfill, and Compaction for Structures

C. Section 31 23 02 – Excavation, Backfill, and Compaction for Utilities

D. Section 31 23 03 – Excavation, Backfill, and Compaction for Pavement

E. Geotechnical Report for boring locations and findings of subsurface materials and conditions.

F. Construction Drawings

1.3 REFERENCE STANDARDS

A. National Fire Protection Association (NFPA) latest edition
   1. 95 Code For Explosive Materials

1.4 ENVIRONMENTAL REQUIREMENTS

A. Determine environmental effects associated with proposed work and safeguard those concerns as regulated by law and local governing authorities by reasonable and practical methods.

1.5 PROJECT CONDITIONS

A. Discrepancy between Drawings and Specifications regarding amount and type of rock to be removed shall immediately be brought to attention of Owner or Owner's Representative. Revised removal plan and schedule shall subsequently be provided and followed.

1.6 QUALIFICATIONS

A. Submit records of documented experience to Owner or Owner's Representative prior to removal of rock by blasting.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Explosives, detonator/delay device, blast mat materials and accessories shall be as recommended by explosive supplier and shall comply with requirements of applicable governing authorities.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify site conditions and note subsurface conditions affecting work of this section.

B. Establish required lines, grades, and elevations that will determine extent of proposed rock removals.

3.2 ROCK EXCAVATION

A. Rock excavation is defined as igneous, metamorphic, or sedimentary rock that cannot be removed by rippers or other mechanical methods, and therefore requires drilling and blasting. Cut rock to form level bearing at bottom of footing and trench excavations. In utility trenches excavate rock to 6 inches below invert elevation of pipe. Remove shale layers to provide sound and unshattered base for footings or foundations. Reuse excavated materials on site in accordance with Section 31 00 20.

B. Comply with laws, rules, and regulations (Federal, State, and local authorities and insurer) which govern storage, use, manufacture, sale, handling, transportation, licensing, or other disposition of explosives. Take special precautions for proper use of explosives to prevent harm to human life and damage to surface structures, utility lines, or other subsurface structures. Do not conduct blasting operations until persons in vicinity have had ample notice and have reached positions of safety.

C. Contractor shall save harmless Owner or Owner’s Representative, Architect, and Engineer from claims growing out of use of such explosives. Removal of materials of any nature by blasting shall be done in such manner and at such time as to avoid damage affecting integrity of design and to avoid damage to new or existing structures included in or adjacent to work. It shall be Contractor's responsibility to determine method of operation to ensure desired results and integrity of completed work.

D. Perform rock excavation in manner that will produce material of such size as to permit it being placed in embankments in accordance with Section 31 00 20. Remove rock to limits as indicated on the Drawings. Remove loose or shattered rock, overhanging ledges and boulders which might dislodge.

E. Use lean concrete or other acceptable materials to replace rock over-blast or over-excavation in building area to facilitate placement of utilities and future footings.

END OF SECTION 312309

SECTION 31 2312 – PAVEMENT SUBGRADE PREPARATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparing the subgrade of areas to be paved with either asphalt or concrete paving layers.

B. Furnishing and installing granular material to fill over-excavations or to replace removed unsuitable material.

1.2 RELATED SECTIONS

A. Site preparation is covered under Section 31 00 10.

B. Excavation and embankment are specified in Section 31 00 20.

C. Aggregate base course is specified in Section 32 11 24.

D. Asphaltic concrete paving is specified in Section 32 12 16.

E. Portland cement concrete paving is specified in Section 32 13 13.

1.3 REFERENCES

A. State Department of Transportation standard specifications for highway construction, as appropriate, latest edition.

B. AASHTO
1. T 96, "Resistance to Abrasion of Small Size Coarse Aggregate by Us of the Los Angeles Machine".
2. T 99, "The Moisture-Density Relations of Soils Using a 5.5-lb Rammer and a 12-in. Drop".
3. T 180, "The Moisture-Density Relations of Soils Using a 10-lb Rammer and an 18-in. Drop".
4. T 224, "Correction for Coarse Particles in the Soil Compaction Test".
5. T 238, "Density of Soil and Soil-Aggregate In-Place by Nuclear Methods".

1.4 SUBMITTALS

A. Submit data concerning source and quality of granular materials being furnished. Indicate frequency of quality control testing by the source supplier.

1.5 QUALITY ASSURANCE

A. Work under this section shall be accomplished by workers skilled and experienced in this kind of work, using equipment designed for this kind of work. Maintain equipment in good operating condition.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Granular material shall be delivered in trucks from the source and directly placed in the location required for construction, with no intermediate storage or stockpiling required, as far as practical.

B. Delivery of materials to be paid for by weight or volume measured in haul trucks shall include a truck ticket delivered to Owner or Owner's Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Refer to Section 31 00 20 for roadbed materials.

B. Refer to Section 31 05 16 for granular materials to fill over-excavations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine prior grading or excavation and embankment work for accuracy and adequacy of construction prior to starting subgrade construction.

3.2 SUBGRADE CONSTRUCTION

A. Prepare subgrade in such a manner as to ensure that the base course, surface course, or pavement will be placed on a firm foundation that is stable and reasonably free from dust pockets, wheel ruts, or other defects.

B. Scarify subgrade area to such depth as is necessary for shaping. Shape and compact to the required grade and section.

C. Unless a different compaction requirement is indicated on the Drawings, compact the top 8 inches of subgrade to a density of not less than 95 percent of maximum density at optimum moisture content obtained by AASHTO T 99, with correction for particles retained on the #4 sieve not to exceed 30 percent when measured in accordance with AASHTO T 224. If subgrade material contains more than 30 percent by weight retained on the #4 sieve, compact to not less than 95 percent of the maximum density at optimum moisture content obtained by AASHTO T 180.

D. Accomplish compaction by any satisfactory methods that will obtain the required density.

E. Adjust moisture content by the addition of water or by manipulation and aeration as necessary under conditions encountered.

F. Compaction operations may be omitted when an old stone or gravel roadbed is used as a foundation or subgrade for a base course or pavement where scarifying for shaping is unnecessary and its stability is approved by Owner or Owner's Representative.

G. Remove soft and yielding materials and other portions of the subgrade that will not compact readily when rolled or tamped. Fill holes or depressions made by this removal with approved material. Bring the entire subgrade to the lines, grade, and cross sections indicated on the Drawings. Compact to specified density.

H. If the succeeding course is not placed immediately after subgrade has been prepared and subgrade becomes cut up, rough, or unstable, re-shape and re-compact subgrade as previously specified.

I. Proof-roll subgrade prepared for road, curb and gutter, and sidewalks, prior to placement of base course or concrete. Proof-rolling vehicle shall be either a roller or loaded truck or scraper of sufficient weight to identify soft and yielding portions of compacted surface.

Proof-rolling pattern shall be approved by Owner or Owner's Representative, and shall generally include passes in two transverse directions.

J. If required by Owner or Owner's Representative, check lines and grades of subgrade by a straight edge or mechanical device to demonstrate that the subgrade is constructed to the lines and grades required by the Drawings, within allowable tolerances.

3.3 DIFFERING ADJACENT PAVEMENT SECTIONS

A. The Drawings indicate different pavement sections within the parking area, such as normal duty, medium duty, and heavy duty, or similar designations. These differing sections will be adjacent to each other. Since the different pavement sections will have different thicknesses of pavement and base course, yet will have a common surface elevation where the different sections adjoin, the difference must be made up in the subgrade lines and grades.

B. Prepare a plan sequence for subgrade preparation that takes into account logical construction of the different pavement sections. The proposed sequence of construction shall take into account the need to proof-roll subgrade. Submit plan to Owner or Owner's Representative for approval.

C. Construction requirements given in Paragraph 3.02 apply to the subgrade under all types of pavement. Scarification depth shall be measured from the top of each subgrade elevation.

D. Differing adjacent subgrade elevations shall be provided with a clean and sound edge. Measure the elevation difference to assure that correct lines and grades have been achieved.

E. Any material sloughed from the higher surface onto the lower shall be removed prior to placement of base course. Sloughed edges may be filled with aggregate base course material and do not have to be repaired with subgrade material.

3.4 FIELD QUALITY CONTROL

A. A testing laboratory will be contracted directly with the Owner to test the density of the base course in place and for thickness, at intervals determined by Owner or Owner's Representative. Density testing will be by AASHTO T 191 or T 238. Correct any deficiencies by scarifying, placing additional material, mixing, reshaping and re-compacting as necessary to obtain the specified density and the required lines, grades, and cross sections.

END OF SECTION 312312

SECTION 31 2501 – GENERAL REQUIREMENTS FOR EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General requirements for temporary erosion and sediment control systems while land-disturbing activities are occurring during construction.

1.2 RELATED SECTIONS

A. Section 31 25 52 – Erosion Control Logs [Wattles]

B. Section 31 25 63 – Silt Fencing

C. Section 31 25 70 – Stabilized Construction Entrance

D. Section 31 25 91 – Concrete Washout

E. Section 32 90 01 – Seeding, Mulching, and Sodding

1.3 REFERENCE DOCUMENTS

A. Stormwater Pollution Prevention Plan (SWPPP)

1.4 REGULATORY REQUIREMENTS

A. Discharge of stormwater from the construction site is regulated by Federal and State laws and regulations. The purpose of these is to minimize discharge of stormwater pollutants from construction activity and construction support activities.

B. Federal regulations are administered through a state-run permit system in most states, with Federal permits in only a few states. Construction General Permit (CGP) is the regulatory document governing stormwater discharges for this project. The permit requires that the operator ensure that the stormwater controls implemented at the site are consistent with all applicable Federal, State, and local requirements.

C. The permit also prohibits discharge of most non-stormwater discharges, including: concrete washout water; excavation dewatering water; vehicle washing water; solvents or lubricating fluids; other fluids.

1.5 PROJECT CONDITIONS

A. The Site and drainage areas immediately downstream do not include any known endangered species. The downstream waterway is not subject to TMDL limits, nor is it on the list of impaired waterways.

1.6 QUALITY ASSURANCE

A. Erosion and sediment control devices (also called best management practices, or BMPs) shall be installed by workers having training in the purpose of the devices. Foremen or site superintendents shall have similar training.

1.7 PERMIT PENALTIES

A. Responsibility for payment of any penalties by Federal, State, or local authorities based on violations of related laws is as follows.

1. Penalties assessed because of defects in the selection or design of BMPs shall be paid by Owner.
2. Penalties assessed because of ineffective installation of BMPs shall be paid by Contractor.
3. Penalties assessed because of ineffective or insufficient maintenance of BMPs shall be paid by Contractor.
4. Penalties assessed due to failure to conduct inspections when required and to document those inspections shall be paid by Owner.
5. Penalties assessed for inadequate storage or display of records or documents shall be paid by Contractor.
6. Penalties assessed for failure to update the SWPPP as required shall be paid by Owner.

B. Owner shall deduct the amount of penalties due from Contractor from monies owed to Contractor. Owner or Owner's Representative shall prepare a Change Order to reflect this deduction.

C. Where a penalty payable by Contractor is anticipated, but has not yet been assessed by a regulatory agency, and where that penalty may not be assessed for a period of months, Contractor may provide a financial assurance to Owner in lieu of having money withheld. Financial assurance may be a surety bond for the specific purpose, or an irrevocable letter of credit. The term shall be a minimum of two years, and the amount shall be the probably maximum amount of the fine.

PART 2 - PRODUCTS

2.1 POSTING AND RECORD STORAGE

A. Posting and record storage facilities are required for this project. Provide a suitable bulliten board and storage "mailbox"-type unit for this purpose. Location and details of construction may be shown on the Drawings. If they are not, use construction techniques customary in the area of the project. This shall include a rain gauge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install erosion and sediment control devices where indicated on and according to the details on the Drawings and requirements given in individual specification sections. Location of posting and record storage center, if required, shall be where indicated on the Drawings; or, if not indicated, in a place that is visible to the site entrance where the public and regulatory inspectors can easily see it from a public right-of-way.

B. Installation shall be approved by Owner or Owner's Representative prior to the start of land-disturbing activities. Make any changes required until erosion and sediment control devices are approved by Owner or Owner's Representative.

C. Deficiencies in or changes required to Drawings as applied to current conditions will be brought to the attention of Owner or Owner's Representative for remedial action.

D. Owner or Owner's Representative has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow, and embankment operations and to direct Contractor to provide immediate additional erosion and sediment control measures. Additional material and work required and authorized by Owner or Owner's Representative which is beyond extent of Drawings shall be paid for by Owner. Owner or Owner's Representative shall prepare a Contract Modification covering this.

3.2 MAINTENANCE

A. Perform maintenance of erosion and sediment control devices as often as necessary to keep them in effective working condition. Frequency of maintenance will be dependent on amount of run-off and amount of sediment build-up.

3.3 REMOVAL

A. Remove erosion and sediment control devices as soon as upstream site stabilization is completed, or when no longer needed to minimize erosion or control sediment.

B. Where erosion and sediment control devices are removed, restore areas to preconstruction conditions. However, regardless of pre-construction condition, areas shall not be left unstabilized.

3.4 SITE HOUSKEEPING

A. Maintain site in a manner to minimize potential stormwater pollution, including:
   1. trash and litter control, and
   2. spill prevention activities.

3.5 INSPECTIONS

A. Owner or Owner's Representative is responsible for conducting inspections required by the SWPPP, and for documenting those inspections in reports. Owner or Owner's Representative will provide Contractor copies of those inspection reports to store on site.

END OF SECTION 312501

SECTION 31 2552 – EROSION CONTROL LOGS [WATTLES]

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install erosion control logs (ECLs) as perimeter sediment controls and as part of temporary slope protection system.

B. Furnish erosion control logs at inlet protection and pipe inlet protection, with installation covered in other sections.

1.2 RELATED SECTIONS

A. 31 25 01 General Requirements for Erosion and Sediment Control

1.3 SYSTEM DESCRIPTION

A. ECLs form a part of a larger erosion and sediment control plan required according to an NPDES permit regulating the discharge of storm water and other pollutants from the site. Section 31 25 01 provides the permit number, and lists certain site and project conditions that affect the work of this section.

1.4 SUBMITTALS

A. Submit manufacturer's data sheets on all ECLs to be used on the project. Samples of ECLs will not be required.

1.5 QUALITY ASSURANCE

A. ECLs shall be the product of a manufacturer regularly engaged in the manufacture of ECLs. If the product proposed for use on the product is unknown to Owner or Owner's Representative, they may request proof of manufacturing experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Follow manufacturer's instructions concerning delivery, storage, and handling of ECLs.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. ECLs shall be manufactured at a factory and shipped as completed units ready for installation. ECLs built up at the site from netting and filler material are not acceptable.

B. Acceptable manufacturers and products: A.S.P. Enterprises, Inc., Big Red Curb Inlet Protector

C. Products of other manufacturers will be considered so long as they are equivalent to these in terms of function and quality.

D. Containment netting: flexible, natural or synthetic fiber netting. Acceptable netting types are:

1. Jute
2. Twine
3. Nylon

4. Polyethylene
5. Polypropylene

E. Filler material: shredded recycled rubber tires.

F. Diameters of ECLs are indicated on the Drawings. If the size of any installation is not indicated, use 12-inch diameter ECL at that location.

G. Stakes shall be wooden, either 1x2 or 2x2, with length sufficient to embed the stake 12 inches into the ground and extend 2 inches above the uncompressed ECL. Metal stakes may be allowed if of sufficient strength to serve the intended purpose.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation, examine the area where the ECL is to be placed. Advise Owner or Owner's Representative if conditions will not allow an ECL to be installed or work properly at the location.

3.2 PREPARATION

A. For perimeter controls, clear installation area of rocks and debris. Clear woody vegetation if required to make room for ECL.

B. For slope protection, grade as necessary until the slope is sufficiently smooth such that the ECL will have full contact with the ground for its entire length. Clear away rocks that would inhibit ECL contact with the ground.

3.3 INSTALLATION

A. Install ECLs used as perimeter controls according to the details and in the locations indicated on the Drawings. As a minimum, take the following installation steps.
   1. Cut a trench in which the ECL will be installed. Trench shall be approximately 2 inches deep, and as wide as the ECL diameter. Do not remove all topsoil and roots that remain after the trench is cut.
   2. Install ECLs in trench, establishing continuous contact between the ECL and the ground.
   3. Stake ECL to the ground approximately every 8 feet, or more frequently if required to maintain contact of ECL to ground. Stake should extend above ECL a minimum of 2 inches.
   4. Curl ends of ECL run slightly up-slope to facilitate ponding.
   5. Overlap adjoining ECL sections tightly to each other, with the overlap being at least the amount indicated on the Drawings. Don't butt ends together. At joints, drive stakes in a way that will cause the adjoining sections to push together.

B. Install ECLs used as inlet protection according to the details and in the locations indicated on the Drawings. On pavement anchor the ECL against displacement and floatation using weights and/or devices as recommended by the manufacturer. Overlap adjoining ECL sections tightly to each other, with the overlap being at least the amount indicated on the Drawings. Don't butt ends together.

3.4 FIELD QUALITY CONTROL

A. After installation of ECL, and before proceeding with soil disturbing activities upstream of ECL, check installation to be sure installation is correct. Assure full contact between ECL and ground.

B. Do not proceed with any land disturbing activities upstream of an ECL against which Owner or Owner's Representative has an objection as to the suitability of the location and installation. Make any changes required before proceeding with land disturbing activities.

3.5 MAINTENANCE

A. Routinely inspect ECLs to verify they are in good condition, including staking, anchoring, etc. Maintain the integrity of the control, including keeping the ECLs free of accumulated silt, debris, etc., until earthwork construction and permanent erosion control features are in place, and/or the disturbed area has been adequately stabilized.

B. Remove the accumulated sediment deposit when it reaches a depth of approximately 6 inches and dispose of it at an approved site in a manner that will not contribute to additional siltation.

C. Repair ECLs damaged by the sediment removal process using appropriate methods as approved.

D. Repair or entirely replace torn or punctured ECLs as required and as directed by Owner or Owner's Representative. Temporarily remove and replace erosion control logs as required to facilitate construction operations.

3.6 REMOVAL AND RESTORATION

A. Remove ECLs when area tributary to the ECL has been stabilized, with a minimum of 70 percent vegetative cover, or as directed by Owner or Owner's Representative.

B. General requirements for restoration are given in Section 31 25 01.

END OF SECTION 312552

SECTION 31 2563 – SILT FENCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Standard Silt Fence (no wire backing) (SSF)

B. Wire-Backed Silt Fence (WBSF)

C. Belted Silt Retention Fence (BSRF)

1.2 RELATED SECTIONS

A. Section 31 25 01 – General Requirements for Erosion and Sediment Controls

1.3 REFERENCES

A. ASTM:
1. D 4439 Terminology for Geosynthetics
2. D 4491 Test Methods for Water Permeability of Geotextiles by Permittivity
3. D 4533 Test Method for Trapezoid Tearing Strength of Geotextiles
4. D 4595 Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
5. D 4632 Test Method for Grab Breaking Load and Elongation of Geotextiles
6. D 4751 Test Method for Determining Apparent Opening Size of a Geotextile
7. D 4873 Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
8. D 5199 Test Method for Measuring the Nominal Thickness of Geosynthetics
9. D 5261 Test Method for Measuring Mass per Unit Area of Geotextiles
10. D 5493 Test Method for Permittivity of Geotextiles Under Load
11. D 6241 Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe
12. D 6461 Specification for Silt Fence Materials
13. D 6462 Practice for Silt Fence Installation

1.4 SUBMITTALS

A. Submit manufacturer’s data, catalogue pages, etc. for geofabrics and for wire backing, if required. Fabric information should include, as a minimum:
1. Apparent opening size
2. Permittivity
3. Flow Rate (Flux)

1.5 PROJECT CONDITIONS

A. Silt fencing is required to provide a silt barrier on the site during the term of land disturbing activities. This is to comply with the Construction General Permit and the SWPPP.

B. The intent is that silt fencing, in each location it is to be provided, be installed once as a measured and paid item. If, due to the length of construction, the amount of rainfall during the project, the amount of sediment collected and removed, removal and reconstruction of the silt fence is required, Contractor shall remove silt fence and install new silt fence at no additional payment. Fence posts may be reused if they are in good

condition and are not disturbed when removing old fabric or installing new. The wire backing may be left in place and reused under the same conditions. Simply installing new fabric with the old fabric left in place is not acceptable.

C. Average rainfall during the ____ months allotted for this construction is _____ inches. If during the course of construction, the cumulative rainfall amount is more than 50 percent greater than this, and if this added rainfall requires that the silt fencing be removed due to deterioration and normal wear, the removal and replacement will be at Owner's expense according to the applicable pay item.

1.6 QUALITY ASSURANCE

A. Silt fence systems shall be assembled and installed by workers who are experienced in this type of construction. A foreman or superintendent experienced in installing erosion and sediment control devices, and particularly silt fencing, shall oversee the work.

B. Silt fence that comes pre-assembled with fabric attached to posts at given intervals is acceptable for SSF provided:
1. the posts are at the spacing indicated on the Drawings;
2. the posts are long enough to have the depth of burial and above-ground projection required by the Drawings;
3. the filter fabric is one of the types specified; and
4. a sufficient amount of filter fabric is loose at the bottom to provide the embedment indicated on the Drawings.

C. Owner or Owner's Representative shall inspect silt fence installation prior to any earth disturbing activity from being performed in the area tributary to the silt fence.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle all materials in such manner as to preserve their quality and fitness for the work.

B. Store silt fence components so as to assure preservation of quality and fitness for the work. Stored materials shall be located so as to facilitate prompt inspection.

C. Any limitations on areas where materials can be stored are given in the General Requirements or on the Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Standard silt fence fabric shall be the equal of one of the following fabrics.
1. Propex, Geotex 2127
2. Thrace-Linq, GTF 170SF
3. Mutual Industries, WF 200
4. Hanes Geo, TerraTex SF-90

B. Silt fence fabric shall include enough UV inhibitors and stabilizers to provide a minimum of 1 year service life from outdoor exposure.

C. Belted Silt Retention Fence: fabric of spunbond polyester material, reinforced by internal scrim (or net), as manufactured by Silt-Saver, Inc.

D. Fence posts shall comply with the details indicated on the Drawings.

E. Wire backing shall be 16 gauge hog-wire type fence fabric, on a 4x4 spacing. Required width of fabric is indicated on the Drawings.

F. Fence ties shall be aluminum or steel. Plastic ties (zip or otherwise) are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine silt fence fabric to verify it is undamaged, and that it complies with the specifications.

B. Examine the area where silt fence is to be installed and verify that any initial clearing or grubbing has been done to allow for installation.

3.2 PREPARATION

A. Location where silt fence is to be installed shall be marked on the ground prior to beginning of installation.

B. Remove all debris from the surface that might hinder effective installation.

3.3 INSTALLATION – TRENCHING AND BACKFILL

A. Excavate embedment trench a minimum of 6 inches deep by 6 inches wide, unless other dimensions are indicated on the Drawings.
   1. Place excavated material on the upstream side of the trench
   2. Hand clear loose debris from trench.
   3. Place fence fabric in trench, flush on bottom and up the downstream side. Lay part of fabric that is to remain above ground on the ground on downstream side. Splice fabric when required, overlapping pieces in accordance with fabric manufacturer's recommendations, but not less than 6 inches. Do not incorporate short remnants of fabric into a longer fence run.
   4. Arrange fabric so that after it is raised to a vertical position it is not more than 18 inches high.
   5. Selvage end of silt fence shall always be placed on the non-buried end.
   6. Backfill trench with excavated material. Do not allow any stones or cobbles larger than 2 inches (in largest dimension) to be used in backfill. Backfill shall be free of deleterious materials, such as roots, trash, clods, sod, etc.
   7. Mound earthen material over the trench at least 2 inches higher than adjacent ground.
   8. Compact trench using mechanical compaction, taking care not to damage exposed fabric. A loaded wheeled vehicle may be used for compaction if approved by Owner or Owner's Representative and if compaction appears adequate to prevent washout of the trench backfill or piping under trench. A minimum of four passes of a vehicle weighing the equivalent of a loaded tandem-axle dump truck is the minimum compaction effort required. After compaction, top of backfill should be approximately level with adjacent grade.
   9. Where wire mesh backing is used, embed it a minimum of 2 inches into the trench prior to compaction, on the downstream side of the fabric.

B. Fence Assembly:
   1. Lift the slack fence fabric, and wire backing when used, from the ground and either lay on the other side of the ground or hold vertically in place to allow fence post installation.
   2. Install fence posts at the spacing indicated on the Drawings. Posts shall be driven into undisturbed earth just on the downstream side of the trench, as close

to the fabric as possible without puncturing or damaging fabric. Fence posts that wobble or otherwise do not seem firmly in place shall be removed and re-installed a short distance away.

3. Install a fence post at any splice location, and tie fabric to post as specified.
4. If wooden posts that cannot be driven are used, excavate holes with care; avoid damage to fabric and wire already installed. Annulus of holes must be backfilled to prevent posts from wobbling.
5. Tie the fabric, and wire backing when used, to fence posts as indicated on the Drawings.
6. When steel posts are used, nipples shall face away from fabric.

C. Inspect completed fence to verify that:
1. fabric is properly embedded;
2. fabric is properly lapped and spliced when necessary;
3. fabric is free of punctures or other damage;
4. trench is properly backfilled;
5. wire mesh, where used, is properly embedded;
6. posts are properly spaced;
7. fabric (and wire when used) are tied to posts at the required frequency; and
8. no opportunity exists for run-off to go through, under, or around the silt fence.

D. If the fence is in any way found not to comply with these specifications, or to result in an installation that will not comply with the SWPPP and the NPDES permit, repair or remove and replace the fence to bring into compliance.

E. The mere laying the lower portion of the fence fabric on the ground and covering it with a layer of earthen material (i.e. not digging an embedment trench) is not acceptable.

3.4 INSTALLATION BY MACHINE SLICING

A. The fabric shall be inserted by a machine in a slit in the soil 8 to 12 inches deep with the selvage edge on top. The slit shall be created such that a soil-slicing blade slightly disrupts soil upward as the blade slices through the soil. Directly behind the soil-slicing blade, the fabric shall be mechanically inserted down into the soil slit such that 8-12 inches of the fabric is below the ground surface. Soil slicing and fabric installation is a simultaneous operation using specialized equipment, achieving consistent placement and depth. No turning over (plowing) of soil is allowed for the slicing method. Compact the soil immediately next to the fabric as indicated in ¶ 3.03.

B. Post embedment and spacing, and fabric-to-post connections, shall be the same as specified elsewhere in this section.

3.5 INSTALLATION OF BSRF

A. Install BSRF according to manufacturer’s recommendations as to: type and size of post; post spacing; height of fabric above ground; and method of fastening fabric to posts.

B. Embedment of fabric shall be essentially the same as described in paragraph 3.3

3.6 MAINTENANCE

A. Silt fence shall be maintained during the entire project, or for whatever portion of the project it is required for controlling sediment movement from the site. The SWPPP and the Drawings indicate required specific sequencing of construction, if any.

B. Maintenance of silt fence includes:
1. Removal of accumulated sediment when it exceeds 1/3 of the fabric height.

2. Repair of damage due to construction activities.
3. Repair of damage due to normal wear and tear.
4. Correction of any defects discovered from inspections during the project, such as ineffective bedding or improper joints.

C. When silt fencing deteriorates to the point that it no longer functions as an effective silt barrier, replace with new silt fencing complying with this section.

END OF SECTION

SECTION 312570 - STABILIZED CONSTRUCTION ENTRANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnishing, installing, maintaining, and removing temporary stabilized construction entrances.

1.2 RELATED SECTIONS

A. Section 31 25 01 – Erosion and Sediment Control – General Requirements

1.3 QUALITY ASSURANCE

A. See Section 31 25 01.

1.4 SUBMITTALS

A. If a manufactured system will be used, submit manufacturer's information for that system.

PART 2 - PRODUCTS

2.1 MATERIALS

A. 3 to 6 inch diameter stones, a mixture roughly equivalent to that used by various State highway departments, often with the name "Stone Backfill". Shall be free of shale and excessive fines.

B. Non-woven polypropylene, adequate weight to support stones and traffic loads. Alternate fabrics may be submitted to Owner or Owner's Representative for review and approval.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Strip topsoil from area to serve as stabilized construction entrance, and grade as required.

B. Install filter fabric. Maintain contact between fabric and soil beneath.

C. Install stones according to the details on the Drawings.

3.2 MAINTENANCE

A. When the spaces between the top stones begin to be clogged with sediment, restore the construction entrance to its intended function by top dressing with more stones or by mechanically mixing the stones. Washing sediment away from stones is not a preferred practice, unless the washed sediment is properly contained and treated.

3.3 REMOVAL

A. When no longer required, remove according to Section 31 25 01.

END OF SECTION 312570

SECTION 312591 - CONCRETE WASHOUT SYSTEMS AND PRACTICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Temporary concrete washout station, either pre-fabricated or self-installed.

1.2 RELATED SECTIONS

A. Section 31 25 01 – General Requirements for Erosion and Sediment Control

1.3 REFERENCE DOCUMENTS

A. As listed in Section 31 25 01.

1.4 QUALITY ASSURANCE

A. Provide a site superintendent or foreman who has had education and experience in the purpose of concrete washout containment.

B. Enforce concrete washout procedures on subcontractors and ready-mix concrete supplier.

PART 2 - PRODUCTS

2.1 SELF-INSTALLED SYSTEMS

A. Plastic liner: 6 mil (minimum) thick polyethylene sheeting, free from slits, holes, or other defects that will prevent it from containing concrete washout water.

B. Other materials, such as wood frames, frame stakes, alternate wall materials, etc. shall be suitable for the intended purpose.

2.2 PRE-FABRICATED SYSTEMS

A. Specially made for concrete washout; undamaged from prior use; leak free; adequately sized for the washout needs of the project, including rainfall allowance and freeboard. Hopper material may be metal or plastic.

PART 3 - EXECUTION

3.1 SITING

A. The Drawings indicate a location for the concrete washout station. An alternate location may be proposed. Obtain Owner’s or Owner Representatives’s approval before changing location. Washout station shall not be within 50 feet of a storm drain.

B. Locate near a stabilized construction entrance or provide a dedicated stabilized construction entrance for the washout facility.

C. Either provide signage to the washout facility or provide a person to direct concrete trucks to the washout area.

3.2 SELF-INSTALLED SYSTEM

A. Size self-installed systems based on anticipated amount of washout water, plus an allowance for rainfall, plus 4 inches of freeboard. Both above ground and below ground systems are allowed.

B. Liner shall make continuous contact with soil beneath so as to avoid tears when washout water is dumped.

3.3 PRE-FABRICATED SYSTEMS

A. Securely anchor against movement from bumping. Install reasonably level to allow full capacity of hopper to be used.

3.4 OPERATION AND MAINTENANCE

A. Washout practices:
   1. Perform washout of concrete trucks offsite or in designated concrete washout areas only.
   2. Do not wash out concrete trucks onto the ground, or into storm drains, open ditches, streets, or streams.
   3. Do not allow excess concrete to be dumped onsite, except in designated concrete washout areas.
   4. Perform washout in a manner that minimizes spray and splatter outside the containment area.

B. Remove accumulated concrete solid and liquid waste when necessary to maintain washout containment capacity for future concrete work. If cleaning damages the liner of a self-installed system, replace the liner before any more concrete washout occurs.

3.5 CLEANING

A. Upon completion of concrete work, remove accumulated concrete solid waste and any residual liquid waste and dispose off-site according to regulations. This includes removal of visible concrete solids that have fallen near the washout station, and any contaminated soils.

B. Dismantle self-installed system and remove non-soil materials from site. Remove pre-fabricates systems from site.

C. Restore washout area in accordance with Section 31 25 01.

END OF SECTION 312591

SECTION 313116 – TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Provide soil treatment for termite control, as herein specified.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Supplementary Conditions, and Division 01 Specification sections, apply to work of this section.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and application instructions.

1.4 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work, including preparation of substrate and application.

B. Engage a professional pest control operator, licensed in accordance with regulations of governing authorities for application of soil treatment solution.

C. Use only termiticides which bear a Federal registration number of the U.S. Environmental Protection Agency.

1.5 JOB CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.6 SPECIFIC PRODUCT WARRANTY

A. Submit under provisions of Section 01 78 00. Furnish written warranty certifying that applied soil termiticide treatment will prevent infestation of subterranean termites and, that if subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.

1. Bid Alternate: At Owner's option, at the termination of the guarantee, an extension renewal of inspections and service treatment shall be made available to Owner.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT SOLUTION

A. Use an emulsible concentrate termiticide for dilution with water, specially formulated to prevent infestation by termites. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements and concentrations:

1. Chloropyrifos ("Dursban TC"); 1.0 percent in water emulsion.

2. Permathrin ("Dragnet", "Torpedo"); 0.5 percent in water emulsion.

B. Other solutions may be used as recommended by Applicator if also acceptable to Owner's Representative and approved for intended application by jurisdictional authorities. Use only soil treatment solutions which are not injurious to planting.

PART 3 - EXECUTION

3.1 APPLICATION

A. Surface Preparation: Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placement of compacted fill under slabs, if recommended by toxicant manufacturer.

B. Application Rates: Apply soil treatment solution as follows:

C. Under slab-on-grade structures, treat soil before concrete slabs are placed, using the following rates of application:

1. Apply 4 gallons of chemical solution per 10 linear feet to soil in critical areas under slab, including entire inside perimeter inside of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.
2. Apply 1 gallon of chemical solution per 10 square feet as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallons of chemical solution to areas where fill is washed gravel or other coarse absorbent material.
3. Apply 4 gallons of chemical solution per 10 linear feet of trench, for each foot of depth from grade to footing, along outside edge of building. Dig a trench 6 to 8 inches wide along outside of foundation to a depth of not less than 12 inches. Punch holes to top of footing at not more than 12 inches o.c. and apply chemical solution. Mix chemical solution with the soil as it is being replaced in trench.

D. At expansion joints, control joints, and areas where slabs will be penetrated, apply at rate of 4 gallons per 10 linear feet of penetration.

E. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs when areas are covered by other construction.

F. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION 313116

SECTION 318000 - GENERAL REQUIREMENTS FOR SITE RESTORATION

PART 1 - GENERAL

1.1 SCOPE

A. This section includes restoration of areas disturbed by this project. "Disturbed by this project" is defined as the excavation area plus any area in project vicinity disturbed by Contractor's operations, including operations of Subcontractors and suppliers, and utility owner operations necessary to complete this project.

B. Keep work areas as clean and neat as practicable. Lawns, gardens, and vehicle and pedestrian crossings shall have excess quantities of supplies, excavated material, man made debris, and organic matter removed from the area immediately following construction.

C. All property improvements shall be restored in kind or as nearly as practicable as determined by Owner or Owner's Representative.

1.2 RELATED WORK

A. Earthwork is specified in Section 31 00 20.

1.3 QUALITY ASSURANCE

A. Adequate equipment and qualified personnel shall be applied to this phase of the work from the beginning of the project.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil shall be placed on disturbed areas equal to or better than the material on each side of the disturbed area.

2.2 FERTILIZER

A. Fertilizer shall be 10-20-10 (nitrogen-phosphorous-potash) delivered to the site in labeled containers conforming to Arkansas fertilizer laws and bearing the name and warranty of the producer.

2.3 SEED

A. Seed mixture per Class of Restoration
   1. Class 1 Restoration seed mixture shall be 40 percent Lawn Fescue, 30 percent Rye Grass (annual), and 30 percent Blue Grass.
   2. Class 2 Restoration seed mixture shall be 40 percent Field Fescue, 40 percent Rye Grass (annual), and 20 percent White Clover (common).
   3. Class 3 Restoration seed mixture shall be 40 percent Tall Fescue (Kentucky 31), 40 percent Rye Grass (annual), and 20 percent White Clover (common).

B. Seed shall be 95 percent pure and 85 percent germination by weight. 50 noxious weed seeds shall be the maximum amount allowed per pound. The following types of seed are not allowed in any amount: Johnson grass, wild onion, wild garlic, field bindweed, or nut grass.

C. Fescue seed shall be certified endophyte free.

2.4 SOD

A. Sod shall consist of a densely rooted growth of Bermuda grass, Zoysia, or Fescue per the drawings, and shall be substantially free from noxious weeds and undesirable grasses. The sod shall be cut in uniform strips with a minimum of 2 inches of root depth approximately 12 inches in width and not less than 12 inches in length but not longer than can be conveniently handled and transported.

B. Sod for replacement of disturbed sodded areas shall be approved by Owner or Owner's Representative before cutting.

2.5 MULCH

A. Straw mulch shall be good grade clean straw, free of weeds or seed, and of a quality approved by Owner or Owner's Representative prior to use.

2.6 WATER

A. Water shall be of irrigation quality, free of impurities which are detrimental to plant growth.

PART 3 - EXECUTION

3.1 SURFACE NOT GRAVELED OR PAVED FOR VEHICLE OR PEDESTRIAN USE.

A. Class 1 Restoration – Areas of construction within lawns, gardens, or other well-kept areas, including street rights-of-way that are kept as lawns by adjacent landowners.
   1. After trench settlement is complete, replace topsoil to same depth as adjacent undisturbed areas.
   2. Trim and remove all damaged limbs on trees, trim limbs of shrubs or, if necessary, cut damaged shrub just below ground surface.
   3. Hand rake disturbed area to remove all rocks 1/2 inch or larger measured in any direction, all man-made debris, and all organic material. Debris and excess material shall be disposed of in a manner approved by the Owner or Owner's Representative and applicable government regulations.
   4. After raked area is accepted by Owner or Owner's Representative for seeding,
      a. apply 250 pounds of fertilizer per acre.
      b. apply 0.15 pounds of seed per 100 square feet.
      c. apply 4,000 pounds of mulch per acre.
   5. Apply straw mulch using an asphalt mixing blower. Add asphalt to straw in sufficient quantity to bind mulch together. Top spraying of straw with asphalt is not acceptable.
   6. As an alternate method of seeding, seed may be applied by hydro mulching. The seed shall be mixed with water and wood cellulose fiber. The wood cellulose fiber shall be composed of natural wood chips and shall contain no growth or germination inhibiting factors and shall contain a water soluble, nontoxic coloring agent.
   7. Other alternate methods will be considered by Owner or Owner's Representative but shall not be utilized until expressly authorized by Owner and Owner's Representative.
   8. Where ground cover adjacent to disturbed areas contains grasses such as Bermuda grass, Zoysia, or other grasses not included in the prescribed seed mixture, Contractor shall remove and stockpile the existing sod on the job site. After trench settlement is complete, the sod shall be replaced to a condition equal to, or better than, that prior to construction. In the event that insufficient sod has been stored, or sod has been lost or destroyed, the Contractor shall be responsible for providing and installing new ground cover of the existing type.

B. Class 2 Restoration – Areas of construction within fields, meadows, and street rights-of-way which are mowed or cultivated (gardens excepted).
   1. Tree and shrub treatment shall be as specified in Section 3.1.A.2.
   2. After trench settlement is complete, machine rake to remove rock, man made debris, and organic material to a condition equal to existing surface on the better side of the adjacent property.
   3. Remove all excess excavated material from the site, including excess material which has accumulated around fence posts, trees, mailboxes, etc. All areas which have been disturbed, such as that caused by equipment tracks, shall be carefully backfilled and repaired as though it were a part of the actual trench excavation.
   4. After raked area is accepted by Owner or Owner's Representative for seeding,
      a. apply 250 pounds of fertilizer per acre.
      b. apply 0.15 pounds of seed per 100 square feet.
      c. apply 4,000 pounds of mulch per acre.
   5. Mulching and seeding methods shall be as specified in Section 3.1.A.
   6. Where existing field grass adjacent to disturbed areas contains grasses such as Bermuda, etc. grasses not included in the prescribed seed mixture, Contractor shall place such topsoil as required and seed with the existing type grass so that an equivalent ground cover will be provided.

C. Class 3 Restoration – Areas of construction that are heavily brushed or wooded, steep rocky slopes, or other areas where it is not practical for the area to be cultivated.
   1. Tree and shrub treatment shall be as specified in Section 3.1.A.2.
   2. Site raking shall be as specified in Section 3.1.B.2.
   3. Seeding shall be as specified in Section 3.1.B.3.
   4. Mulching and seeding methods shall be as specified in Section 3.1.A.

3.2 RESTORATION OF SLOPES

A. Terrace slopes where, in the opinion of Owner or Owner's Representative, erosion problems may arise after construction.

3.3 RESTORATION BY SODDING

A. Area to be sodded
   1. Place 3 inches of topsoil before installing sod.
   2. Apply 250 pounds of fertilizer per acre and work into top 1 inch of topsoil.
   3. Make surface of top soil moist and firm (not compacted) at the time sod is placed.

B. Sod
   1. Moisten sod before placing.
   2. Lay by hand along contour lines beginning at lowest elevation.
   3. Stagger transverse joints.
   4. Make tight joints between sod pieces.
   5. Cut sod into existing surface and backfill with topsoil to provide a smooth transition from sodded areas to non-sodded areas.
   6. Apply thin layer of topsoil over sod and over-seed with 45 pounds of annual rye grass per acre.

C. Maintenance of Sod

D. Water over-seeded areas as directed by Owner or Owner's Representative.
   1. Apply water to sod for 3 weeks as directed by Owner or Owner's Representative.

3.4 HARD SURFACED FOR VEHICLE OR PEDESTRIAN USE

A. Pavement: Restore damaged pavement sections to existing joints or a sawed joint.

B. Asphalt Surfaces

1. Asphalt Pavement Repair. After the trench has been backfilled and compacted, as specified elsewhere in these Specifications, permanent repair shall be made as follows. The existing pavement shall be saw-cut and removed (including base) to a point 18 inches beyond the trench edge, or as directed by Owner or Owner's Representative.
2. Asphalt pavement shall match the pavement adjacent to the disturbed area, complying with applicable highway department standards.
3. New granular base course shall match existing base in thickness or have following minimum thickness, whichever is greater.
    a. 4 inches for areas used mainly by pedestrians.
    b. 8 inches, placed in two courses, for areas used mainly by vehicles.
    c. Compact each course to a density, as determined by AASHTO T191 or T238, of not less than 95 percent of maximum density determined by AASHTO T180
4. Apply prime coat to base course at rate of 0.25 gallons per square yard.
5. New asphalt pavement shall match existing asphalt in thickness or have following minimum thicknesses, whichever is greater.
    a. 2 inches for areas used mainly by pedestrians.
    b. 4 inches for areas used mainly by vehicles.
6. Place hot mixed, hot laid asphalt in maximum lifts of 2 inches compacted to 92 percent of the theoretical density to an elevation matching the existing finished grade.
7. One nuclear density test per asphaltic patch or repair shall be performed.
8. Any unacceptable patch or repair shall be recompacted and retested without additional expense to Owner.

C. Concrete Surfaces

1. Concrete shall meet the requirements of Section 03 31 60.
2. Replace damaged pavement areas to existing joints or a sawed joint which is more than 3 feet from an existing joint.
3. New concrete pavement shall match existing pavement in thickness and reinforcement or have following minimum thicknesses, whichever is greater.
    a. 4 inches for areas used mainly by pedestrians.
    b. 6 inches for areas used mainly by vehicles.
4. New concrete pavement shall match elevation of pavement being replaced before it was damaged or to elevation directed by Owner or Owner's Representative.

D. Maintenance of Traffic

1. Carry on the Work in a manner which will cause the least interruption to traffic. All roads and highways shall be kept open to traffic at all times.
2. Provide adequate personnel to direct traffic when working in the street right-of-way.
3. Traffic control devices and methods shall be in strict accordance with the latest issue of the Manual of Uniform Traffic Control Devices.

END OF SECTION

SECTION 321123 – PAVING BASE COURSE [PARKING LOTS]

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Construction of granular base for asphaltic concrete and Portland cement concrete paving.

1.2 RELATED SECTIONS

A. Section 31 00 10 – Site Preparation

B. Section 31 00 20 – Earthwork

C. Section 31 05 16 – Aggregate Materials

D. Section 31 23 03 – Excavation, Backfill, and Compaction for Pavement

E. Section 31 23 12 – Paving Subgrade Preparation

F. Section 31 32 13 – Soil Stabilization

G. Section 32 12 16 – Asphaltic Concrete Paving

H. Section 32 13 13 – Portland Cement Concrete Paving

I. Section 32 90 00 – Landscaping

J. State Highway Department Standard Specifications

K. Construction Drawings

1.3 REFERENCES

A. ASTM Interational (ASTM) latest edition
   1. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN.m/m3))
   2. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 Kn.m/m3))
   3. D 2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
   4. D 2487 Classification of Soils for Engineering Purposes
   5. D 2922 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
   6. D 3017 Water Content of Soil and Rock In Place by Nuclear Methods (Shallow Depth)
   7. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
   1. T 88 Particle Size Analysis of Soils

1.4 QUALITY ASSURANCE

A. An independent testing laboratory, selected by Owner or Owner's Representative and contracted directly with the Owner, will be retained to perform construction testing of in-place base course for compliance with requirements for thickness, compaction, density, and tolerances. Paving base course tolerances shall be verified by rod and level readings on not more than 50 foot centers and shall not be more than 0.05-feet above subgrade design elevation to allow for paving thicknesses as indicated on Construction Drawings. Contractor shall provide instruments and suitable benchmark.

B. Following tests shall be performed on each type of material used as base course material:
   1. Moisture and Density Relationship: ASTM D 698 (or ASTM D 1557)
   2. Mechanical Analysis: AASHTO T 88
   3. Plasticity Index: ASTM D 4318
   4. Base material thickness: Perform 1 test equally spaced for every 20,000 sq. ft of in-place base material.
   5. Base material compaction: Perform 1 test equally spaced for each lift for each 20,000 sq. ft. of in-place base material.
   6. Test each source of base material for compliance with applicable state highway department specifications.

C. Field density tests for in-place materials shall be performed in accordance ASTM D 2922 (Method B-Direct Transmission).

D. The independent testing laboratory shall prepare reports that indicate test location, elevation data, and test results. Owner, Owner's Representative, and Contractor shall be provided with copies of reports within 96 hours of time test was performed. In event that test performed fails to meet Specifications; Owner or Owner's Representative and Contractor shall be notified immediately by the independent testing laboratory.

E. All costs related to retesting due to test failures shall be paid for by Contractor at no additional expense to Owner. Owner reserves right to employ an independent testing laboratory and to obtain a second opinion when deemed necessary. Contractor shall provide free access to site for testing activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate base course materials are specified in Section 31 05 16.

B. Submit materials certificate to the independent testing laboratory which is signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that the subgrade has been inspected, tested, and gradients and elevations are correct, dry, and properly prepared in accordance with Section 31 23 03 and Section 31 23 12.

3.2 AGGREGATE BASE COURSE CONSTRUCTION

A. Place base course material on completed and approved subgrade or existing base that has been bladed to substantially conform to the grade and cross sections indicated on the Drawings.

B. Subgrade shall be free from excess or deficiency of moisture at the time of placing base course material. There shall be no standing water on subgrade. Do not place base course material on frozen subgrade.

C. Perform base course construction in manner that will drain the surface properly and prevent runoff from adjacent areas from draining onto base course construction.

D. Place aggregate on subgrade or other base course material and spread uniformly to such depth and lines that when compacted it will have the thickness, width, and cross section indicated on the Drawings. If specified compacted depth of base course exceeds 6 inches, construct base in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches.

E. Compact by any satisfactory method that will produce specified density. Maintain aggregate substantially at optimum moisture content during mixing, spreading, and compacting operations. Add water or aerate to dry as necessary. Maintain specific grade and cross section by blading throughout compaction operation.

F. Unless indicated otherwise on the Drawings, compact material in each layer to a density of not less than 100 percent of maximum density at optimum moisture content in accordance with AASHTO T 180. Compact aggregate across full width of application.

G. Spread base course material the same day that it is hauled. Do not use any base course material that becomes contaminated with the underlying strata. Perform spreading in such a manner that no segregation of coarse and fine particles nor nests or hard areas caused by dumping aggregate on subgrade will exist. Take care to prevent mixing of subgrade with base course material in blading and spreading.

H. When base course is placed adjacent to an existing or newly constructed asphalt surface course, do not dump or mix aggregate on the pavement surface. Use mechanical spreading equipment, if necessary, to place base course on subgrade.

I. If sufficient working space is not available to allow proper aeration or addition of water to base course material, mix the base course material by any satisfactory method prior to placement.

J. Maintain base course in a satisfactory condition until accepted, and afterward until paving courses are constructed.

3.3 SPECIAL REQUIREMENTS FOR PARKING LOTS

A. Where adjacent pavement sections differ (such as regular duty, medium duty, or heavy duty, or similar designations), base course thickness may be different for the adjacent courses, and the subgrade elevation may be different. In such circumstances, base course layers shall be constructed with sharp edges to facilitate pavement construction.

B. For asphalt pavement construction: If base course layer has a sloping edge, at a location of discontinuous finished base course elevations, strike off the sloping portion of the edge to provide a surfice consistent with differing thicknesses of asphalt course.

C. For Portland cement concrete pavement: A sloping edge of the base course may be allowed by Owner or Owner’s Representative if, in their opinion, the sloping edge will not be detrimental to construction of the pavement.

3.4 ACCEPTANCE

A. Acceptance will be based on meeting compaction requirements and having the finished surface to within 0.5 inches of plan grade and having the specified thickness.

B. Acceptance requires that the completed base course surface provide positive drainage according to the planned final pavement surface with exactly the correct thickness of asphalt. If it appears, in the judgment of Owner or Owner's Representative, that paving course(s) placed correctly will not drain because the base course elevations are not correct, additional work on the base course will be required.

C. If enough time lapses between construction of the base course and construction of pavement courses such that the continued satisfactory condition of the base course is questionable, Owner or Owner's Representative may require that more work be done to the base course and that its acceptability be demonstrated again.

END OF SECTION

SECTION 321201 - COLD MILLING ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cold milling of existing asphalt street pavement where required to allow construction of new roadway configuration.

B. Removal of milled material from the site.

1.2 RELATED SECTIONS

A. Hot mix asphaltic cement paving is covered in Section 32 12 21.

B. Demolition is included in Section 02 41 00.

1.3 REFERENCES

A. DOT “Standard Specifications for Highway Construction.”

1.4 QUALITY ASSURANCE

A. Work under this section shall be accomplished using workers and operators experienced in this type of work. Equipment used shall be suitable for this type of work, and shall be maintained in good working condition.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 EQUIPMENT

A. Provide self-propelled equipment with sufficient power, traction, and stability to maintain an accurate depth of cut and slope. The equipment shall be capable of accurately and automatically establishing profile grades along each edge of machine by referencing from the existing pavement by means of a ski or matching shoe or from an independent grade control and shall have an automatic system for controlling cross slope at a given rate. The milling machine shall have an effective means for preventing dust resulting from the operation from escaping into the air.

3.2 CONSTRUCTION REQUIREMENTS

A. Cold mill existing pavement to the depth indicated on the Drawings or as required to obtain the pavement cross-section required.

B. Use number of passes and the depth of each pass required to obtain the total depth to be removed, unless a specific number of passes is indicated on the Drawings.

C. Taper transverse joint at the end of the day to provide a smooth ride. When cold milling of asphalt pavement results in vertical differentials at the lane lines or at the edge of the traveled lanes, comply with maintenance of traffic requirements.

D. At the end of the day’s run, vertical differentials will only be permitted at the centerline or lane lines.

E. Operate equipment at a rate of travel that will provide a surface meeting the applicable requirements.

END OF SECTION 321201

SECTION 321216 – ASPHALTIC CONCRETE PAVING – MARSHALL MIX

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Placement of asphaltic paving, including prime coat materials and installation, and hot mix asphalt binder and surface courses.

1.2 RELATED SECTIONS

A. General quality control requirements and the division of responsibilities for laboratory and field testing are specified in Division 01 of the Project Manual.

B. Site preparation is specified in Section 31 00 10.

C. Earthwork is specified in Section 31 00 20.

D. Subgrade preparation and base course construction are specified Section 31 23 03.

E. Concrete curbs and gutters and sidewalks are specified in Section 03 31 60.

1.3 REFERENCES

A. AASHTO

1. M 17, "Mineral Filler for Bituminous Paving Mixtures".
2. M 81, "Cut-Back Asphalt (Rapid-Curing Type)".
3. M 140, "Emulsified Asphalt".
4. M 145, "The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes".
5. M 208, "Cationic Emulsified Asphalt".
6. M 226, "Viscosity Graded Asphalt Cement".
7. T 30, "Mechanical Analysis of Extracted Mixture".
8. T 44, "Solubility of Bituminous Materials in Organic Solvents".
9. T 48, "Flash and Fire Points by Cleveland Open Cup".
10. T 49, "Penetration of Bituminous Materials".
11. T 51, "Ductility of Bituminous Materials".
12. T 78, "Distillation of Cut-Back Asphaltic (Bituminous) Products".
13. T 96, "Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine".
14. T 102, "Spot Test of Asphaltic Materials".
15. T 104, "Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate".
16. T 166, "bulk Specific Gravity of Compacted Bituminous Mixtures".

B. ASTM standards may be substituted for the listed AASHTO standard when the standards are essentially the same.

C. State highway standards are not listed specifically. Apply all State standards that are appropriate to local practice, and which supersede or supplement the AASHTO standards listed.

1.4 SUBMITTALS

A. Submit product information on prime coat and tack coat products, and on asphalt cement when requested by Owner or Owner's Representative.

B. Submit mix design information in accordance with Paragraph 2.04.

C. Submit source quality control information when requested by Owner or Owner's Representative in accordance with Paragraph 2.05.

1.5 QUALITY ASSURANCE

A. Testing for materials and construction performance shall be at the option of Owner, or as specified herein. Owner has the authority to require any test needed, in their opinion, to demonstrate that the quality of the construction materials or workmanship meet the specified requirements.

B. Site tests shall be made in the presence of Owner or Owner's Representative. Required tests must demonstrate compliance with the specifications before the paving work will be accepted.

1.6 DELIVERY, STORAGE, AND HANDLING

A. ACHM mixtures shall be transported from mixing plant to the Work in vehicles with clean, tight beds.

B. When mixtures are hauled more than 15 miles, or when mixtures are being placed between November 1 and April 1, cover beds of vehicles with canvas or other suitable material to retard loss of heat. Cover shall extend over the sides and ends of truck bed and shall be securely fastened. Store cover on truck at all times regardless of haul distance or time of year.

C. Provide sufficient vehicles to provide a continuous operation on the roadway.

D. Use only non-petroleum release agents.

PART 2 - PRODUCTS

2.1 SOURCES

A. Obtain aggregate from a permanently established quarry regularly engaged in supplying mineral aggregates for asphaltic concrete mixtures. Quarry shall have an established quality control program.

B. Obtain asphalt cement from sources that have executed a certification agreement with the State Department of Transportation.

C. Obtain asphaltic concrete mixtures from a permanently established mixing plant regularly engaged in supplying paving materials conforming to State DOT specifications. Owner or Owner's Representative will not be inspecting or monitoring operations of the plant.

2.2 PRIME AND TACK COATS

A. Prime coat shall be emulsified petroleum resin, EPR-1, manufactured by Blackridge, or equal.

B. Bituminous tack coat shall be rapidly curing cutback asphalt conforming to AASHTO M 81, or an emulsified asphalt conforming to AASHTO M 140 or M 208. Cationic emulsified asphalt shall have a minimum Saybolt Furol Viscosity at 122 degrees F at the point of manufacture of 200 seconds, and a maximum Saybolt Furol viscosity of 500 seconds.

2.3 ASPHALTIC CONCRETE

A. Mineral Aggregates

1. Mineral aggregates for asphaltic concrete binder course and surface course shall consist of combinations of coarse aggregate, fine aggregate, and mineral filler proportioned as provided for in the specific mix designs.
2. Coarse aggregate is that fraction retained on the No. 10 sieve and shall consist of crushed gravel, crushed stone, or slag.
3. Fine aggregate is that fraction passing the No. 10 sieve, and shall consist of clean, hard, durable particles of natural or manufactured sand or combinations of the two. Natural sand shall meet the requirements of AASHTO M 145 except that a maximum of 35 percent may pass the #200 sieve. Fine aggregate may contain a maximum of 2 percent coal and lignite by weight of the fine aggregate.
4. Crushed stone shall consist of clean, hard, durable fragments of rock of uniform quality, free from an excess of soft particles. The stone shall have a percent of wear, measured by AASHTO T 96, not greater that 40, and when subject to 5 cycles of the Sodium Sulfate Soundness test, AASHTO T 104, the loss shall not exceed 12 percent.
5. Crushed gravel shall consist of clean, hard, durable aggregate free from an excess of soft particles in which at least 98 percent of the particles retained on the #10 sieve have been produced from larger particles by crushing operations. Gravel shall have a percent of wear, measured by AASHTO T 96, not greater than 40.
6. Mineral aggregates shall be clean and free of deleterious material and adherent films of clay that will prevent thorough coating with asphalt materials. The fraction passing the #40 sieve shall have a plasticity index not greater than 4. For asphaltic concrete mixes, a minimum of 65 percent of total aggregate shall be produced by crushing larger particles.
7. Mineral filler shall comply with the requirements of AASHTO M 17.
8. Gradation of aggregates shall comply with the design mix, within the master ranges given in paragraphs 2.03.C and 2.03.D.

B. Asphalt cement shall conform to AASHTO M 226. Physical requirements are per Table II of AASHTO M 226, with the further provision that ductility for all grades of asphalt cement shall be a minimum of 100 cm and all grades shall have a negative spot as determined by the Spot Test. The grade to be used will be determined by the mix design.

C. Binder course shall be hot mix asphaltic concrete composed of mineral aggregate, asphalt cement, and any required additives proportioned in accordance with the following.

Sieve Size	Percent Passing	Maximum Tolerance Percent
1¼ inch	100	
1 inch	92-100	
¾ inch	75-97	
		± 7
½ inch	55-85	
		± 7
#4 sieve	35-60	
		± 7

#10 sieve	20-45
± 5	
#20 sieve	14-35
± 4	
#40 sieve	10-30
± 4	
#80 sieve	6-20
± 4	
Asphalt cement	3.7-7.0
± 0.4	
Fines to Asphalt Ratio	0.6-1.4
Design Test Requirements	
No. of Blows:	50
Minimum Marshall Stability	1000 lbs
Marshall Flow, 1/100 inch	7-16
Air voids	3.0-6.0 percent
Min. voids in mineral aggregate	13 percent
Minimum water sensitivity ratio	70 percent
Percent anti-strip	As required

Fines to asphalt ratio is defined as the weight of the aggregate passing the #200 sieve, expressed as a percentage of the total mix weight divided by the percent asphalt cement content.

Exact quantities of mineral filler and anti-strip additive incorporated into the mix will be as determined by the laboratory mix design.

D. Surface course shall be composed of mineral aggregates, asphalt cement, and any required additives proportioned to meet the requirements for Road or Parking Lot surface course, as indicated on the Drawings, and in accordance with the following.

Mineral Aggregate: Asphaltic Concrete

Maximum Tolerance	Road Mix		Parking Lot Mix
Sieve Size	percent passing	percent passing	percent
¾ inch	100		
½ inch	85-100	100	± 7
#4	55-80	54-80	± 7
#10	35-60	32-64	± 5
#16		22-51	± 5
#20	22-45		± 4
#30		14-43	± 4
#40	15-35		± 4
#50		8-32	± 4
#80	8-22		± 4
Asphalt cement	4.5-7.5	4.75-7.5	
Fines to Asphalt Ratio	0.6-1.4	0.6-1.4	

Design Test Requirements (for both Roads and Parking Lots)

No. of Blows:	50
Minimum Marshall Stability	1000 lbs
Marshall Flow, 1/100 inch	7-16
Air voids	2.5-5.0 percent
Min. voids in mineral aggregate	14 percent
Minimum water sensitivity ratio	70 percent
Percent anti-strip	As required

Exact quantities of mineral filler and anti-strip additives incorporated into the mix will be as determined by the laboratory mix design.

Surface course shall contain not more than 60 percent limestone aggregate in the coarse mineral aggregate fraction. When limestone is the primary coarse mineral aggregate, crushed sandstone, crushed siliceous gravel, syenite, novaculite, or crushed slag shall be used as the remaining coarse mineral fraction. The portion retained on the #10 sieve shall have an insoluble residue of not less than 85 percent when tested in a 1:1 solution of hydrochloric acid and water.

2.4 MIX DESIGN

A. A special mix design prepared specifically for this project will not be required. Submit for review the mix design in use at the mixing plant for its regular supply of the mixes specified.

B. Mix designs shall be prepared by laboratory analysis in accordance with the requirements of the specifications. Mix design preparation shall comply with applicable provisions of State DOT specifications and practices.

2.5 SOURCE QUALITY CONTROL

A. Contractor is responsible for quality control testing of the ACHM mixtures to be incorporated in the work prior to their placement in the work, in accordance with provisions in Division 01 of the Project Manual.

B. Tests shall be conducted by the mixing plant, as part of a regular quality control program. Such tests shall be of the type and at the frequency required to demonstrate that the mixing plant is producing mixtures in conformance with required design mixes.

C. If required by Owner or Owner's Representative, submit a copy of standing quality control program in use at the mixing plant.

D. If required by Owner or Owner's Representative, submit copies of testing records of tests conducted at the mixing plant on the ACHM products delivered for this project. Such tests will be ordered if Owner or Owner's Representative has reason to believe the ACHM mixtures supplied are not in compliance with the specifications, or if the mixtures appear to result in overly difficult placement or compaction such that specified results are not obtained. Such testing, if ordered, may include: extraction tests, and sieve analysis (AASHTO T 30) of the extracted aggregate; nuclear asphalt content gauge, and sieve analysis (AASHTO T 30) of the aggregate sample. Additional tests required for further evaluation of the mixture will be as needed to prove the adequacy of the mixture.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which work will be performed. Conditions detrimental to timely and proper execution of this work shall be corrected. No work shall be done until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Before application of each course, prepare the existing course to receive the new course. Such preparation may include filling sags and depressions with asphalt binder or surface course mixtures. Accomplish this work by hand, blade grader, or mechanical spreader methods. Featheredge to a smooth and even surface around the edges of these areas. Prime coat or tack coat as applicable before placing this material. Examine base course to verify that the lines and grades conform to the requirements of the Drawings and Specifications.

B. Clean away loose and foreign materials.

C. Paint contact surfaces of curbing, gutters, manholes, and other structures with a thin coating of rapid curing cutback asphalt or emulsified asphalt.

3.3 INSTALLATION

A. Prime Coat

1. Clean surface to be treated with prime coat of dust, dirt, and loose or foreign material by sweeping with mechanical brooms immediately preceding application of prime coat. Take care to clean but not loosen or dislodge embedded aggregate in base course. Remove patches of asphalt, dirt, or other material which does not form an integral part of the surface to be treated.
2. Perform cleaning only far enough in advance of the application to ensure the surface being properly prepared at the time of application.
3. Spray prime coat material uniformly over surface by means of mechanical pressure distributor at the rate of 0.25 gallons per square yard, or as recommended by the manufacturer for project conditions. Remove surplus material that collects in surface depressions.
4. Allow prime coat to cure per manufacturer's recommendations before application of asphalt material. No material for a succeeding course shall be placed on a primed base course until the prime coat has cured sufficiently to prevent damage by hauling operations.
5. Do not apply when air temperature is below 45 degrees F.
6. Observe special precautions to ensure uniform distribution of prime coat material. Adjust and operate distributor so as to evenly distribute material. Remove excess quantities on the road surface caused by stopping or starting the distributor, by overflow, leakage, or otherwise.
7. Apply prime coat material only at temperatures within manufacturer's recommendations.
8. Repair prime coat that becomes damaged.

B. Apply tack coat in a manner similar to that described in paragraph 3.03.A for prime coat. Apply at the rate of 0.02 to 0.03 gallons per square yard. Apply tack coat sufficiently in advance of asphalt course to allow proper curing of the tack coat material but not so far in advance as to lose its adhesiveness as a result of being covered with dust or foreign material. If tack coat becomes damaged or covered with foreign material, clean and re-treat with tack coat as required.

C. Binder course construction: Refer to State DOT specifications to supplement these requirements. Binder course shall be constructed to the following standards.

D. Minimum Density, percent of theoretical: 92.0

E. Maximum Moisture, percent (Roadway): 0.75

1. Place mixture on prepared surface, spread, and strike off to line, grade, and elevation required. Place mixture only on a base that shown no evidence of free moisture, and when weather conditions are suitable. Owner or Owner’s Representative may permit work of this character to continue when overtaken by sudden rains to utilize materials that may be in transit from the mixing plant to the site.
2. Mixture shall be delivered to the paver within recommended compaction temperature range according to the design mix. Do not place binder course on roadway at a temperature lower than 250 degrees F.
3. Hand spreading is permitted only in areas inaccessible to pavement.
4. Paver shall uniformly distribute and compact mixture in front of the screed for full width being paved. Finished surface shall be smooth and of uniform texture.

5. Screed or strike-off assembly shall effectively produce a finished surface of required evenness and texture without tearing, shoving, or gouging mixture.
6. Operate mixer at forward speeds consistent with satisfactory laying of mixture. Match speed of paver with mixing plant production rate and number of hauling units.
7. Establish edge of binder course by string or chalk line for at least 500 feet ahead of spreading operation.
8. Thoroughly compact mixture after spreading by rolling as soon as it will bear weight of rollers without undue displacement.
9. Establish an optimum rolling pattern at beginning of placement of each mix design.
10. The number, weight, and type of rollers, and the optimum rolling pattern shall be such that the specified density and surface requirements are consistently attained while mixture is in a workable condition. Rollers which produce excessive crushing of aggregate particles will not be permitted.
11. Following the breakdown rolling operation and as soon as the mat will support the roller without displacement, pass pneumatic roller over binder course a sufficient number of times to knead and seal entire mat being placed.
12. Exercise due care when using vibratory rollers to prevent any deterioration of material caused by excessive rolling or vibration. Operate vibratory rollers in such a manner that overlap of adjacent passes shall be held to a minimum.
13. Start rolling longitudinally at the low edge and proceed toward the higher portion of the mat. When paving abutting a previously placed lane, longitudinal joint shall be rolled first followed by regular rolling procedure. Terminate alternate passes of roller 3 feet from any preceding stop. Do not stop rollers perpendicular to centerline of traveled way.
14. Restrict speed of roller to avoid displacement of hot mixture, and do not exceed 3 mph. Operate roller in such a manner that no displacement of the mat will occur. Rolling shall proceed continuously until all roller marks are eliminated and required density attained. Keep rollers moist for full width of roller to prevent adhesion of asphalt mixture to roller. Excess water will not be permitted.
15. Do not pass rollers over unprotected end of a freshly laid mixture. Form transverse joints by cutting back on previous run to expose full depth of the course. Use a brush coat of asphalt material on contact surfaces of transverse joints just before additional mixture is placed against previously placed material.
16. Upon completion of rolling operations, surface shall be smooth and of uniform texture.

F. Surface course construction: Refer to State DOT specifications to supplement these requirements. Surface course shall be constructed to the following standards.

1. Minimum Density, percent of theoretical 92.0
2. Maximum Moisture, percent (Roadway) 0.75

G. Surface course construction shall comply with the requirements of Paragraph 3.03.C, and with the following additional requirements.

1. Offset longitudinal joint in one layer by approximately 6 inches from the layer below. However, in any non-parking lot pavement joint in top layer shall be at the centerline of pavement or at lane lines. General casting back of material or hand raking material onto surface will not be permitted.
2. Establish edge of surface course at least 500 feet ahead of spreading operation.
3. Finished surface, when checked with a 10 foot straight edge parallel to the centerline, shall show no variation more than 1/8 inch for surface course.

3.4 FIELD QUALITY CONTROL

A. Responsibility for quality control testing of the completed pavement is specified in Division 01 of the Project Manual. Tests to be taken and their frequency will be

determined by Owner or Owner's Representative. Tests may include coring for depth and laboratory density, in-place density, and straight edge for smoothness. Density of compacted mixture shall be in accordance with AASHTO T 166.

B. If testing shows deficiencies, correct deficiencies by means satisfactory to Owner or Owner's Representative prior to beginning additional work. If deficiencies appear to be the result of variation from approved mix design, an inadequate mix design or materials (as opposed to workmanship), stop operations until corrections can be made at the mixture source. If deficiencies are a result of workmanship, adjust operations and equipment to achieve the specified results.

3.5 CLEANING

A. Clean surface of pavement as required of debris and loose material after compaction and before final acceptance.

B. Clean ACHM splatter or excess material from curbs, gutters, drainage structures, and other places where it has been placed and exceeds the limits of paving indicated on the Drawings.

END OF SECTION 321216

SECTION 321236 - SLURRY SEAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install a seal coat mixture of emulsified asphalt, mineral aggregate, mineral filler, water and other additives, properly proportioned, mixed and spread on the surface.

1.2 RELATED SECTIONS

A. Demolition – Section 02 41 00

B. Pavement Markings – Section 32 17 23

1.3 REFERENCES

A. AASHTO M 17 – Mineral Filler for Bituminous Paving Mixtures

B. AASHTO M 208 – Cationic Emulsified Asphalt

C. AASHTO T 96 – Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

D. AASHTO T176 – Plastic Fines in Graded Aggregate and Soils by Use of the Sand Equivalent Test

E. ISSA A-105 - Recommended Performance Guidelines for Emulsified Asphalt Slurry Seal Surfaces

F. ISSA A-105 - Recommended Performance Guidelines for Emulsified Asphalt Slurry Seal Surfaces

1.4 QUALITY ASSURANCE

A. Work shall be performed by workers knowledgeable and experienced in this type of slurry seal application. Materials and mixtures shall be furnished by a supplier who is on the State Department of Transportation list of qualified products or approved products and suppliers.

1.5 SEASONAL LIMITATIONS

A. Slurry seal shall not be applied if either the pavement or ambient temperature is 55 deg F or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall accept full responsibility for proper delivery, storage and handling or all materials used in the mixture, and of the mixture itself, at the mixing plant, while en-route to the site, and at the site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Suppliers and the materials they supply shall be on the State DOT approved suppliers and products list(s).

2.2 MATERIALS

A. Asphalt Material: Asphalt emulsion shall include cationic emulsified asphalt or polymer modified cationic emulsified asphalt. The cationic emulsified asphalt shall be a quick setting CSS – 1h meeting the requirements of AASHTO M 208, except that the cement mixing test requirement is excluded. The polymer modified emulsified asphalt shall be CSS – 1h that has been modified to meet the following requirements by the addition of polymers.

	Min.	Max.
Viscosity, Saybolt Furol at 25 deg C, Sec.:	20	100
Storage stability test, one day		1 percent
Particle Charge test:	Positive	Positive
Sieve test, percent		0.1
Distillation*		
Oil distillate, by volume of emulsion, percent	0.5	
Residue from distillation	62.0	
Polymer Solids, percent	3.0	
Penetration, 25 degrees, 100g, 5 sec	55	90
Ductility, 25 degrees, 5 cm/min, cm	70	
Solubility in trichloroethylene, percent**	97	
Softening point, R & B, degree C	57	

* The standard distillation procedure shall be modified as follows: The temperature on the lower thermometer shall be brought slowly to 176 deg C ± 6 deg C and maintained at this point for 20 minutes. Complete the total distillation in 60 ± 5 minutes from the application of heat.

** Base Asphalt Binder

B. The emulsified asphalt and the modified emulsified asphalt shall be so formulated that when the mixture is applied with the relative humidity at not more than 50 percent and ambient air temperature of at least 77 degrees F, it will cure sufficiently that rolling traffic can be allowed to use the surface in two hours (one hour for polymer modified slurry seal) with no damage to the surface.

C. Mineral aggregate shall be crushed slag, crushed gravel or crushed stone meeting applicable requirements of State DOT standard specifications. Limestone aggregates shall not be used as mineral aggregate. The aggregate shall meet the following gradation requirements.

Sieve Size	Type 2	Type 3
	Percent Passing (by weight)	
3/8	100	100
#4	90-100	70-90
#8	65-90	45-70
#16	45-70	28-50
#30	30-50	19-34
#50	18-30	12-25
#100	10-21	7-18
#200	5-15	5-15
Los Angeles Test (AASHTO T 96)	35 max.	35 max.
Sand Equivalent Test (AASHTO T 176)	45 min.	45 min.

D. Mineral Filler, if used, shall be Portland Cement or hydrated lime which meets the requirements of AASHTO M 17. Portland cement shall be a commercial quality, non-air-entraining cement and shall not be considered as mineral filler for the purpose of satisfying the gradation requirement of the aggregate.

E. Water shall be potable and free of harmful soluble salts.

F. Other additives: Additives supplied by the emulsion manufacturer may be added to the emulsion mix or to any of the component materials to provide control of the set time in the field.

G. Mix Design: The design of the Slurry Seal is the responsibility of the Contractor and shall meet or exceed the criteria set forth in ISSA A-105 and A-143. Quality control of the mix shall be according to State DOT standard specifications. The mix design and materials and methods must receive the approval of Owner or Owner's Representative prior to use on the project. The proportions to be used shall be within the following limits:

1. Residual Asphalt: 6.5 to 13.5 percent for slurry seals, and 5.5 to 9.5 percent for polymer modified slurry seals by weight of dry aggregate.
2. Mineral filler: 0.5 to 2.0 percent by dry weight of aggregate.
3. Polymer Modifier: When required to provide the specified properties.
4. Field Control Additive: As required to provide the specified properties.
5. Water: As required to provide the proper consistency.

H. Mixing and spreading equipment shall be maintained in good repair and operating condition and subject to the approval of Owner or Owner's Representative. Any equipment found to be defective with a potential for affecting the quality of the paving mixture will be rejected by Owner or Owner's Representative and must be replaced or repaired before its use or continued use.

1. Material shall be mixed by a self-propelled mixing machine which shall be a continuous flow mixing unit able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, additives, and water to a revolving multi-blade mixer and discharge the mixed product on a continuous flow basis. The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, and water to maintain an adequate supply to the proportioning controls. The machine shall be equipped with self-loading devices which provide for the loading of all materials while continuing to lay slurry seal, thereby minimizing construction joints.
2. Individual volume or weight controls for proportioning each material to be included in the mixture shall be provided. Each material control device shall be calibrated and properly marked. Calibration shall be performed prior to starting the project and in the presence of Owner or Owner's Representative. Documentation shall be included for each individual calibration of material at various settings, which can be related to the machine's metering devices. No machine will be allowed to work on the project until the calibration has been completed and accepted. Calibration will be verified using State DOT approved test method.
3. The emulsion pump shall be a positive displacement type and shall be equipped with a revolution counter or similar device so that the amount of emulsion used may be determined at the time.
4. The mixing machine shall be equipped with a water pressure system and nozzle type spray bar to provide a water spray immediately ahead of and outside the spreader box.
5. The mixing machine shall be equipped with an approved fines feeder and liquid additives feeder that shall provide a uniform, positive, accurately metered, predetermined amount of the specified mineral filler.

2.3 SOURCE QUALITY CONTROL

A. Slurry manufacturer shall maintain a plant quality control program that meets all requirements of State DOT.

B. If mineral aggregates are stored or stockpiled, they shall be handled in such a manner as to prevent segregation, mixing of the various materials or sizes, and contamination with foreign materials. The grading of aggregates supplied to the mixing plant shall be uniform. Suitable equipment of acceptable size shall be furnished to work the stockpiles and prevent segregation of the aggregates. If a polymer modified slurry seal is used, a scale system shall be supplied to weigh the aggregate. Scale shall provide printed tickets for each truck loaded.

C. Asphalt material storage shall be ample to meet the requirements of the plant. Asphalt emulsion shall not be heated to a temperature in excess of 160 deg F. All equipment used in the storage and handling of asphalt material shall be kept in a clean condition at all times and shall be operated in such manner that there will be no contamination by foreign matter.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the area to receive slurry seal to verify that all preparation work has been done.

3.2 PREPARATION

A. The area to be sealed shall be thoroughly cleaned of all vegetation, loose aggregate, and soil. Utility entrances within the area to be sealed shall be protected from the slurry seal by the use of plastic fabric coverings or other methods. All utility entrances shall be uncovered before the surface is reopened to traffic. Water used to pre-wet the surface ahead of and outside the spreader box shall be applied at a rate which will dampen the entire surface without any free flowing water ahead of the spreader box.

B. Rut filling will be required if ruts exceed 1/2 inch in depth, with a separate leveling course.

3.3 TRAFFIC CONTROL

A. Provide adequate traffic control measures to protect the uncured slurry seal from all types of traffic and to provide traffic safety in the construction area. These measures shall be employed in a safe manner, and must be approved by Owner or Owner’s Representative.

B. Opening of the pavement surface to traffic does not constitute acceptance of the work. Any damage to the uncured slurry seal material will be the responsibility of Contractor and the damages surface shall be repaired to the satisfaction of Owner or Owner’s Representative.

3.4 APPLICATION

A. Paving mixture shall be spread uniformly by means of a mechanical type squeegee box attached to the mixer and equipped with paddles to agitate and spread the materials throughout the box. A front seal shall be provided to ensure no loss of the mixture at the pavement contact surface. The rear seal shall act as a final strike off and shall be a uniform skid resistant application of aggregate and asphalt on the surface. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved while producing a free flow of material to the rear strike-off. A secondary strike-

off shall be used to provide uniformity. The seam where two spreads join shall be neat and uniform in appearance.

B. Workmanship.

1. No excessive buildup, uncovered areas or unsightly appearance will be permitted at longitudinal or transverse joints.
2. Longitudinal joints shall be placed at lane lines. Excessive overlap will not be permitted. Take care to ensure straight lines at joints to provide a neat appearance.
3. Exercise care in areas that require hand work so that the finished surface is uniform in texture, density, and of overall appearance comparable to that produced by the spreader box.
4. Areas of non-uniform textured, density, or appearance shall be patched as directed. Patching shall be done using the same process and equipment that originally surfaced the area. Handworking of patches will not be permitted, except as authorized by Owner or Owner's Representative.
5. Supervise and direct the work, using best skill and attention. Direct the work using any means as is the custom of the trade to complete the work in an acceptable manner.

3.5 PROTECTION

A. Protect pavement from traffic until applied slurry seal has cured to the point that it will not be damaged by traffic.

B. Coordinate areas closed to traffic with Owner or Owner's Representative.

3.6 ACCEPTANCE

A. Owner will have tests made of the completed slurry seal at their discretion.

B. Acceptance of the completed slurry seal mixture shall be in accordance with the provisions of State DOT standard specifications, as they apply to parking lot construction.

END OF SECTION 321236

SECTION 321313 – PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. A. Preparation and placement of Portland cement concrete roads and entrances.

1.2 RELATED SECTIONS

A. Section 31 00 10 – Site Preparation

B. Section 31 00 20 – Earthwork

C. Section 31 05 16 – Aggregate Material

D. Section 31 23 03 – Excavation, Backfilling, and Compaction for Pavement

E. Section 32 11 23 – Paving Base Course

F. Drawings

1.3 REFERENCE STANDARDS

A. State Department of Transportation standard specifications for highway construction, as applicable, latest edition

B. American Concrete Institute (ACI) latest edition
1. 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete
2. 305R Hot Weather Concreting
3. 306R Cold Weather Concreting
4. 308 Standard Practice for Curing Concrete
5. 318 Building Code Requirements for Reinforced Concrete
6. 347 Recommended Practice for Concrete Formwork

C. ASTM International (ASTM) latest edition
1. A 185 Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
2. A 497 Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
3. A 615 Deformed and Plain Billet-Steel for Concrete Reinforcement
4. C 31 Making and Curing Concrete Test Specimens in the Field
5. C 33 Concrete Aggregates
6. C 39 Compressive Strength of Cylindrical Concrete Specimens
7. C 42 Method of Obtaining and Testing Drilled Cores
8. C 94 Specification for Ready-Mixed Concrete
9. C 150 Portland Cement
10. C 260 Air-Entraining Admixtures for Concrete
11. C 309 Liquid Membrane-Forming Compounds for Curing Concrete
12. C 494 Chemical Admixtures for Concrete
13. D 1751 Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

D. Federal Standard
1. FS TT-C-800 – Curing Compound, Concrete, for New and Existing Surfaces

E. Concrete Reinforcing Steel Institute (CRSI) latest edition
   1. CRSI-MSP Manual of Standard Practice
   2. CRSI 63 Recommended Practice for Placing Reinforcing Bars
   3. CRSI 65 Recommended Practice for Placing Bar Supports

F. American Association of State Highway and Transportation Officials (AASHTO) latest edition

1.4 QUALITY ASSURANCE

A. An independent testing laboratory, selected by Owner and paid by Owner, shall randomly core pavement at a minimum rate of 1 core per 20,000 sq. ft of pavement, with a minimum of 3 cores from heavy duty areas and 3 cores from light duty areas. Core shall be tested for thickness and quality of aggregate distribution. Patch core holes immediately with Portland cement concrete and finish to provide level surface as specified.

B. Establish and maintain required lines, grades and elevations.

C. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Owner or Owner's Representative.

1.5 SUBMITTALS

A. Submit materials certificate to Owner or Owner's Representative which is signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Coat forms with a non-staining type of coating that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185. Furnish in flat sheets, not rolls, unless approved by Owner or Owner's Representative.

C. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40.

D. Concrete Materials:
   1. Portland Cement conforming to ASTM C 150, Type 1 or 1A, Type III or IIIA (high early strength) may be used if specifically approved by Owner or Owner's Representative.
   2. Coarse Aggregates conforming to 3/4 inches maximum to No. 4 minimum size.
   3. Fine Aggregates conforming to ASTM C 33
   4. Water shall conforming to ASTM C 94

E. Joint Fillers: Resilient premolded bituminous impregnated fiberboard units complying with ASTM D 1751 or AASHTO M 213.

F. Joint Sealants: Non-priming, pourable, self-leveling polyurethane. Acceptable sealants are Sonneborn "Sonolastic Paving Joint Sealant", Sonneborn "Sonomeric CT 1

Sealant", Sonneborn "Sonomeric CT 2 Sealant", Mameco "Vulken 245", or Woodmont Products "Chem-Caulk".

2.2 MIX DESIGN AND TESTING

A. Design mix shall produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture when approved by Owner or Owner's Representative, air-entraining admixture, and water to produce following properties:
   1. Compressive Strength: 4000 psi, minimum at 28 days, unless otherwise indicated on the Drawings.
   2. Slump Range: 3 to 5-inches at time of placement
   3. Air Entrainment: 5 to 8 percent

PART 3 - EXECUTION

3.1 PREPARATION

A. Proof-roll prepared base material surface to check for unstable areas. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.

B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

A. Form Construction
   1. Set forms to required lines, grades and elevations, rigidly braced and secured in accordance with ACI 347.
   2. Install sufficient quantity of forms to allow continuance of work; forms to remain in place a minimum of 24 hours after concrete placement and finishing operations.
   3. Check completed formwork for grade and alignment to following tolerances:
      a. Top of forms not more than 1/8-inch in 10 feet
      b. Vertical face on longitudinal axis, not more than 1/4-inch in 10 feet
   4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage to concrete.

B. Reinforcement: Locate, place, and support reinforcement in accordance with CRSI 63 and CRSI 65.

C. Concrete Placement
   1. Place concrete in accordance with requirements of ACI 304R, 305R and 306R.
   2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structures until they are at required finish elevation and alignment.
   3. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or other structural components. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
   4. Deposit and spread concrete in a continuous operation between transverse joints. If interrupted for more than 1/2 hour, place construction joint that corresponds to the established joint pattern.

D. Joint Construction: Construct expansion, weakened-plane control or contraction, and construction joints straight with face perpendicular to concrete surface. Construct transverse joints perpendicular to longitudinal joints, unless otherwise indicated on the Drawings. Where the Drawings do not provide a specific joint pattern, construct joints to the following requirements.

1. Weakened-Plane Control or Contraction Joints: Provide joints at a maximum spacing of 15 feet each way and at a depth not less than 1/4 of the concrete thickness and as follows:
    a. Form tooled joints in fresh concrete by grooving top with the recommended tool to provide a rounded edge having a 3/16 inch radius.
    b. Form sawed joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will support the saw and not be torn, abraded, or otherwise damaged by cutting action.
2. Construction Joints: Provide joints that correspond to established joint pattern at end of placements and at locations where placement operations are stopped for period of more than 1/2 hour, except where such placements terminate at expansion joints. Construct joints using standard metal keyway-section forms unless otherwise indicated on the Drawings.
3. Expansion Joints: Locate expansion joints at a maximum of 180 feet o.c. each way. Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, sidewalks, and other fixed objects.

E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2-inch or more than 1-inch below finished surface where joint sealer is indicated. Furnish joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.

F. Joint Sealants: Joints shall be sealed with approved exterior pavement joint sealants and shall be installed in accordance with manufacturer's recommendations.

3.3 CONCRETE FINISHING

A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10 foot straightedge. Distribute concrete as required to remove surface irregularities and refloat repaired areas to provide continuous smooth finish.

B. Work edges of slabs and formed joints with edging tool, rounding edge to 3/16-inch radius. Eliminate tool marks on concrete surface. After completion of floating and trowelling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Inclined Slab Surfaces: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to flow of traffic.
2. Paving: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to flow of traffic.

C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Owner or Owner’s Representative.

D. Protect and cure finished concrete paving using acceptable moist-curing methods, more particularly described in "water-curing" section of ACI 308.

3.4 CLEANING AND ADJUSTING

A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

B. Protect concrete from damage until acceptance of work. 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.

END OF SECTION 321313

SECTION 321713 – PRECAST CONCRETE WHEEL STOPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install precast concrete wheel stops at parking spaces in the locations indicated on the drawings.

1.2 QUALITY ASSURANCE

A. Precast concrete wheel stops shall be the product of a manufacturer regularly engaged in the manufacture of these units.

B. Units precast at the job site are not acceptable.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Precast concrete wheel stop units received at site shall be immediately inspected for damage and defects. If paving work is essentially complete, distribute units in the approximate locations where they will be installed. If paving work is not complete, handle and store units in such a way to minimize damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacter wheel stop units from Portland cement concrete, using aggregate gradation appropriate for a small concrete unit.

B. Reinforcement shall be deformed bars, grade 40 or above.

C. Holes shall be factory drilled or cast in units.

D. Anchor bars shall be No. 6 deformed bar or larger.

2.2 FABRICATION

A. Shape of precast concrete unit shall be as indicated on the Drawings, as required by local codes, or in accordance with customary local practice.

B. Precast units shall be fabricated under controlled conditions. Finish shall be smooth, without honeycombing or irregular surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine units when they arrive at the job site. Reject units that are damaged, or that are irregularly shaped or finished.

3.2 PREPARATION

A. Surface shall be finished before units are installed. Surface shall be smooth, allowing entire bottom of unit to bear on pavement.

3.3 INSTALLATION

A. Drill hole in pavement slightly larger than anchor bar. Hole should be large enough to allow bar to be easily hammered in place, but not so large that there is annular space between bar and hole wall.

B. Install precast concrete wheel stop units over drilled holes. Hammer bars in place through units. Bars shall not be pushed into holes using equipment. Any units damaged during installation shall be removed and replaced.

3.4 CLEANING

A. Remove concrete or asphalt splatter that occurs after installation.

B. Remove striping paint from wheel stop, or replace wheel stop.

END OF SECTION 321713

SECTION 321723 – PAVEMENT MARKING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install paint pavement markings, including words, arrows, and emblems, of the color and type specified, in accordance with the specifications and at the locations indicated on the Drawings.

B. Pavement markings shall be reflectorized unless the Drawings indicate otherwise. If the markings are not to be reflectorized, statements hereinafter about reflectorized paint shall be considered void.

1.2 RELATED SECTIONS

A. Hot mix asphaltic concrete pavement is specified in section 32 12 21.

B. Portland cement concrete paving is specified in section 32 13 13.

C. Signage is specified in section 32 17 24.

1.3 REFERENCES

A. Federal Highway Administration (FHWA)
   1. Manual on Uniform Traffic Control Devices (MUTCD).

B. American Association of State Highway and Transportation Officials (AASHTO)
   1. M 247, “Glass Beads used in Traffic Paint”.

C. ASTM International (ASTM)
   1. D 711 “No-Pick-Up Time of Traffic Paint”.
   2. E 97 “Method of Test for Directional Reflectance Factor, 45 Deg 09 Deg, of Opaque Specimens by Broad Band Filter Reflectometry
   3. E 1347 “Standard Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry”

D. Federal Specifications
   Fed Spec TT-P-85e, “Paint, Traffic and Airfield Marking, Solvent Base”

1.4 SUBMITTALS

A. Submit product information of paint and glass beads to be used.

1.5 QUALITY ASSURANCE

A. Pavement marking shall be accomplished by workers who are experienced in placing reflectorized paint pavement markings conforming to the MUTCD.

1.6 DELIVERY, STORAGE AND HANDLING

A. Paint shall be stored according to manufacturer’s recommendation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Paint shall be a ready-mixed alkyd resin, chlorinated polyolefin, chlorinated paraffin based white and yellow paint suitable for application on concrete and bituminous pavements. Materials supplied shall be acceptable to the State DOT, and shall be on any approved products list maintained by the DOT.

B. Paint shall have the property of angular reflectivity and be suitable as a binding medium for glass beads placed on the surface of the wet paint in the amount of not less than 6 pounds per gallon. Paint shall be homogeneous and well ground, shall not settle badly, and shall be readily broken up with a paddle to a smooth, uniform consistency. Paint shall be free from water or foreign matter and shall dry within the specified time to a tough serviceable film. Paint shall be properly strained during the final filling of containers and not more than one percent of coarse particles and skins shall be retained on a #325 sieve when tested according to Federal Test Method Standard No. 141 B.

C. Materials used in manufacture of paints shall meet the requirements herein specified. Minor ingredients not specifically covered will be left to the discretion of the manufacturer except that the finished product shall not be adversely affected. Suitability of raw materials from different sources for use in paints shall be the responsibility of the manufacturer.

D. Reactive or unstable products causing excessive viscosity or container instability will be cause for rejection of the paint.

E. Paint shall conform, on a weight basis, to the composition requirements of the formulation as closely as accepted good paint practice will permit. No intentional variation will be permitted except for replacement of volatiles lost in processing. Recognized test procedures will be used by Owner to determine the composition of the finished paint.

F. Paint components shall conform with applicable State DOT standard construction specifications.

G. Finished Paint Requirements.

1. Chlorinated polyolefin paint shall dry to no-pick-up in not more than 10 minutes without glass beads when tested in accordance with ASTM D 711 except that the film will be applied at a wet film thickness of 15 mils. When applied under field conditions with normal hot spray application with drop-on beads the paint shall dry to a no-tracking condition in not more than 3 minutes.
2. Daylight directional reflectance of the white paint, without glass spheres, shall be not less than 80 percent, and that of the yellow paint without glass spheres shall not be less than 48 percent, when tested in accordance with ASTM E 97 or ASTM E 1347. In addition the yellow paint shall visually match Federal Standard 595-A Color Number 33538. Yellow paint shall comply with the Federal following limits:

$\leq$V+	$\leq$C+	$\leq$H+
$\geq$V-	$\geq$C-	$\geq$H-

Visual comparison shall be made with standard yellow Federal Color Tolerance chart for highway signs and markings obtainable from the Federal Highway Administration.

3. Paint shall have a minimum contrast ratio of 0.97 when applied at a wet film thickness of 15 mils to a color matching panel.
4. Paint shall have a minimum bleeding ratio of 0.94 when tested in accordance with Federal Specification TT-P-85e, except the asphalt saturated felt shall be Standard 15 pound roofing felt. Paint shall not check or crack on asphalt

saturated felt indicating suitability for use on fresh asphalt pavement. Any checking or cracking on the felt or on fresh asphalt cores will be cause for rejection.

5. Paint shall adhere firmly and shall not show any evidence of cracking or flaking when a 15 mil wet thickness is tested.
6. Paint shall show no adhesion loss or blistering when a 15 mil wet film thickness is tested.
7. No skinning shall be present on the surface when the paint is allowed to stand in a partly filled, closed container for 48 hours. After 48 hours, paint shall be free of lumps and skins when strained through a #100 sieve.
8. Finished paint shall have a Krebs Stormer viscosity of between 70 and 85 K.U. when measured at 77 degrees F.
9. White and yellow paint shall show a Hegeman grind of 4 minimum.
10. White and yellow paint shall have a weight per gallon within + 0.60 pounds of the theoretical weight per gallon indicated by formulation.
11. When tested in accordance with appropriate methods in Federal Test Method Standard No. 141, the paints shall show a total solids content, pigment content, and vehicle solids content within reasonable proximity of those properties indicated by the formulations.
12. Pigments and vehicles extracted from paints shall be subjected to testing by appropriate methods as may be deemed necessary by Owner or Owner's Representative to assure compliance with these formulations.

Pounds per 100 gallons	White	Yellow
Titanium Dioxide, anatase or rutile	105	--
Medium Chrome yellow	--	105
Calcium carbonate	250	260
Magnesium silicate	250	270
Zinc oxide, lead free	20	20
Bentone 38 or equal	6	6
Alkyd resin, 60 percent solution	145	145
Chlorinated polyolefin, CP 173	90	90
Chlorinated paraffin	35	35
Soya lecithin	8	8
DER 331 or equal	3	3
36 percent lead naphthenate	2	2
Anti-skinning agent	3	3
Methyl alcohol	3	3
Methyl ethyl ketone	285	285

H. Glass beads for use on traffic line paint shall, except for gradation, meet the requirements of AASHTO M 247.

1. Glass beads shall be moisture resistant, clear, colorless, and clean, and of such character as to permit their embedment in a pigmented binder having their upper surface exposed to permit the refracting of light rays.
2. Not more than 30 percent of glass spheres shall be irregular of fused spheroids per screen size, and at least 70 percent of the spheres on each screen shall be true spheres.
3. When tested by liquid immersion method at 25 degrees C, spheres shall show an index of refraction within the range of 1.50 to 1.60.
4. Spheres shall conform to the following gradation.

Sieve	Percent Passing
40	90-100
80	0-10

5. Acid resistance test shall be performed in accordance with State DOT approved test method.

6. Sodium sulphide test shall be performed in accordance with State DOT approved test method.
7. Free flowing and moisture resistance properties test shall be performed in accordance with State DOT approved test method. Beads shall not be specially treated to enhance flotation.

2.2 SOURCE QUALITY CONTROL

A. Manufacturer shall maintain a regular quality control program that ensures that the specified requirements for paint are met. The written quality control program, as well as documentation concerning its continuing implementation, shall be available for the review by Owner or Owner's Representative.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pavement to be marked. Verify that paving work is complete, requiring only cleaning and preparation for painting.

3.2 PREPARATION

A. Clean surface before paint application using any appropriate means.

3.3 APPLICATION

A. Spot line locations if necessary.

B. Apply paint in the locations and of the line types indicated on the Drawings.

C. Apply reflectorized paint to clean, dry, dirt-free surfaces. Apply paint at a minimum wet film thickness of 15 mils, at rate of not less than 16.5 gallons per mile of 4 inch line.

D. Place glass beads on the surface of the wet paint in the amount of not less than 6 pounds of beads per gallon of paint.

E. Lines shall be even thickness. Ends of lines shall be sharp, with no splatter or unevenness.

END OF SECTION 321723

Section 321724 – TRAFFIC SIGNAGE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnishing and installing signs of all types required, complete with bases, posts, and fastening hardware.

1.2 RELATED SECTIONS

A. Concrete is specified in Section 03 31 60.

1.3 REFERENCES

A. Manual of Uniform Traffic Control Devices (MUTCD).

B. ASTM International (ASTM).
   1. B 209, "Specification for Aluminum and Aluminum-Alloy Sheet and Plate".
   2. B 221, "Specification for Aluminum and Aluminum-Alloy Extruded bars, Rods, Wire, Shapes, and Tubes".

C. State Department of Transportation specifications for highway construction, as applicable, latest edition, concerning the following specific information.
   1. General Requirements for Signs
   2. Guide Sign
   3. Standard Sign
   4. Channel Post Sign Support

1.4 QUALITY ASSURANCE

A. Signage materials shall be manufactured by a manufacturer regularly engaged in producing signage materials complying with the specified standards.

B. Installation of signs shall be accomplished with workers experienced in construction of the type of signage specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Signs shall meet the requirements of the MUTCD, Standard Highway Signs.

B. Colors for signs shall match colors specified in the MUTCD. Color and size of letters, symbols, borders, and background on signs shall be as specified in the MUTCD.

C. Signs shall be made of aluminum and shall be reflectorized.

D. Standard signs shall be fabricated without stiffeners on the back, of aluminum alloy conforming to ASTM B 209, Alloy 5052 H38, and shall consist of a single sheet of aluminum. Sign blank thickness shall be 0.100 inch for signs 5 square feet or less; and 0.125 inch for a sign size greater than 5 square feet. Sign blanks shall be flat and straight and within commercial tolerances established by the aluminum industry.

E. Fabricate signs from either one-piece extruded aluminum panels or extruded and welded panels. One-piece extruded aluminum panels shall be fabricated of aluminum

alloy conforming to ASTM B 221, Alloy 6063 T6. Extruded and welded aluminum panels shall be fabricated of sections of extruded aluminum alloy stiffeners conforming to ASTM B 221, Alloy 6063 T6 welded to flat sheet aluminum alloy conforming to ASTM B 209, Alloy 3003 H18. Welds shall be spot welds approximately 9 inches apart.

F. One-piece extruded aluminum panels shall be a minimum of 12 inches wide, except one 6 inch panel may be used per sign face when necessary to construct sign as indicated on the Drawings.

G. Extruded and welded sign panel sections shall be either 2 feet or 3 feet in width. Exceptions to this are as required for the specific signs on the project.

H. Panels to which reflective sheeting is to be applied shall be degreased, etched, and alodized. Degreasing shall be done by either vapor method or alkaline method. Vapor degreasing shall be accomplished by total immersion of sign panels in a saturated vapor of trichloroethylene or perchloroethylene. Alkaline degreasing shall be accomplished by immersion of the sign panels in a tank containing alkaline solutions, controlled and titrated to the solution manufacturer's recommendations. Immersion time shall depend upon amount of soil present and the gage of the metal. Trade mark printing shall be removed with lacquer thinner or by a controlled alkaline cleaning system.

I. Etching shall be done by the acid method.

J. Sign panels shall be treated by alodizing process to uniformly provide a chemically formed light and tight amorphous coating that becomes an integral part of the aluminum alloy. This process shall be accomplished in accordance with the recommendation of the manufacturer of the coating.

K. Fabrication, including cutting and punching of holes shall be completed prior to degreasing, etching, alodizing, and the application of reflective sheeting.

L. Panels shall be free of buckles, warp, dents, cockles, burrs, and defects resulting from fabrication. Surface of panels shall be flat.

M. Reflective sheeting shall conform to State DOT standard specifications.

N. Legend, which includes letters, numerals, symbols, arrows, and border, shall conform to State DOT standard specifications.

O. Post sign supports shall be made of a U-section channel or galvanized steel pipe and support as indicated on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine sign materials upon receipt at the site. Remove damaged sign materials.

3.2 ERECTION

A. Erect signs at the locations indicated on the Drawings.

B. Erect signs plumb and to the indicated vertical and horizontal dimensions and clearances.

C. Minimum horizontal clearance to any ground mounted sign shall be as specified in the MUTCD.

D. Erect signs so that sign face is vertical and at 93 degrees away from center of the lane which the sign serves and away from the direction of travel. Where lanes divide and on curves, orient sign faces so as to be most effective both day and night, and to avoid possibility of specular reflection.

E. Field drill holes in sign support structure only when specified in the Drawings or as directed by Owner or Owner's Representative.

3.3 ADJUSTING

A. After signs have been installed, Owner or Owner's Representative will inspect signs at night. If specular reflection is apparent on any sign, adjust sign position to eliminate this condition.

3.4 CLEANING

A. Clean installed signs of any construction dirt or dust.

END OF SECTION 321724

SECTION 323113 – CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Installation of chain link fences and gates shall be provided by a single source including erection accessories, fittings, and fastenings.

1.2 RELATED SECTIONS

A. A. Section 03 31 60 – Miscellaneous Concrete Work

B. B. Construction Drawings

1.3 REFERENCE STANDARDS

A. A. American Society for Testing and Materials (ASTM) latest edition
1. A 116 Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
2. A 120 Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses
3. A 121 Zinc-Coated (Galvanized) Steel Barbed Wire
4. A 123 Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
5. A 153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
6. A 392 Zinc-Coated Steel Chain-Link Fence Fabric
7. A 428 Weight of Coating on Aluminum-Coated Iron or Steel Articles
8. A 491 Aluminum-Coated Steel Chain Link Fence Fabric
9. A 569 Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled, Sheet and Strip Commercial Quality
10. A 585 Aluminum Coated Steel Barbed Wire
11. C 33 Concrete Aggregates
12. C 94 Ready-Mixed Concrete
13. C 150 Portland Cement
14. F 668 Polyvinyl Chloride (PVC) Coated Steel Chain Link Fence Fabric
15. F 567 Installation of Chain-Link Fence
16. F 573 Residential Zinc-Coated Steel Chain Link Fence Fabric

B. Chain Link Fence Manufacturers Institute (CLFMI) latest edition
1. Product Manual

C. Federal Standard
1. FS RR-F-191 – Fencing, Wire, and Metal Post including Gates, Chain Link Fence Fabric, and Accessories.
2. CE CRD-C621

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with Construction Drawing requirements, acceptable products consist of one of following:
1. Allied Tube and Conduit Corp.
2. Anchor Fence, Inc.

3. United States Steel

2.2 MATERIALS

A. Fabric:
1. No. 9 gauge, 0.148 inch ± 0.005 inch, finished size galvanized steel wires, 2-inch mesh, top and bottom selvages twisted and barbed.
2. Furnish 1-piece fabric widths for fencing.

B. End, Corner, and Pull Posts: Galvanized steel, minimum sizes and weights as follows:
1. Up to 6 feet Fabric Height: 2.375-inch OD pipe, 3.65 pounds/inch-foot, or 3.5-inch x 3.5-inch roll-formed section, 4.85 pound/inch-feet
2. Over 6 feet Fabric Height: 2.875-inch OD pipe, 5.79 lb/in.-ft, or 3.5-in. x 3.5-in. roll-formed section, 4.85 lb/in.-ft

C. Line Posts: Galvanized steel, minimum sizes and weights as follows:
1. Up to 6 feet Fabric Height: 1.90-in. OD steel pipe, 2.70 lb/in.-ft or 1.875-in. x 1.625-in. C-section, 2.28 lb/in.-ft
2. Over 6 feet to 8 feet Fabric Height: 2.375-in. OD steel pipe, 3.65 lb/in.-ft or 2.25-in. x 1.875-in. H-section, 2.64 lb/in.-ft
3. Over 8 feet Fabric Height: 2.875-in. OD steel pipe, 5.79 lb/in.-ft or 2.25-in. x 1.875-in. H-section, 3.26 lb/in.-ft

D. Gate Posts: Galvanized steel posts for supporting single gate leaf or 1 leaf of double gate installation, for nominal gate widths as follows:
1. Up to 6 feet: 3.5-in. x 3.5-in. roll-formed section, 4.85 lb/in.-ft, or 2.875-in. OD pipe, 5.79 lb/in.-ft.
2. Over 6 feet to 13 feet: 4.00-in. OD pipe, 9.11 lb/in.-ft.

E. Top Rail: 1.66-in. OD pipe, 2.27 lb/ft or 1.625-in. x 1.25-in. roll-formed sections, 1.35 lb/ft; galvanized steel, manufacturer's longest lengths.

F. Couplings: Expansion type, approximately 6-inches long, for each top rail joint.

G. Attaching Devices: Provide means for attaching top rail securely to each gate corner, pull, and end post.

H. Sleeves: Galvanized steel pipe not less than 6-inches long with inside diameter not less than 1/2-inch greater than outside diameter of pipe. Provide steel plate closure welded to bottom of sleeve of width and length not less than 1-inch greater than outside diameter of sleeve.

I. Tension Wire: 7 gauge galvanized steel, coated coil spring wire, located at bottom of fabric.

J. Wire Ties: 11 gauge galvanized steel

K. Post Brace Assembly: Manufacturer's standard adjustable brace at gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375-inch diameter rod and adjustable tightener.

L. Post Tops: Galvanized steel, weathertight closure cap for each tubular post. Furnish caps with openings to permit passage of top rail.

M. Stretcher Bars: Galvanized steel, 1 piece lengths equal to full height of fabric, with minimum cross-section of 3/16-in. x 3/4-in. Provide 1 stretch bar for each gate and end post, and 2 for each corner and pull post.

N. Stretch Bar Bands: Manufacturer's standard to match post O.D.

O. Gate Cross-bracing: 3/8-inch diameter galvanized steel adjustable length truss rods.

P. Portland Cement Concrete: Class B concrete complying with section 03 31 60.

Q. Non-Shrink, Non-Metallic Grout: Premixed, factory-packaged, noncorrosive non-staining, nongaseous, exterior grout complying with CE CRD-C621.

R. Swinging Gate Hardware:

1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit full 180 degree gate opening. Provide 1 1/2-in. pair of hinges for each leaf over 6 feet nominal height.
2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

S. Double Gates Hardware: Provide gate stops for double gates, consisting of mushroom type of flush plate with anchors set in concrete, to engage center drop rod or plunger bar. Include locking device and padlock eye as integral part of latch, using 1 padlock for locking both gate leaves.

T. Sliding Gate Hardware: Provide manufacturer's standard heavy-duty track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and accessories as required.

PART 3 - EXECUTION

3.1 GATE FABRICATION

A. Fabricate swing gate perimeter frames of 1.90-inch OD pipe, galvanized steel. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories. Space frame members maximum of 8 feet apart.

B. Assemble gate frames by welding or special fittings and rivets, for rigid connections. Install same fabric as for fence with stretcher bars at vertical edges. Install diagonal cross-bracing on gates as required to ensure rigid frame without sag or twist. Bars may be used at top and bottom edges. Attach stretchers to gate frame at 15-inches o.c. maximum.

C. Attach hardware to provide security against removal or breakage.

3.2 FINISH

A. Fabric Finish: Galvanized, ASTM A 392, Class I, with not less than 1.2 oz zinc/sq. ft of surface.

B. Framing: Galvanized steel, ASTM A 120 or A 123, with not less than 1.8 oz zinc/sq. ft of surface.

C. Hardware and Accessories: Galvanized, ASTM A 153 with zinc weights in accordance with Table I of ASTM A 153.

3.3 CONCRETE MIXING

A. Mix materials to obtain concrete with minimum 28-day compressive strength of 2,500 psi; 1-inch maximum size aggregate, maximum 3-inch slump, and 6 percent ± 1 percent of entrained air. See Section 03 31 60 for additional information.

3.4 INSTALLATION

A. Comply with recommended procedures and instructions of fencing manufacturer. Provide secure, aligned installation with line posts spaced at 10 feet o.c. maximum.

B. Grade Set Posts: Drill or hand excavate using post hole digger in firm undisturbed or compacted soil.

C. Excavate hole for each post to minimum diameter recommended by fence manufacturer but not less than 4 times the largest cross-section of post. Excavate hole depths not less than 36-inch below finish grade surface.

D. Center and align posts in holes with bottom of posts 3-inch above bottom of excavation.

E. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations. Extend concrete footing 2-inches above grade and trowel crown to shed water.

F. Sleeve Set Posts: Anchor posts by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with non-shrink, non-metallic grout, mixed and placed to comply with grout manufacturer's directions.

G. Top Rails: Run rail continuously, bending to form radius for curved runs. Provide expansion couplings as recommended by manufacturer.

H. Center Rails: Provide center rails where indicated. Install in 1 piece between posts and flush with post on fabric side, using special offset fittings where necessary.

I. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

J. Tension Wire: Install tension wires at bottom of fabric before stretching fabric and tie to each post with not less than 6 gauge galvanized wire. Fasten fabric to tension wire using 11 gauge galvanized steel hog rings spaced 24-inches o.c.

K. Fabric: Leave approximately 2 inches between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

L. Stretcher Bars: Secure at end, corner, pull, and gate posts by threading through or clamping to fabric at 4 inches o.c., and secure to posts with metal bands spaced at 15 inches o.c.

M. Tie Wires:

1. Use U-shaped wire, conforming with diameter of pipe to which attached, clasping pipe and fabric firmly when ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.

2. Tie fabric to line posts with wire ties spaced 12 inches o.c. Tie fabric to rails and braces with wire ties spaced 24 inches o.c. Tie fabric to tension wires with hog rings spaced 24 inches o.c.
3. Manufacturer's standard procedure will be accepted if of equal strength and durability.

N. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

O. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubrication.

P. Refer to architectural building plans for fencing attached to a building or structure.

END OF SECTION 323113

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SECTION 323129 - WOOD FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Wood screen fence and gates.

PART 2 - PRODUCTS

2.1 WOOD MATERIALS

A. Wood Materials:
   1. Pickets: Pressure Treated; #1 Grade.
      a. 1 x 6-inch pickets.
      b. 1 x 6-inch top trim.
      c. 2 x 10-inch cap.
      d. 2 x 6 stringers.

B. Steel Posts:
   1. 4 x 4 and 6 x 6 galvanized tube steel.
   2. Galvanized steel, weather tight closure cap for each post.

C. Finish: Exterior water-borne (alkyd vehicle) toner giving UV, water repellant, and mildew protection, enhancing natural wood grain and texture with a natural amber tone.
   1. Woodscapes, by Sherwin-Williams.
   2. Color: As indicated on Drawings.
   3. Substitutions not allowed.

2.2 ACCESSORIES

A. Fasteners: Hot-dipped galvanized nails, screws, and bolts.

B. Hardware: US1D, Black Finish.
   1. Heavy Duty Barrel Hinge: #SKU213000.
   2. Latch: Stanley CD1264.

A. Rolling Gate Hardware:
   1. Swing Gate Roller: Model 017833 with 6-inch wheel, by Hearne Steel Company (979) 279-3464.
   2. Substitutions: Similar product by other Manufacturers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare 16-inch diameter post hole excavation, minimum 3 feet deep or as shown on the drawings.

B. Set fence posts in concrete, centered and plumb.

3.2 INSTALLATION

A. Construct fence as indicated on Drawings.
   1. Secure wood rails to galvanized steel posts with galvanized bolts.
   2. Secure wood pickets to wood rails with galvanized screws.

~~B. Latch: On outside face of gates, at 48" above finish grade.~~

~~C. Hinges:~~
~~1. Top and Bottom of Gate: One at each location.~~
~~2. Intermediate: 30 inches o.c., maximum, from any other hinge.~~

~~D. Cane Bolt: On inside face of gate leaf that has the strike portion of latch on the outside face.~~

~~E. Swing Gate Roller: Install per Manufacturer's written instructions.~~

~~F. Finish: Prepare surfaces and apply finish per Manufacturer's directions/recommendations. Ensure complete, uniform coverage of all surfaces. Apply two coats minimum. Apply second coat within two hours of first coat, per Manufacturer's directions.~~

~~END OF SECTION 323129~~

CONTRACTOR'S RECORD LETTER OF CONFORMANCE
SECTION 323129 – WOOD FENCES AND GATES

Project Location: _____ Date: _____

_____
(City & State)

Statement of Conformance:
This Record Letter of Conformance is provided as a Record Document in accordance with Section 017700 – Closeout Procedures. The undersigned hereby declares that the wood fences and gates are installed and are in general conformance with the Contract Documents, applicable Codes, and shop drawings. The wood fences and gates have been provided and placed in operational condition in accordance with the Manufacturer's published instructions and the Contract Documents.
To be accepted, all signatures must be original ink signatures (copies are not allowed).

WOOD FENCE AND GATE INSTALLER:

_____
(Subcontractor Signature)

_____Phone Number: (___)_____
(Subcontractor name and address)

CONTRACTOR:

_____
(Contractor Signature)

_____ Phone Number: (___)_____
(Contractor name and address)

_____

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SECTION 323130 - METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Metal screen fence and gates.

PART 2 - PRODUCTS

2.1 METAL PANEL MATERIALS

A. Deck:

1. Finish: Prime Painted, prepped for field painting. Paint as indicated on drawings
2. Deck Profile**:** Type F, Intermediate Rib.
3. Profile Depth: 1-1/2 inches
4. Profile Width: 36 inches width
5. Side Laps: Overlapped

B. Steel Posts:
1. 4 x 4 and 6 x 6 galvanized tube steel.
2. Galvanized steel, weather tight closure cap for each post.

C. Finish:
1. Color: As indicated on Drawings.
2. Substitutions not allowed.

2.2 ACCESSORIES

A. Fasteners: Hot-dipped galvanized nails, screws, and bolts.

B. Hardware: US1D, Black Finish.
1. Heavy Duty Barrel Hinge: #SKU213000.
2. Latch: Stanley CD1264.

A. Rolling Gate Hardware:
1. Swing Gate Roller: Model 017833 with 6-inch wheel, by Hearne Steel Company (979) 279-3464.
2. Substitutions: Similar product by other Manufacturers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare 16-inch diameter post hole excavation, minimum 3 feet deep or as shown on the drawings.

B. Set fence posts in concrete, centered and plumb.

3.2 INSTALLATION

A. Construct fence as indicated on Drawings.
1. Secure metal deck to galvanized steel posts with minimum 3/16” weld every 12” OC minimum.

B. Latch: On outside face of gates, at 48” above finish grade.

C. Hinges:
   1. Top and Bottom of Gate: One at each location.
   2. Intermediate: 30 inches o.c., maximum, from any other hinge.

D. Cane Bolt: On inside face of gate leaf that has the strike portion of latch on the outside face.

E. Swing Gate Roller: Install per Manufacturer's written instructions.

F. Finish: Prepare surfaces and apply finish per Manufacturer's directions/recommendations. Ensure complete, uniform coverage of all surfaces. Apply two coats minimum. Apply second coat within two hours of first coat, per Manufacturer's directions.

END OF SECTION 323130

CONTRACTOR'S RECORD LETTER OF CONFORMANCE
SECTION 323129 – WOOD FENCES AND GATES

Project Location: _____ Date: _____

_____
(City & State)

Statement of Conformance:
This Record Letter of Conformance is provided as a Record Document in accordance with Section 017700 – Closeout Procedures. The undersigned hereby declares that the wood fences and gates are installed and are in general conformance with the Contract Documents, applicable Codes, and shop drawings. The wood fences and gates have been provided and placed in operational condition in accordance with the Manufacturer's published instructions and the Contract Documents.
To be accepted, all signatures must be original ink signatures (copies are not allowed).

WOOD FENCE AND GATE INSTALLER:

_____
(Subcontractor Signature)

_____Phone Number: ( )_____
(Subcontractor name and address)

CONTRACTOR:

_____
(Contractor Signature)

_____ Phone Number: ( )_____
(Contractor name and address)

SECTION 323219 – MODULAR RETAINING WALLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide modular retaining wall system to lines and grades indicated on the Drawings and as specified.

B. Construction of foundation, soil preparation, leveling pad or footing installation, modular wall units, and wall anchors with unit fill and compacted backfill.

1.2 RELATED SECTIONS

A. Section 31 00 10 – Site Preparation

B. Section 31 00 20 – Earthwork

C. Section 03 31 60 – Miscellaneous Concrete Work

D. Drawings

1.3 REFERENCE STANDARDS

A. ASTM International (ASTM) latest edition
   1. C 90 Hollow Load-Bearing Concrete Masonry Units
   2. C 140 Sampling and Testing Concrete Masonry Units

1.4 SUBMITTALS

A. Certification letter by professional engineer, registered in state where project is located, that the sealed and signed retainage system drawings included in and made part of Contract Documents has been designed specifically for the project. Certification shall state that proper factors of safety have been incorporated in design regarding sliding, bearing, overturning, slope stability, and other unique design conditions.

1.5 QUALITY ASSURANCE

A. Soil testing and associated testing for quality control during earthwork operations will be supplied by Owner in accordance with Section 31 00 20. Specific testing or inspection services required by retaining wall design shall be clearly delineated on the Drawings.

B. Construction of mockup of adequate size to illustrate finish and construction techniques may be required by Owner or Owner's Representative for wall system with which Owner is not familiar or for which unique design modifications are proposed.

C. Testing for compaction of subgrade and fill materials shall be performed by an independent testing laboratory selected by Owner or Owner's Representative and paid by Owner.

D. If compaction requirements, embedment of reinforcing, or other conditions are not met at any time during construction process, remove and reconstruct deficient areas to obtain proper conditions at no additional cost to Owner.

E. The independent testing laboratory shall promptly prepare reports and distribute to Owner or Owner's Representative and Contractor for testing required by certified and approved design documents. In event any required test fails to meet specified design

requirements, the Owner or Owner's Representative and Contractor shall be notified immediately by the independent testing laboratory.

F. All costs related to retesting due to test failures shall be paid for by Contractor at no additional expense to Owner. Owner reserves right to employ an additional independent testing laboratory to obtain a second opinion when deemed necessary. Contractor shall provide free access to site for testing activities.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Retaining wall units, reinforcing, and accessories shall be supplied as indicated and specified in the Contract Documents. Units produced under license from approved proprietary system shall be manufactured in facility meeting requirements of licensing system with adequate capacity to supply product to site in timely manner. Materials shall be stored as required to prevent damage and staining.

B. Acceptable retainage systems include the following products:
   1. Reinforced Earth® retaining wall units as manufactured by licensed distributer for The Reinforced Earth Company, Bedford, Texas.
   2. Keystone® Retaining Wall Units as manufactured by licensed distributer for Keystone Retaining Wall Systems, Inc., Minneapolis, Minnesota.
   3. Versa-Lok® Retaining Wall Units as manufactured by licensed distributer for Versa-Lok Retaining Wall Systems, North St. Paul, Minnesota.

C. Geogrids or other anchoring materials as specified by manufacturer and indicated on the Drawings. Material shall be stored as required to protect from damage until used.

2.2 LEVELING PAD

A. Leveling pad material shall consist of compacted sand, gravel, crushed rock, or leveling concrete as indicated on the Drawings.

2.3 FILL AND BACKFILL

A. Unit fill, if required, and backfill materials, shall be as specified and indicated on the Drawings.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate to lines and grades required. Overexcavation and/or recompaction shall be performed as required to produce specified bearing conditions.

3.2 SYSTEM INSTALLATION

A. Leveling pads and foundations, unit installation, backfilling, cap installation, installation of geogrid or other anchor materials, and installation of accessories and appurtenances shall be carried out in accordance with manufacturer's recommendations and the Drawings.

END OF SECTION

SECTION 328400 – LANDSCAPE IRRIGATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Installation of underground, automatically controlled lawn and shrub bed irrigation system, including electrical connections, connections to water mains, and necessary accessories.

1.2 RELATED SECTIONS

A. Section 31 23 03 – Excavation, Backfill, and Compaction for Utilities

B. Section 33 11 00 – Water Distribution Systems

C. Section 32 90 00 – Landscaping

D. Section 32 90 01 – Seeding, Mulching, and Sodding

E. Local governing authority and code requirements

F. Drawings

1.3 REFERENCE STANDARDS

A. ASTM International (ASTM) latest edition
   1. D 2239 Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
   2. D 2241 Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series)
   3. D 2609 Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe
   4. D 2855 Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

B. National Fire Protection Agency (NFPA) latest edition
   1. 70 National Electrical Code

C. National Sanitation Foundation (NSF)

D. The Irrigation Association (IA)

E. Uniform Plumbing Code (UPC) published by the Western Plumbing Officials' Association.

1.4 QUALITY ASSURANCE

A. Installer shall have a minimum of 3 years of experience and be licensed in the state where the project is (provided the state licenses irrigation contractors).

B. Piping installation shall be performed in accordance with Section 33 11 00.

C. Following pipe and accessories installation, make final adjustments to landscape irrigation system prior to Owner or Owner's Representative final inspection.
   1. Flush system completely, with nozzles removed, to remove debris.
   2. Verify sprinkler operation and alignment for direction of throw.
   3. Check pop-up spray nozzling for proper arc of spray.

4. Ensure uniform distribution exists.

D. Following final adjustment, operate entire installation, zone by zone, to demonstrate complete and successful operation of equipment.

E. Guarantee installation for one year from date of final acceptance for the following:
1. Defects in material, equipment, and workmanship.
2. Repair of damage to premises resulting from leaks or other defects in material, equipment, and workmanship to the satisfaction of Owner or Owner's Representative.

F. Repairs, if required, shall be done promptly at no cost to Owner.

1.5 SUBMITTALS

A. Submittals:
1. Do not proceed with purchase or installation of materials prior to receipt of approved submittals from Owner or Owner's Representative.

B. Substitutions shall be made only with written approval of the Owner or Owner's Representative. Substitutions will not be considered prior to opening of bids.
1. Substitution of specified irrigation heads after awarding of bid shall require piping diagram noting revised pipe sizes, pressure loss calculations, and revised head locations necessary to achieve desired watering provided by system as shown on the Drawings.

C. Controller Chart: Prepare color-coded chart, reduced in size, containing same plan information as Record Drawings, and laminated in plastic on both sides, with following specific information.
1. Routing of control wires.
2. Identity of valves as to size, station number shown on controllers, and type of irrigation head (e.g. spray head, turf head) on each valve.
3. Delineate each station's limits of coverage by color-coding, with each station having different color showing its zone with zone number designation.

D. Operation Manual shall include the following.
1. Approved submittals as specified herein.
2. Installation instructions including mounting details for control valves.
3. Operation instructions, including:
a. Winterizing procedures
b. Recommended operation sequence, frequency, and length of operation cycle, as per relationship to estimated absorption rate, evaporation rate, and anticipated flow.
4. Maintenance instructions, including:
a. Manufacturers' product data, installation, and maintenance instructions.
b. Copies of completed warranty information. Complete all necessary warranty registration information to manufacturer, keeping copies for Contractor's records.

1.6 PROJECT RECORD DOCUMENTS

A. Shop Drawings: Contractor shall provide a full system design for review by the Landscape Architect and Owner.

B. Record drawings: noting exact locations of elements and changes to the Shop Drawings.

C. Operation Manual including the following:
   1. Approved submittals as specified herein.
   2. Installation instructions including mounting details for control valves.
   3. Operating Instructions:
      a. Winterization procedures
      b. Recommended operation sequence, frequency, and length of operation cycle, as required for the estimated absorption rate, evaporation rate, and anticipated flow.
   4. Maintenance Instructions:
      a. Items requiring manufacturer's product data, installation, and maintenance instructions.
      b. Complete warranty information forms and mail to manufacturer with copies to included in manuals.

D. Controller Chart: Prepare color-coded chart, reduced in size, containing same plan information as record drawings, and laminated in plastic on both sides, with following specific information.
   1. Note routing of control wires.
   2. Identify valves as to size, station number shown on controller including quantity and type of irrigation head served by each valve.
   3. Delineate each station's limits of coverage by color coding, with each station having different color showing its area of coverage.

1.7 PROJECT CONDITIONS

A. Visit site and become familiar with nature and location of work, existing conditions, and conditions that will exist during installation.

B. Water for irrigation work and testing shall be provided by Irrigation Contractor at no expense to Owner.

1.8 WARRANTY

A. Guarantee installation for one year from date of final acceptance for the following:
   1. Defects in material, equipment, and workmanship.
   2. Repair of damage to premises resulting from leaks or other defects in material, equipment, and workmanship to satisfaction of Owner.

B. Repairs, if required, shall be done promptly at no cost to Owner.

C. Parts manufacturer’s warrantees shall be provided to Owner.

1.9 MAINTENANCE

A. Maintenance Agreement (Alternate Bid)
   1. Prior to beginning installation, execute bonded, optional Extended 2-Year Maintenance Agreement with Owner for period of two years from date of Final Acceptance for the following.
      a. Spring start-up of system in accordance with Section 32 90 00.
      b. Monthly checks of system during operating season.
      c. Winterization of system in accordance with Section 32 90 00.
   2. Costs for additional work required for repair of items not covered by warranty (e.g. damage by others) shall be negotiated between Owner and Contractor prior to initiation of any repairs.

PART 2 - PRODUCTS

2.1 GENERAL

A. Acceptable manufacturers shall include:
   1. Rain Bird Sales, Inc. – Turf Division
   2. The Toro Company – Irrigation Division
   3. L.R. Nelson Corporation – Turf Division

2.2 PIPE

A. Polyvinyl Chloride (PVC) Main Line: Pipe shall conform to ASTM D 2241, Class 200.

B. Polyvinyl Chloride (PVC) Lateral Line: Pipe shall conform to ASTM D 2241, Class 315.

C. Flexible Polyethylene (PE) Lateral Line: Pipe shall conform to ASTM D 2239, SDR 11.5, PE23, rated at 100 PSI, National Sanitation Foundation (NSF) approved. Subject to approval of Owner, shall be utilized for laterals in areas where ground is subject to freezing for extended periods of time each year.

D. Pipe sizes 2.5-inches or smaller shall have bell and spigot joints.

E. Pipe sizes larger than 2.5-inches shall have snap connections with rubber gasket joints. Thrust blocking shall be required in accordance with Section 33 11 00.

2.3 FITTINGS

A. Sleeves: Sleeves shall conform to ASTM D 2241, Schedule 40. Minimum diameter of 2-inches or two sizes larger than pipe scheduled to pass through them.

B. Plastic Fittings:
   1. Polyvinyl Chloride (PVC) Main Line Fittings: Fittings shall conform to ASTM D 2241, SDR not larger than 18.
   2. Polyvinyl Chloride (PVC) Lateral Line Fittings: Fittings shall conform to ASTM D 2241, SDR not larger than 18.
   3. Flexible Polyethylene (PE) Lateral Line Fittings: Fittings shall conform to ASTM D 2609, Type 1 PVC insert fittings designed for use with this type of pipe. Pipe and fittings shall be joined with stainless steel pinch clamps or wormgear clamps, including stainless steel screw.
   4. Risers above finished grade shall receive two coats of black exterior semi-gloss enamel paint.

C. PVC Solvent Cement: Cement shall conform to ASTM D 2564.

D. Swing Joint Connections: Connections between heads and laterals shall be thick wall, flexible, polyethylene pipe, with fittings that have male barbs on one end and either male or female screw ends on the opposite end. Glue fittings and female barb adapters are not allowed. Pipe and fittings shall be one of following:
   1. Rain Bird SP swing pipe with SB spiral barb fittings
   2. Toro Funny Pipe and Fittings

2.4 GLOBE VALVES 3 INCHES OR SMALLER

A. Cut off or isolation valves shall be as manufactured by Red-White Valve Corporation, Carson, CA. or approved equal.

2.5 MECHANICAL JOINT VALVES LARGER THAN 3 INCHES

A. Cut off or isolation valves shall be non-rising stem, of cast iron and bronze construction in accordance with AWWA C509 and have fusion bonded epoxy coated interior finish similar to the Resilient Wedge Valve, manufactured by Clow Valve Co., Oskaloosa, Iowa or approved equal.

B. Provide with each valve a valve key and cast iron cylindrical valve box with cover.

2.6 QUICK COUPLER VALVES

A. Provide a key with each quick coupler valve having 3/4-inch male pipe threads for top hose connection and shall be one of following:
   1. Rain Bird model 44NP Valve with model 33K Key
   2. Toro 470 Series Valve and Coupler Key

2.7 ELECTRIC CONTROL VALVES

A. Rain Bird PEB Series electric remote control valves

B. Toro 252 Series plastic valves

C. Nelson Model 7900 Series plastic valves

D. Provide water-tight connectors similar to Scotch Lock or Rain Bird Snap Tight connectors with sealant for wiring connections.

2.8 MASTER VALVES

A. Master Valves shall be electric control valve as specified in this section.

B. Size of valve shall be same as diameter of main line pipe as noted on the Drawings.

C. Provide water-tight connectors similar to Scotch Lock or Rain Bird Snap Tight connectors with sealant for wiring connections.

2.9 SPRINKLER HEADS

A. Full or part Circle Pop-Up Fixed Spray Sprinkler:
   1. Pop-up heights:
      a. Turf – 4 inches
      b. Shrub and Groundcover Beds – 12 inches
   2. Acceptable Products:
      a. Rain Bird 1800 Series nozzles with 1800 Series sprinklers having Pressure Regulating Modules (PRS) and Seal-A-Matic (SAM) features.
      b. Toro 570 Series plastic nozzles with 570C Series sprinklers having Pressure Compensating Devices (PCD) and optional check valve unit.
      c. Nelson 6400 Series with Anti-Drain Valve (ADV) with Pressure Compensating Screens (PCS).
      d. Rain Bird SAM features and Toro optional check valve units shall not be provided on systems using PE pipe or when heads are to be raised above grade leaving part of sprinkler body exposed.

B. Full or Part Circle Pop-up Gear Driven Rotor Sprinkler. Acceptable Products:
   1. Rain Bird Turf Bird Rotor Pop-up Sprinkler Series, R-50C Commercial Series, R-70 Series, with Seal-A-Matic (SAM) check valve.

2. Toro Super 700 Sprinklers Series S700C Commercial, with check valve.
3. Nelson Pro 6000 and 6500 Series Gear Drives with Anti-Drain Valves.
4. Rain Bird SAM features and Toro optional check valve units shall not be provided on systems using PE pipe or when heads are to be raised above grade leaving part of sprinkler body exposed.

C. Unless otherwise indicated on the Drawings, pop-up heights shall be:
1. Turf: 4 inches
2. Shrub and groundcover beds: 12 inches

2.10 VALVE BOX

A. Valve boxes shall be manufactured by Ametek, Plymouth Products Division, Sheboygan Wisconsin, or approved equal.

B. When valve box is used with single valve, provide Economy Turf Box with black colored snap fit cover labeled "Valve Box".

C. When valve box is used with two valves, provide Jumbo Box with 20- x 14-inches cover opening with cover labeled "Control Valve".

2.11 LOW POINT DRAINS

A. Low point drains are requires on all zones. Automatic drain valves shall be Rain Bird Model Number 16A, FDV, or approved equal.

B. Provide 2 drains at lowest points of each zone above 1 cu. ft. of coarse gravel.

2.12 AUTOMATIC CONTROLLER

A. Controller shall have wall mount, weatherproof, lockable cabinet with internal transformer. Acceptable Manufacturers:
1. Rain Bird Sales, Inc. – Turf Division
2. The Toro Company – Irrigation Division

2.13 CONTROL WIRE

A. Control wire shall be number 14 copper wire or larger and U. L. approved for underground direct burial.

B. Colored wire shall have same color coding as shown on controller.

C. Provide single wire from controller to each valve.

D. Provide common neutral from controller to each valve.

2.14 BACKFLOW PREVENTOR

A. Comply with requirements and codes of local governing authority regarding backflow prevention.

B. Provide the necessary materials, insulation/draining capabilities, and acceptable concealment to satisfy requirements and codes of local authority and aesthetic needs of Owner. Concealment techniques consist of painting of exposed piping, providing plant material screen, providing painted metal enclosure around unit, or approved equal.

C. Backflow Preventers shall be suitable for use in high hazard areas and shall prevent cross connection to potable water system. If the local utility does not have any specific units required, provide backflow preventer by Watts Regulator Company, Lawrence, Ma., or approved equal:
   1. Reduced pressure backflow preventers shall be No. 909 series Reduced Pressure Principle Backflow Preventer, or approved equal.
   2. Double check valve assembly backflow preventers shall be No. 709 series Double Check Valve Assembly, or approved equal.
   3. In absence of local codes or requirements, double check assembly backflow preventer installed in strict accordance with manufacturer's written instructions shall be considered as the minimum requirement.

2.15 RAINFALL SENSOR

A. Provide rainfall sensor to cancel operation of controller during substantial rainfall. Sensor shall be by same manufacturer as controller and shall be one of following:
   1. Rain Bird Rain Check Automatic Rain Shutoff
   2. Toro Rainswitch model 850-74

2.16 METER

A. Water meter and meter box shall meet or exceed requirements of the local utility company.

PART 3 - EXECUTION

3.1 PREPARATION

A. Pressure/Flow Test: Conduct tests at the water source tap or meter and provide written results to Owner or Owner’s Representative prior to start of work:
   1. Static pressure in psi
   2. Residual pressure in psi
   3. Flow in gpm

B. Layout of sprinkler heads: Stake locations of each sprinkler in accordance with the Drawings. If discrepancies in become apparent, notify Owner or Owner’s Representative.

C. Prior to installation, obtain approval from Owner or Owner’s Representative to proceed with construction along with proposed revisions required due to test results or discrepancies on the Drawings.

3.2 EXCAVATION

A. Excavate trench to proper depth.

B. Minimum trench width shall be 3.5 inches.

C. Backfill and hand tamp over-excavation prior to installing piping.

D. Excavate trenches 2 inches deeper than required in soils containing rock or other hard material that might damage pipe. Backfill and compact to proper depth with selected fine earth or sand.

E. Keep trenches free of obstructions and debris that would damage pipe.

F. Avoid heating trenches, electric ducts, storm and sanitary sewer lines, water and gas mains when trenching for piping.

G. Do not cut surface improvements such as sidewalks, paved areas, or curb and gutter when trenching for piping.
   1. Provide sleeves under surface improvements prior to installation of surface improvements.
   2. Provide sleeves under existing surface improvements by jack and bore or other methods without damage to surface improvements.

3.3 PIPING SYSTEM

A. Minimum cover from top of piping to finished grade shall be provided as follows:
   1. Lawn and planting areas:
      a. Mains and Control Valves: 18 inches.
      b. Laterals: 12 inches.
   2. Drives or parking areas: 24 inches
   3. In cold weather climates, provide greater depth of burial to protect irrigation pipes from freezing.

B. Clearances: Maintain minimum of 3 inch horizontal clearance between lines in the same trench and 3 inch minimum vertical clearance between lines crossing at angles.

C. Special Requirements – PVC and PE pipe:
   1. Snake in trench at least 1 foot per 100 feet of pipe to allow for thermal expansion.
   2. Pipe mains and laterals shall drain to low point drains located at lowest point of each zone.

3.4 SLEEVING

A. Provide sleeves for both piping and control wiring in accordance with 3.02.G of this section.
   1. Depths of sleeves shall be same as that required for piping at each location or condition.
   2. Extend sleeves 12 inches beyond paving or other surface improvement.
   3. Install permanent mark on top of existing curbs for reference to sleeve locations.

3.5 PIPING INSTALLATION

A. Do not lay pipe on unstable material or blocking, or when, in opinion of Owner or Owner's Representative, conditions are unsuitable.

B. Rest full length of pipe section on bedding in trench, excavating recesses to accommodate joints.

C. Hold pipe securely in place while joints are being completed and properly supported.

D. Threaded Plastic Pipe:
   1. Do not use solvent cement on threaded joints.
   2. Wrap joints with Teflon tape or use virgin Teflon lubricant.

E. Bell and Spigot Plastic Pipe: Cemented joints shall be in accordance with ASTM D 2855.

3.6 VALVES

A. Do not locate valves beneath paved surfaces.

B. Install valves plumb to within 1/16-inch

C. Locate valve within valve box with a 6 inches thick layer of coarse gravel beneath bottom of valve.

D. Top of quick coupler valves shall be as close to top of valve box as possible. Top of gravel layer shall be 3 inches below top of valve.

E. Master Valve:
1. Locate master valve adjacent to and on sprinkler system side of backflow preventer.
2. Master valve shall be energized by master valve circuit on automatic controller.

3.7 SPRINKLERS

A. Install sprinklers plumb to within 1/16-inch, with top collar, not nozzle, flush with finish grade.

B. Provide swing joint with each sprinkler, except where entire head is raised above grade and/or where rigid riser piping is required.

C. Sprinkler heads adjacent to paving and curb shall be located between 1 inch and 4 inches from edge of paving or back of curb.

3.8 ELECTRICAL CONNECTIONS AND CONTROL WIRE

A. All connections shall be in strict accordance with latest edition of National Electrical Code and local electrical codes.

B. Provide electrical connection to system as designated on the Drawings and as specified herein.

C. General:
1. Do not run control and power supply wiring in same conduit.
2. Provide continuous runs of wire between controller and valves. Splices shall be made with one of following:
   a. Watertight below-ground electrical junction boxes.
   b. Watertight connectors, such as utilized for valves, and located within valve box for ease of locating.
3. Bury control wire beside pipe in same trench. Bundle and tape together at not more than 10 foot intervals.

D. Expansion Loops: Constructed by wrapping wire around 1/2-inch diameter pipe to create coil. A 3 foot section of wire shall be used to create 12-inch coil with 6 foot section being used to create 24-inch coil.
1. Provide 12-inch coils at each wire splice, not including valves, and at each change of wire direction.
2. Provide 24-inch coils at each control valve and where each valve enters conduit for automatic controller.

3.9 BACKFILLING

A. Sand or fine grained soils shall be used for initial backfill to sufficient depth to prevent damage to pipe from rocks or other debris during compaction of subsequent backfill.

B. Fill trench to within 3 inches of finish grade with excavated soil and compact in accordance with Section 31 23 02.

C. Fill top 3 inches of trench with existing topsoil in planting or turf areas and wheel roll until compaction of backfill is same as surrounding soil.

D. Grade backfilled trench uniform with surrounding grades.

3.10 BACKFLOW PREVENTOR

A. Comply with local codes for installation of backflow preventer. In absence of local codes, minimum requirements shall be to set in accordance with manufacturer's written instructions.

B. Provide a combination of drains and quick coupler valves to accommodate winterization of entire system by forced air. Submit materials and methods for winterization to Owner or Owner’s Representative for consideration and receive approval prior to installation of work.

3.11 AUTOMATIC CONTROLLER

A. Location and installation of Automatic Controller shall be as shown on the Drawings and approved by Owner or Owner’s Representative prior to installation.

B. Provide rigid conduits to and from the Automatic Controller for both power supply and control wiring.
   1. Control wire conduit from Automatic Controller to sprinkler system shall be installed not less than 18 inches below grade.
   2. Secure conduit to building wall or structure in manner acceptable to Owner or Owner’s Representative.

C. Provide electrical grounding for the Automatic Controller in accordance with all applicable codes and the manufacturer's written instructions.

3.12 FIELD QUALITY CONTROL

A. Inspection and Adjustments: Following installation, make final adjustments to lawn irrigation system prior to Owner’s final inspection.
   1. Flush system completely, with nozzles and screens removed, to extract debris.
   2. Verify sprinkler operation and alignment for direction of throw. Correct as necessary.
   3. Check pop-up spray nuzzling for proper arc of spray with no overthrow onto pavement. Adjust nozzles as necessary for proper throw.
   4. Ensure uniform distribution exists.
   5. Ensure proper sprinkler head operational after landscaping and/or sod installation

B. Demonstration: Following final adjustment, operate entire installation to demonstrate complete and successful operation of equipment.

END OF SECTION

SECTION 329000 – LANDSCAPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Preparation and excavation of planting beds.

B. Planting of seed and associated materials.

C. Protection of existing landscaping to remain.

D. Extended maintenance after construction (Alternate Bid)

1.2 RELATED SECTIONS

A. Section 31 00 20 – Earthwork

B. Section 31 25 01 – General Requirements for Erosion and Sediment Control

C. Drawings

1.3 REFERENCE STANDARDS

A. American Association of Nurserymen, Inc. (AAN) latest version

B. American Standard for Nursery Stock

1.4 QUALITY ASSURANCE

A. No error or discrepancy in Drawings or Specifications shall cause defective or inappropriate materials to be used or poor workmanship to be allowed.

B. Condition of new plant materials is the responsibility of Contractor and shall be approved by Owner or Owner's Representative. Owner reserves the right to inspect and reject plants at any time and place.

1.5 SUBMITTALS

A. Submit certification tags from trees, shrubs, and seed verifying type and purity.

B. Unless otherwise authorized by Owner or Owner's Representative, notify Owner or Owner's Representative at least 48 hours in advance of anticipated delivery date of plant materials. Legible copy of invoice, showing kinds and sizes of materials included for each shipment, shall be furnished to Owner or Owner's Representative.

C. Inform Owner or Owner's Representative of date when planting shall commence.

1.6 PROJECT CONDITIONS

A. Work must be carried out only during weather conditions favorable to landscape construction and to health and welfare of plants. Suitability of such weather conditions shall monitored and determined by Contractor, subject to the review of Owner or Owner's Representative.

PART 2 - PRODUCTS

2.1 PLANT MATERIALS

A. Plants shall conform to requirements of American Standard for Nursery Stock of rules and grading upgraded to meet the following:

1. Seeds shall be free of disease, insect pests, eggs, or larvae.
2. Plants shall be typical of their species or variety and shall have normal habit of growth and be legibly tagged with proper name. Stock shall have been grown under climatic conditions similar to those of site or have been acclimated to such condition for at least 2 years.

2.2 TOPSOIL

A. Natural, friable, fertile, fine loamy soil possessing characteristics of representative topsoil in the vicinity which produces heavy growth.

B. Topsoil shall be free from subsoil, objectionable weeds, litter, sods, stiff clay, stones larger than 1-inch in diameter, stumps, roots, trash, toxic substances, or any other material which may be harmful to plant growth or hinder planting operations.

C. Verify amount of topsoil stockpiled and supply any additional as needed.

2.3 FERTILIZER

A. Fertilizer shall be delivered, mixed as specified, in original unopened standard size bags showing weight, analysis and name of manufacturer. Containers shall bear manufacturer's guarantee statement of analysis or manufacturer's certificate of compliance covering analysis shall be furnished to Owner or Owner’s Representative. Store fertilizer in such manner to keep dry.

B. Percentages of nitrogen, phosphorus, and potash shall be based on laboratory test recommendations as approved by Owner or Owner’s Representative. For bidding assume 10 percent nitrogen, 6 percent phosphorus, and 4 percent potash by weight. At least 50 percent of total nitrogen shall contain no less than 3 percent water-insoluble nitrogen. At least 60 percent of nitrogen content shall be derived from super-phosphate containing not less than 18 percent phosphoric acid or bone meal containing 25-30 percent phosphoric acid and 2-3 percent nitrogen. Potash shall be derived from muriate of potash containing 55-60 percent potash.

2.4 PEAT MOSS

A. Peat moss shall be Michigan peat moss or approved equal, similar in color and consistency.

B. Peat moss shall be moss peat, finely shredded to pass 1/2-inch mesh and shall be no less than 90 percent organic material by weight, with ash content by ignition of no more than 10 percent.

C. Material shall contain 35 to 66 percent moisture by weight, but shall have water-holding capacity of 150 to 200 percent.

D. Material shall have pH value of 4 to 5.

E. Material may be imported supplied in bales or domestic furnished in bulk. If furnished in bulk, material and its source must be acceptable to Owner or Owner’s Representative.

2.5 WATER

A. On-site water shall be furnished by Contractor. Hose and other watering equipment shall be furnished by Contractor.

2.6 LAWN SEED

A. Lawn seed mixture shall be fresh, clean new crop seed. Furnish to Owner or Owner's Representative the dealer's guarantee statement of composition of mixture and percentage of purity and germination of each variety.

2.7 SOD

A. Either field grown or nursery grown sod, type as specified by the Drawings, consisting of a densely rooted growth of grass free from noxious weeds and undesirable grasses.

B. Sufficiently thick to secure a dense stand of live grass, including a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling.

C. Cut in uniform strips. Width of sod pieces shall be satisfactory to Owner or Owner's Representative.

D. Live, fresh, and uninjured at the time of placing.

E. Use sod cut and delivered as soon as possible after being cut. Sod that had been on the site long before it is placed, or which has not been kept moist and thriving while in temporary storage, may not be used in the work.

2.8 EROSION CONTROL BLANKET

A. Unless otherwise indicated on the Drawings or specified, provide and install, where required to prevent erosion, "Curlex" blankets by American Excelsior Company, "Polyjute" Style 465 GT by Synthetic Industries, or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. If project completion date prohibits in-season planting, prepare for out-of-season seeding or sodding so that lawns shall be completed and ready for acceptance at time of project completion, without additional cost to Owner.

B. Provide sufficient tools and equipment required to carry out planting operation.

C. Locations containing unsuitable subsoil shall be treated in one or more of the following ways:

1. Where unsuitability is deemed by Owner or Owner's Representative to be due to excessive compaction caused by heavy equipment and where natural subsoil is other than AASHTO classification of A6 or 7, loosen such areas with spikes, discing, or other means to loosen soil to condition acceptable to Owner or Owner's Representative. Soil shall be loosened to minimum depth of 12-inches with additional loosening as required to obtain adequate drainage. Contractor may introduce peat moss, sand, or organic matter into the subsoil to obtain adequate drainage. Such remedial measures shall be considered as incidental, without additional cost to Owner.
2. Where unsuitability is deemed by Owner or Owner's Representative to be due to presence of boards, mortar, concrete, or other construction materials in subgrade and where natural subsoil is other than AASHTO classification of A6 or 7,

remove debris and objectionable material. Such remedial measures shall be considered as incidental, without additional cost to Owner.

3. Where unsuitability is deemed by Owner or Owner's Representative to be because natural subsoil falls into AASHTO classification of A6 or 7 and contains moisture in excess of 30 percent, then installation of sub-drainage system or other means removing excess moisture shall be used. Where such conditions have not been known or revealed prior to planting time and they have not been recognized in preparation of Drawings and Specifications, a change order to install proper remedial measures will be required.

D. Planting operations shall be performed at a steady rate of work unless weather conditions make it impossible to work. No plant material shall be planted in frozen ground.

E. Disc, drag, harrow, or hand rake subgrade to a depth of 3-inches to provide bond for topsoil. Topsoil that must be transported across finished sidewalks or paving shall be delivered in such manner that no damage will be done to sidewalks or paving. Repair any damage at no cost to Owner.

F. Place no topsoil until subgrade has been approved in accordance with Section 31 00 20. Before placing topsoil, rake subsoil surface clear of stones, debris, and roots. Compact topsoil to form layer with minimum depth of 4-inches in lawn areas and 12-inches in shrub beds. Topsoil shall be placed so that after final settlement there will be good drainage conforming to elevations shown on Drawings.

G. Seed Bed Preparation

1. Grade seed bed areas to finish grades, filling as needed or removing surplus material such that areas are smooth and to uniform grade as indicated on Drawings. Lawn areas shall slope to drain.
2. Where no grades are shown, areas shall have smooth and continual grade between existing or fixed controls, such as walks, curbs, catch basin, steps, or building, and elevations shown on the Drawings. Roll, scarify, rake, and level as necessary to obtain true, even lawn surfaces. Finish grades shall meet approval of Owner or Owner's Representative before grass seed is sown.
3. Loosen soil to depth of 6-inches in lawn areas by approved method of scarification and grade to remove ridges and depressions. Remove stones or foreign matter over 2-inches in diameter from top 3-inches of soil. Grade lawn areas to finish grades.
4. Seed beds shall be permitted to settle or should be firmed by rolling before seedings are made.

H. Grass areas shall have fertilizer applied in two applications with a thorough watering as specified in Section 4.02 B, immediately following each application. The first application shall be one week prior to seeding/sodding at the rate of 25 pounds per 1000 square feet and harrowed into the top two inches of topsoil. The second application shall be at the rate of 10 pounds per 1000 square feet immediately following the second mowing.

3.2 PROTECTION

A. Before commencing work, trees and shrubs which are to be saved must be protected from damage by placement of fencing flagged for visibility or some other suitable protective procedure approved by Owner or Owner's Representative. No work shall begin until this requirement is fulfilled.

B. In order to avoid damage to roots, bark, or lower branches, no truck or other equipment shall be driven or parked within drip line of any tree that is to be saved, unless tree overspreads paved area.

C. Use precautionary measures when performing work around trees, sidewalks, pavements, utilities, and other features either existing or previously installed.

D. Adjust depth of earthwork and topsoil when working immediately adjacent to trees to be saved in order to prevent disturbing tree roots, undermining sidewalks and pavements, and damage in general to other features either existing or previously installed.

E. Where excavation, filling, or grading is required within the dripline of trees that are to remain, work shall be performed as follows:

1. Trenching: When trenching occurs around trees to remain, tree roots shall not be cut but trench shall be tunneled under or around roots by careful hand digging without injury to roots.
2. Raising Grades:
    a. Where fill not exceeding 16-inches is required, clean, washed gravel graded from 1- to 2-inches in size shall be placed directly around tree trunk. Gravel shall extend out from trunk on all sides a minimum of 18 inches and finish approximately 2 inches above finished grade at tree. Install gravel before any earth fill is placed. New earth fill shall not be left in contact with trunks of trees requiring fill.
    b. Where fill exceeding 16-inches is required, a dry laid tree well shall be constructed around trunk of tree. Tree well shall extend out from trunk on all sides minimum of 3-feet and to 3-inches above finish grade. Coarse grade rock shall be placed directly around tree well to a depth of 6-inches, and extending out to drip line of tree. Clean, washed gravel graded from 1- to 2-inches in size shall be placed directly over coarse rock to a depth of 3-inches. Approved backfill material shall be placed directly over washed gravel to desired finish grade.
3. Lowering Grades: Existing trees in areas where new finish grade is to be lowered shall have regrading work done by hand to elevation indicated on Drawings. Roots as required shall be cut cleanly 3-inches below finished grade and scars covered with tree paint.
4. Trees marked for preservation that are more than 6-inches above proposed grades shall stand on broad rounded mounds and be graded smoothly into lower level. Trees located more than 16-inches above proposed grades shall have dry laid stone wall or other retaining structure as detailed on Drawings constructed minimum of 5-feet from trunk. Exposed or broken roots shall be cut clean and covered with topsoil.

3.3 MISCELLANEOUS INSTALLATIONS

A. Peat moss shall only be used for planting soil mixture and not be used as mulch, except on ground cover.

B. Apply fertilizer to grass areas per Paragraph 3.01 H.

C. Areas to be covered with erosion control blankets shall be properly prepared, fertilized, and seeded before blanket is applied. When blanket is unrolled, netting shall be on top and fibers in contact with soil. In ditches, blanket shall be applied in direction of flow of water. On slopes, blankets shall be applied vertically on slope. Ends and sides shall be butted snugly and stapled. Staple to manufacturer's recommendations.

3.4 SEEDING

A. Do not perform seeding in windy weather.

B. Seed in two directions at right angles to each other.

C. Seed lawn areas by sowing evenly with approved mechanical seeder at rate as specified on the Drawing. Culti-packer or approved similar equipment may be used to cover seed and to form seed bed in one operation. In areas inaccessible to culti-packer, seeded ground shall be lightly raked with flexible rakes and rolled with water ballast roller. After rolling, seeded areas shall be lightly mulched with wheat straw.

D. Surface layer of soil for seeded areas must be kept moist during germination period. Water seeded areas twice first week to minimum depth of 6 inches with fine spray and once per week thereafter as necessary to supplement natural rain to equivalent of 1 inch or to 6 inches depth.

3.5 MAINTENANCE DURING CONSTRUCTION

A. Maintenance shall begin immediately after planting. Seed shall be watered, mulched, weeded, sprayed, fertilized, cultivated, and otherwise maintained and protected until acceptance. Defective work shall be corrected as soon as possible after it becomes apparent and when weather and season permit.

B. Lawns shall be maintained for at least 60 days after seeding, or as long as is necessary to establish 95 percent cover of the specified grasses, or until substantial completion of project, or until acceptance of lawns, whichever is later.

C. In event that lawn operations are completed too late in the fall season for adequate germination and/or growth, maintenance shall continue into the following growing season or until a 95 percent cover of specified grasses has been established.

D. Make weekly inspections to determine moisture content of soil and adjust watering schedule established to maintain proper moisture conditions.

E. After grass growth has started, areas which fail to show 95 percent cover of grass for any reason whatsoever shall be reseeded in accordance with Drawings and as specified herein. Such areas shall be reseeded repeatedly until areas are covered with satisfactory growth of grass at no additional cost to Owner.

F. Watering shall be done in such a manner and as frequently as is deemed necessary by Owner or Owner’s Representative to assure continued growth of healthy grass. Areas of site shall be watered in such way as to prevent erosion due to excessive quantities applied over small areas and to avoid damage to finished surface due to watering equipment.

G. Furnish portable tanks, pumps, hose, pipe, connections, nozzles, and any other equipment required to transport water from available outlets and apply it to seeded areas in approved manner.

H. Mowing of seeded areas shall be initiated when grass has attained height of 2-inches to 2 1/2-inches. Grass height shall be maintained at 2-inches to 2 1/2-inches at subsequent cuttings depending on time of year. Not more than 1/3 of grass leaf shall be removed at any cutting and cutting shall not occur closer than 10 days apart.

I. Heavy cuttings shall be removed to prevent destruction of underlying turf. If weeds or other undesirable vegetation threaten to smother planted species, such vegetation shall be mowed or, in case of rank growths, shall be uprooted, raked and removed from area by methods approved by Owner or Owner’s Representative.

J. Protect seeded area from trespassing while grass is germinating. Furnish and install fences, signs, barriers, or other necessary temporary protective devices. Repair damage resulting from trespass, erosion, washout, settlement, or other causes at no expense to Owner.

K. Remove fences, signs, barriers, or other temporary protective devices after final acceptance.

L. If a substantial portion of lawn is sickly or dead at time of inspection, acceptance shall not be granted and Contractor's responsibility for maintenance of lawn shall be extended until replacements are made.

M. Replacements shall be grasses of same kind specified on Drawings, furnished and planted as specified herein at no cost to Owner. Replacements resulting from removal, loss, or damage due to occupancy of project in any part, vandalism, physical damage by animals, vehicles, etc., and losses due to curtailment of water shall paid for by Owner.

N. Remove and replace dead, defective and/or rejected lawn as required before final acceptance. Replacement of lawn that may be necessary shall be at no expense to Owner.

O. Grassed areas damaged during process of work shall be the responsibility of Contractor. Restore disturbed areas to condition satisfactory to Owner or Owner’s Representative. This may include filling to grade, fertilizing, seeding, and mulching.

P. Lawn shall be guaranteed for a period of 1 year after inspection and acceptance which will be considered the Establishment Period.

Q. At end of the Establishment Period, inspection shall be made again. Any lawn that is dead or considered unsatisfactory by Owner or Owner’s Representative shall be removed from site and shall be replaced during normal planting season.

3.6 MULCHING

A. After seeded areas are rolled, apply mulch over seeded areas to improve germination and moisture retention. Apply at a rate consistent with local practice.

3.7 SODDING

A. Install sod where indicated on the Drawings, and in the following locations.

B. Final dress area to be sodded to the shape and section shown on the Drawings, with top and bottom slopes to be rounded to a radius of approximately 3 feet unless otherwise directed. Finished slopes shall be free of objectionable foreign matter. Top 1 inch of topsoil shall be loosened and finely divided. The bed shall be in a firm but un-compacted condition with a relatively fine texture at the time of sodding.

C. Apply water before, during, or after final to maintain the desired moisture content in the soil.

D. Apply fertilizer before placement of sod, at the rate of 250 pounds per acre.

E. Apply sod in a moist condition on a moist earth bed. Lay sod strips along contour lines, by hand, commencing at the base of the area to be sodded and working upward. Lay adjacent ends and sides carefully to produce tight joints.

F. Anchor at top of slope by either pegging or pinning or by turning sod into the embankment and covering with a layer of earth, compacted to conduct surface water over and onto the sod.

G. Firm, water, and re-firm sod immediately after it is placed. Firming shall be accomplished by use of a law roller or approved tamper, taking care to avoid tearing end strips.

H. When sodding is complete, clear areas of loose sod, excess soil, or other foreign material. Gather twine from sod bundles; remove from the site.

END OF SECTION 329000

SECTION 330200 - PIPE LAYING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Installation of storm sewer pipe, sanitary sewer pipe, water pipe, and appurtenances.

1.2 RELATED WORK

A. Trenching, Backfilling and Compacting for Utilities is specified in Section 31 23 02.

B. Water pipe, fittings and appurtenances are specified in Section 33 11 00.

C. Sewer pipe is specified in Section 33 31 00.

D. Storm sewer piping, both reinforced concrete pipe and fittings and corrugated metal pipe and fittings, are specified in Section 33 41 00.

E. Testing of installed pipe is specified in the individual sections for the pipe.

F. Concrete is specified in Section 03 31 60.

1.3 REFERENCES

A. AASHTO
1. T 99, "Standard Method of Test for the Moisture-Density Relations of Soils Using a 5.5-lb. Rammer and a 12-in. Drop".
2. T 180, "Standard Method of Test for the Moisture-Density Relations of Soils Using a 10-lb. Rammer and an 18-in. Drop".
3. State Department of Transportation standard specifications for highway construction, section concerning "Aggregate Base Course".

B. ASTM
1. D 448, "Standard Classification for Sizes of Aggregate for Road and Bridge Construction".
2. D 2922, "Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth),

C. AWWA
1. C600, “Installation of Ductile-Iron Water Mains and Their Appurtenances.

1.4 QUALITY ASSURANCE

A. Provide skilled workers to ensure proper handling, jointing, and embedment of pipe.

B. Methods of Testing
1. Moisture density relations of material shall be determined in the laboratory in accordance with AASHTO T 99 or T 180, as specified.
2. Field density of backfill shall be determined in accordance with ASTM D 2922.

PART 2 - MATERIALS

2.1 BEDDING MATERIALS

A. Bedding materials, used for bedding, haunching, and initial backfill in the locations indicated on the Drawings, shall conform to one of the following materials.

1. Natural pea gravel may be used as an alternative bedding material for drainage piping, subject to approval of Owner or Owner's Representative.
2. Sand: well graded natural sand, free of gravel, angular pieces, organic matter, and other deleterious substances; may be used for drainage piping.
3. Granular Base material, generally sized #4 sieve; may be used for drainage piping.
4. Materials meeting ASTM D 448 Size No 67; may be used for water, sewer, and drainage piping.
5. Concrete rock meeting the gradation requirements of State DOT specifications for Coarse Aggregate; may be used for drainage piping.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine pipe and appurtenances for compliance with specifications.

B. Reject pipe and appurtenances not in compliance with specifications.

C. Remove foreign matter from pipe and appurtenances before lowering into excavated area.

3.2 PIPE HANDLING

A. Pipe shall be off loaded at site as close to location of installation as possible, subject to constraints of traffic control and availability of land for construction. Pipe shall not be dropped from carrier deck. Stack pipe according to manufacturer's recommendations.

B. Lower pipe into trench after placement of bedding using slings and mechanical equipment. Workers shall be present in trench, in accordance with safety practices, to direct pipe into place.

3.3 PIPE BEDDING, HAUNCHING, AND INITIAL BACKFILLING

A. For PVC pipe and fittings, and corrugated metal pipe, place 6 inches minimum of bedding between excavated trench bottom or stabilized trench bottom and bottom of pipe or fitting as bedding. Provide depression in bedding for joints so that barrel of pipe or fitting rests on bedding material.

B. For ductile-iron pipe and appurtenances, place 6 inches minimum of granular material between excavated trench bottom or stabilized trench bottom and bottom of pipe or appurtenance as bedding. Provide depression in granular material for joints so that barrel of pipe or fitting rests on bedding.

C. Place bedding material in 6 inch maximum layers, compacted to 85 percent of maximum proctor density to spring line of pipe as haunching, and to top of pipe as initial select backfill, ensuring that material is placed against haunch area of pipe.

D. For reinforced concrete pipe and appurtenances, place 4 inches of granular material between the excavated trench bottom or stabilized trench bottom and bottom of pipe or appurtenance as bedding. Provide depression in bedding for joints so that barrel of pipe

or appurtenance rests on bedding. No haunching is required for reinforced concrete pipe unless indicated otherwise on the Drawings. Initial backfill shall be job-excavated select material.

3.4 JOINTING

A. Place pipe and appurtenances to planned line and elevation.
   1. Place drainage pipe from low end to high end with pipe bells facing upstream.
   2. Place potable water pipe with bells facing the direction of laying.
   3. Cover open end of laid pipe whenever pipe laying is interrupted to prevent rodents and debris from entering pipe.

B. Prepare pipe before jointing operations in accordance with manufacturer's recommendations. Place gasket in location marked.

C. Shove pipe home into joint using mechanical equipment as recommended by manufacturer. Pipe barrel shall be inserted into joint to appropriate mark, if available on pipe.

3.5 BACKFILLING

A. Pipe Covering
   1. Place minimum 6 inches of granular material (the same material used for haunching) over top of PVC pipe and fittings.
   2. Place minimum 6 inch of granular material over top of iron pipe and fittings.
   3. Place job excavated select material from bedding of reinforced concrete pipe and compact to 90 percent of standard proctor density when groundwater is not encountered.
   4. When groundwater is encountered in storm sewer pipe construction, place concrete rock for a minimum of 18 inches above the underdrain pipe as initial backfill, and compact to 90 percent standard proctor density.

B. See Section 31 00 20 for remainder of backfill.

C. Existing Utility Crossings: Expose utilities located between two manholes 24 hours minimum before the downstream manhole is constructed. Wherever possible sewer will be adjusted to provide necessary clearance.

3.6 THRUST BLOCKING

A. Construct thrust blocking at all pressure pipe fittings, including bends and reducers, as indicated on the Drawings.

B. Concrete for thrust blocking is specified in section 03 31 60.

C. Construct thrust blocking between pipe and undisturbed earth. If trench conditions do not exist, either extend thrust blocking or backfill over excavation and dig new trench to obtain trench conditions.

END OF SECTION 33 0200

SECTION 331100 - WATER SERVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Site water piping and fittings including domestic water, valves, fire hydrants and appurtenances, and requirements for testing and disinfecting completed systems.

1.2 RELATED SECTIONS

A. Section 31 00 20 – Earthwork

B. Drawings

1.3 REFERENCE STANDARDS

A. American Water Works Association (AWWA) latest edition
   1. C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
   2. C110 Ductile-Iron Fittings for Water and Other Liquids
   3. C111 Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
   4. C151 Ductile-Iron Pipe, Centrifugally Cast for Water or Other Liquids
   5. C153 Ductile-Iron Compact Fittings for Water or Other Liquids
   6. C502 Dry-Barrel Fire Hydrants
   7. C509 Resilient-Seated Gate Valves for Water and Sewage Systems
   8. C600 Installation of Ductile-Iron Water Mains and Appurtenances
   9. C651 Disinfecting Water Mains
   10. C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in., for Water Distribution

B. Underwriters Laboratories (UL) latest edition
   1. 246 Hydrants for Fire Protection Service

1.4 QUALITY ASSURANCE

A. Perform installation in accordance with the Local Utility District requirements. If there is a conflict between these specifications and the Local Utility requirements, the Local requirements shall take precedent.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Compaction testing of trench backfill shall be performed in accordance with Section 31 23 02.

1.5 SUBMITTALS

A. Product Data: Provide submittal data on pipe materials, pipe fittings, hydrants, valves, and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed state or local requirements.

C. Furnish results of leakage test and pressure test to Owner or Owner’s Representative and Utility District upon completion of testing of water distribution piping construction.

1.6 TESTING OF COMPLETED SYSTEMS

A. The completed water system shall be subject to a pressure test according to the requirements in Part 3 of this specification, prior to disinfection and placing in service.

1.7 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping mains, valves, connections, and top of pipe elevations.

B. Identify and describe unexpected variations in subsoil conditions and location of uncharted utilities.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE

A. Ductile-iron pipe complying with AWWA C151, pressure class 350. Pipe shall have cement mortar lining in accordance with AWWA C104. Pipe joints may be either mechanical joint or push-on joints. Pipe shall be continually marked with manufacturer's name, pipe size, pressure class and AWWA standard and material classification. Elastomeric gaskets and lubricant shall comply with ASTM F477 or AWWA C111.

B. Ductile-iron fittings shall conform to AWWA C110 or AWWA C153, designed for at least 250 psi working pressure, cement mortar lined, and with mechanical joint ends.

C. Tapping sleeves and valves shall be in accordance with Utility District standards.

D. Tracer wire: Type THHN, 10 gauge for non-metallic pipes, unless another wire type is required by the local utility’s standards.

2.2 PVC PIPE

A. PVC pipe 4-inches to 12-inches diameter complying with AWWA C900. Unless otherwise indicated on the Drawings, provide DR 14, pressure class 200 pipe. Push on or mechanical joint ends as indicated on the Drawings.

B. Fittings for PVC pipe shall be as required for ductile-iron pipe.

C. Pipe shall be marked as stated in AWWA C900.

D. Tracer wire: Type THHN, 10 gauge, unless another wire type is required by the local utility’s standards.

2.3 GATE VALVES 3-INCH AND LARGER

A. Manufacturers: Resilient Seat Gate Valves by American-Darling, Mueller or approved equal.

B. AWWA C509, Ductile Iron body, non-rising stem with square nut, resilient seat, mechanical joint ends, control rod, post indicator where indicated on Construction Drawings, extension box and valve key.

C. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground connector, with control rod, extension box and valve key.

1. Corrosion.

2.4 FIRE HYDRANTS

A. Fire Hydrants: Type as required by Utility standards and as shown on the Drawings.

B. Hydrant Extensions: Fabricate in multiples of 6 inches with rod and coupling to increase barrel length.

C. Hose and Steamer Connections: Match size and thread as required by Local Fire Marshall, with two hose nozzles and one pumper nozzle.

D. Finish: Apply primer and twp coats of enamel or special coating of color as required by the Utility District.

2.5 WATER SERVICES

A. Service pipe shall be Type “K” copper pipe, soft tempered, seamless, for underground installation, in accordance with ASTM B 88

B. Tapping saddles shall be made from ductile or malleable iron, provided with a shop coat and designed for a working pressure of 200 psi. Tapping saddles must be in accordance with the Utility District standards.

C. Corporation stops shall be per the Utility District standards.

D. Meter settings, meter boxes and box lids shall be purchased from the Utility District.

2.6 ACCESSORIES

A. Thrust Blocking: Place concrete as indicated on the Drawings to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil.

B. Locked or restrained joint fittings may be installed in lieu of thrust blocking requirements where vertical changes in direction are required if approved by governing authority.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that Utility District water main size, location, and depth are as indicated on the Drawings.

B. Examine polyethylene encasement materials (tubes and sheets) before installation to verify that they are intact and have not deteriorated from exposure to sunlight, weather, or improper storage.

3.2 PREPARATION

A. Ream pipe ends (if required) and remove burrs prior to assembly.

B. Remove scale and dirt, on inside and outside, prior to assembly.

C. Prepare and properly align pipe for connections to equipment.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 BEDDING

A. Excavate pipe trench and place bedding and haunching material in accordance with Section 31 23 02.

3.4 INSTALLATION – PIPE AND FITTINGS

A. Maintain separation of water main from sanitary and storm sewer piping in accordance with state or local codes.

B. Install pipe and fittings in accordance with AWWA C600.

C. Install pipe to allow for expansion and contraction without stressing pipe or joints as specified by pipe manufacturer.

D. Install access fittings in accordance with local codes to permit disinfection of water system performed under this Section.

E. Connections with Existing Pipelines: Where connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions that cause the least interference with the operation of existing pipeline and in compliance with local utility company requirements.

F. Tapping Sleeves and Valves: Install tapping sleeve and valve where indicated on the Drawings. Check for proper alignment of sleeve and valve. Pressure test installed sleeve and valve to a minimum of 1.5 times pipe working pressure. Hold test pressure for 5 minutes without adding water. Provide sufficient space in the pit for tapping machine. Tap shall be made by Utility District personnel. Schedule tap with the local utility at least 48 hours prior to time for tap to be made.

G. Form and place concrete for thrust blocks or other specified methods of thrust protection at each change of direction or end of pipe.

H. Establish elevations of buried piping in accordance with Section 31 23 02.

I. Backfill trench in accordance with Section 31 23 02.

J. Tracer Wire
   1. Install tracer wire continuous along pipe and appurtenances regardless of type of pipe.
   2. Fix tracer wire to outside of pipe (or to polyethylene wrapping) with adhesive tape.
   3. Do not wrap wire around bolts, nuts, corporation stops, or other protrusions. Any loops around valve bonnets or fittings shall be made with lose loops to prevent breakage of wire.
   4. Splices between adjacent wires shall be complete so as to transfer current.
   5. Test integrity of tracer wire; repair as needed. Owner will also conduct a test of tracer wire as a condition of substantial completion.

3.5 INSTALLATION – VALVES AND HYDRANTS

A. Install gate valves as indicated on the Drawings and supported on concrete pads with valve stem vertical and plumb. Install valve boxes in manner that will not transmit loads, stress, or shock to valve body. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.

B. Install fire hydrant assemblies as indicated on the Drawings in vertical and plumb position with steamer/pumper nozzle pointed perpendicular to traffic where hydrant is adjacent to street, roadway, or parking lot drive or toward protected building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly brace on side opposite inlet pipe against undisturbed soil and concrete thrust blocking. Place a minimum of 6 cu. ft. of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.

3.6 TESTING

A. Water distribution system pipe installed below grade and outside building shall be tested in accordance with the following procedures. Utility District may modify these procedures to comply with current practices and regulations.

1. Perform testing of pipe materials, joints, and other materials incorporated into construction of water mains and force mains to determine leakage and watertightness. Pressure pipeline shall be tested in accordance with Section 4 of AWWA C600. In event state or local code requires more stringent test, the more stringent shall apply.
2. After pipe has been laid, newly laid pipe or valved section thereof shall be subjected to hydrostatic pressure of at least 1.5 times working pressure at point of testing and not less than 1.25 times working pressure at highest point along test section.
3. Leakage test shall be conducted concurrently with pressure test. Leakage is defined as quantity of water that must be supplied into newly laid pipeline or valved section thereof to maintain pressure within 5 psi of specified test pressure after air in pipeline has been expelled and pipeline has been filled with water. Leakage shall not be measured by drop in pressure in test section over period of time.
4. No pipeline installation will be accepted if leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133200}$$

L = allowable leakage, (gallons per hour)
S = length of pipe tested, (feet)
D = nominal diameter of pipe, (inches)
P = average test pressure during test, (psig)

5. Visible leaks shall be repaired regardless of amount of leakage measured.
6. Acceptance of Installation: If test of pipe laid in place discloses leakage greater than that specified, locate leak and make repairs as necessary until leakage is within specified allowance, at no expense to Owner.
7. Supply water for testing at no additional cost to Owner.

3.7 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect distribution system with chlorine before acceptance for domestic operation. Amount of chlorine shall be such as to provide dosage of not less than 50 parts per million. Thoroughly flush lines before introduction of chlorinating materials and after contact period of not less than 24 hours, system shall be flushed with clean water until residual chlorine content is not greater than 1.0 part per million. Open and close valves in lines being disinfected several times during contact period. After disinfection, take water sample and bacteriologically test in accordance with AWWA C651. Do not place distribution system in service until approval is obtained from governing authorities.

B. In accordance with Utility District standard practices, disinfect water system after all services are in place and corporation stops are open. The taking of samples shall be

scheduled with the Utility District to facilitate transport to and testing by the approved laboratory.

END OF SECTION 331100

SECTION 333100 – WASTEWATER COLLECTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sanitary sewer drainage piping, fittings, accessories, cleanouts, and bedding.

B. Forcemain piping and appurtenances.

C. Connection of site and/or building sanitary sewer system to municipal sanitary sewer systems.

D. Septic systems will not be allowed unless otherwise approved by Owner or Owner's representative.

1.2 RELATED SECTIONS

A. Section 31 23 02 – Excavation, Backfill, and Compaction for Utilities

B. Section 33 02 00 – Pipe Laying

C. Section 33 39 00 – Sanitary Sewer Structures

1.3 REFERENCE STANDARDS

A. ASTM latest edition
   1. D 1785 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
   2. D 3034 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
   3. F 477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe

B. AASHTO latest edition
   1. M 294 Polyvinyl Chloride (PVC) Pipe and Fittings

1.4 QUALITY ASSURANCE

A. Sanitary sewer piping work shall be accomplished by workers experienced in this type of system, and be supervised by experienced foremen and superintendents.

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of pipe runs, connections, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.6 PROJECT CONDITIONS

A. Coordinate work with sanitary sewer connections to structures and to municipal sewer system.

PART 2 - PRODUCTS

2.1 SEWER PIPE MATERIALS

A. Polyvinyl Chloride Sanitary Sewer

1. Pipe and fittings shall comply with ASTM D 3034, rated SDR 35 unless otherwise specified by the utility company. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.
2. Pipe joints shall be integrally molded bell ends per ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.

2.2 PIPE ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps, etc.

2.3 CLEANOUTS

A. Lid and Frame: Heavy Duty cast iron construction, as manufactured by Mueller or approved equal. Lid Design: Closed Lid.

B. Shaft Construction: Cast Iron shaft of internal diameter as indicated on Construction Drawings with 2500 psi concrete collar matching finish grade.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify items specified in other sections are properly sized and located.

B. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Construction Drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over-excavation with bedding material.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate trench and place bedding material in accordance with Section 31 23 02.

3.4 INSTALLATION OF PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM C 12, ASTM C 14, ASTM D 2321, or manufacturer's instructions and local requirements.

B. Lay pipe to slope gradients noted on Construction Drawings.

C. Install pipe on bedding in accordance with Section 31 23 02.

D. Refer to Section 31 23 02 for trenching requirements. Do not displace or damage pipe when backfilling and compacting.

E. Refer to Section 31 39 00 for manhole requirements.

F. Connect to building sanitary sewer outlet and municipal sewer system as indicated on Construction Drawings.

3.5 INSTALLATION OF CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Provide concrete encasement as indicated on Construction Drawings after sanitary sewer pipe and fittings have been installed to proper elevations.

3.6 TESTING OF COMPLETED SEWER SYSTEMS

A. Compaction testing of bedding, haunching, initial backfill, and final backfill will be performed in accordance Section 31 23 02, at Owner's discretion.

B. Test sanitary sewer pipe system installed below grade and outside building in accordance with the following procedures:

1. Perform testing of manhole construction, pipe materials, joints, or other materials incorporated into construction of sanitary sewer system to determine leakage and watertightness. In event state or local code requires more stringent test, the more stringent shall apply.
2. Manhole Testing: The Owner or his designated representative or Governing Agency shall determine method of testing set forth below. Method selected will be determined by depth of each manhole, groundwater level, concrete honeycombing, or other conditions which make selected test suitable for determining physical condition and watertightness of manhole.
3. Manhole Exfiltration Testing: Incoming and outgoing sewer lines shall be plugged and manhole filled with water up to top of poured concrete or above highest precast barrel joint. Manhole fails if water loss exceeds maximum allowable shown below:

Depth of Manhole	Maximum Allowable Water Loss
0 – 8 feet	1 inch over 5 minutes
greater than 8 feet	1/8 gal/vertical feet over 5 minutes

4. Manhole Vacuum Testing: Test shall be performed with suitable apparatus made for such purpose and shall draw vacuum of 10-inches of Mercury (Hg). Test passes if vacuum remains at 10 inches of Hg or drops to not less than 9 inches of Hg in 1 minute.
5. Flexible Pipe Deflection Testing:
   a. Allowable Deflection: Maximum allowable pipe deflection shall not exceed 5 percent of nominal inside diameter.
   b. Mandrel: Mandrel, go/no-go, device shall be cylindrical in shape and constructed with either 9 or 16 evenly spaced arms or prongs. Mandrels with less arms will be rejected as not sufficiently accurate. Contact length of mandrel's arms shall equal or exceed nominal inside diameter of sewer to be inspected. Critical mandrel dimensions shall carry tolerance of 0.01-inch maximum. Provide mandrel and necessary equipment for mandrel test.
   c. Procedure: Mandrel shall be hand-pulled through flexible pipe sewer lines no earlier than 30 days after trench has been completely backfilled and compacted. Sections of sewer not passing mandrel shall be uncovered and rebedded, rerounded, or replaced to satisfaction of the Owner or

Owner's Representative or Governing Agency. Repaired section shall be retested.

d. Mandrel O.D. (outside diameter): Outside diameter of mandrel shall conform to the following table:

Nominal Diameter, inches	Mandrel O.D., inches
4	3.60
6	5.40
8	7.12
10	8.80
12	10.44
15	12.90
18	15.30

e. Contractor's Warranty: Owner or Owner's Representative or Governing Agency reserves the right to mandrel test flexible pipe sewer line before acceptance, and also prior to expiration of first year of operation. If previously accepted line fails mandrel test performed during first year of operation, defects must be corrected at Contractor's expense.

6. Air Testing of Gravity Sewers:

a. Plug pipe outlets with suitable test plugs and brace each plug securely.

b. Pipe air supply to pipeline to be tested in such manner that air supply may be shut off, pressure observed, and air pressure released from pipe without workers entering manhole.

c. Add air slowly to portion of pipe under test until internal pressure of line is raised to approximately 4 psig, but less than 5 psig.

d. Shut air supply off and allow at least 2 minutes for air pressure to stabilize.

e. When pressure has stabilized and is at or above starting test pressure of 3.5 psi, start test.

f. Determine time in seconds with stopwatch for pressure to fall 0.5 psig so that pressure at end of time is at or above 3.0 psig.

g. Compare observed time with minimum allowable times in chart below for pass/fail determination.

1 Nominal Pipe Diameter (inches)	2 Minimum Time (min:sec.)	3 Length for Minimum Time (feet)	4 Time for Longer Length (sec.)	SPECIFICATION TIME FOR LENGTH (L) SHOWN (MIN:SEC)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	46:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

7. Safety Precautions: Low pressure air test may be dangerous to personnel if, through lack of understanding or carelessness, line is overpressurized or plugs are installed improperly. It is extremely important that various plugs be installed so as to prevent the sudden expulsion of poorly inflated plug. As example of hazard, force of 250-lb is exerted on 8-inch plug by internal pressure of 5 psi. Observe following safety precautions:

a. No person shall be allowed in manholes during test or when plugged pipe is under pressure.
b. Gauges, air piping manifolds, and valves shall be located at top of ground.
c. Install and brace plugs securely.
d. Do not overpressurize lines.

8. Groundwater Elevation: If pipeline to be tested is below groundwater level, starting test pressure shall be increased by 0.433 psi for each foot groundwater level is above invert of sewer pipe. In no case shall starting test pressure exceed 9.0 psig.

C. Acceptance of Installation: No gravity sewer or manhole will be accepted that does not comply with minimum requirements of tests described in herein.

D. Test Equipment: Necessary equipment to perform air test in accordance with Specifications shall be provided by Contractor. Test gauge shall preferably have incremental division of 0.10 psi and have accuracy of at least 0.04 psi. In no case shall test gauge be used which has incremental divisions of greater than 0.25 psi. Gauge shall be of sufficient size in order to determine this accuracy.

E. Furnish gravity sewer and manhole test results to Owner or Owner's Representative and Governing Agency upon completion of gravity sewer system backfilling operations.

END OF SECTION 333100

SECTION 333900 – SANITARY SEWER STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Monolithic, cast in place concrete manhole barrel and either monolithic concrete or masonry transition to lid frame.

B. Modular precast concrete manhole barrel with tongue-and-groove joints and either precast concrete or masonry transition to lid frame.

C. Preparation and installation of lid frame, covers, anchorage, and accessories.

1.2 RELATED SECTIONS

A. Section 31 23 02 – Excavation, Backfill, and Compaction for Utilities

B. Section 33 31 00 – Wastewater Collection Systems

C. Section 33 49 00 – Storm Sewer Systems

D. Section 03 31 60 – Miscellaneous Concrete Work

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM) latest edition
   1. A 48 Gray Iron Castings
   2. C 55 Concrete Building Brick
   3. C 478 Precast Reinforced Concrete Manhole Sections
   4. C 923 Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

B. International Masonry Industry All-Weather Council (IMIAC) latest edition

C. Recommended Practices and Guide Specification for Cold Weather Masonry Construction

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manhole Barrel: Nonreinforced cast-in-place concrete in accordance with Section 03 31 60. Cast-in-place manholes shall be not less than 4 feet inside diameter and constructed of 3500 psi concrete.

2.2 COMPONENTS

A. Lid and Frame: Lid and frame shall comply with ASTM A 48, Class 35B heavy duty cast iron construction, machined flat bearing surface, removable lid, closed or open as indicated on Construction Drawings with sealing gasket and manufactured by Neenah Foundry Company or approved equal.

B. Manhole Steps (if required): Neenah Foundry Company catalog No. R-1980-0 for brick or cast-in-place manholes, or approved equal.

C. Base Pad: Cast-in-place concrete as specified in Section 03 31 60.

2.3 CONFIGURATION

A. Barrel Construction: Concentric barrel with eccentric cone top section.

B. Shape: Cylindrical

C. Clear Inside Dimensions: 48-inches diameter or as indicated on the Drawings.

D. Design Depth: As indicated on the Drawings.

E. Clear Lid Opening: 22-inches diameter minimum

F. Pipe Entry: Provide openings as indicated on the Drawings

G. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls. Point up irregularities and rough edges with nonshrinking grout.

H. Inverts: Shape inverts for smooth flow across structure floor as indicated on the Drawings. Use concrete and mortar to obtain proper grade and contour. Finish surface with fine textured wood float.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify items specified by other Sections are properly sized and located.

B. Verify that items associated with structures are in proper location and ready for connection to other work and/or structure construction.

C. Verify that the excavation for manholes and other structures are correct.

3.2 PREPARATION

A. Coordinate placement pipe connections to structure as indicated on Construction Drawings.

3.3 CONSTRUCTION

A. Construct cast-in-place manholes of ready-mix concrete in one continuous pour, including base, barrell, and cone section. If depth of manhole or site conditions require more than one pour, provide a roughened construction joint to assure wall integrity.

B. Forms shall be provide barrell and cone wall thicknesses as indicated on the Drawings. Forms shall be set plumb, and checked for plumbness before pouring.

C. Concrete shall be deposited in evenly distributed layers of about 18 inches. Consolidate each layer of concrete with a vibrator of sufficient size.

D. Pour and shape invert paths at the same time as the manhole is poured. Inverts shall be smooth, with no low or high points or rough or jagged edges that will allow sewage-bourne debris to catch and accumulate.

E. Lid shall be set in fresh concrete, and shall be leveled.

F. Remove forms only after concrete has obtained sufficient strength to support its own weight.

G. Patch any honeycombing inside and outside after forms are removed.

H. Backfill manhole only after concrete has obtained sufficient strength to support the soil loads. Final grade area around manhole so that run-off flows away from the manhole top.

3.4 SITE QUALITY CONTROL

A. Test manholes in accordance with Section 33 31 00, and as required by local wastewater utility.

END OF SECTION 333900

SECTION 334100 – STORM SEWER SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Storm water drainage culverts and sewer.

B. Storm water drainage structures, including curb inlets and junction boxes.

C. Perforated Plastic Drain pipe.

D. Requirements for French drains.

1.2 RELATED SECTIONS

A. General quality control provisions and the division of responsibility for laboratory testing services are specified in Section 01 45 01 and Section 01 45 23.

B. Restoration of disturbed areas is specified in Section 31 80 00.

C. Pipe installation is specified in Section 33 02 00.

D. Concrete drainage structures are specified in Section 33 49 00.

E. Concrete for drainage structures and flared end section curtain walls is specified in Section 03 31 60.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)
1. M 105 – Gray Iron Castings.
2. M 170 – Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
3. M 198 – Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets.
4. M 206 – Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
5. M 252 – Corrugated Polyethylene Drainage Pipe
6. M 259 – Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers.
7. M 273 – Pre-cast Reinforced Concrete Box sections for Culverts, Storm Drains, and Sewers with Less Than 2 ft of Cover Subject to Highway Loadings.
8. M 294 – Corrugated Polyethylene Pipe

B. ASTM International (ASTM)
1. C 443 – Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
2. C 990 – Joints Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

C. Department of Transportation specifications and standards governing Pipe Culverts, Drop Inlets and Junction Boxes, and Pipe Underdrains.

1.4 SUBMITTALS

A. Product Data: Provide data on pipe.

B. Submit a manufacturer's certificate that the product was manufactured, tested, and supplied in accordance with this specification.

1.5 QUALITY ASSURANCE

A. Materials furnished shall be manufactured by a manufacturer regularly engaged in providing storm water drainage pipes complying with the specified standards.

B. Materials shall be furnished from those sources listed on the qualified products list of the Department of Transportation in the state where the project is located.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Pipe sections received at site shall immediately be inspected for damage and defects. If grading work is essentially complete, distribute pipe in approximate locations where it will be installed. If grading work is not complete, handle and store pipe in such a way to minimize damage.

PART 2 - PRODUCTS

2.1 CONCRETE CULVERTS

A. Circular Reinforced Concrete Culverts: AASHTO M 170, Type 3, minimum wall thickness B, of the sizes indicated on the Drawings; either bell and spigot or tongue and groove pipe ends are acceptable.

B. Reinforced Concrete Arch Culverts: AASHTO M 206, class A-III, of the sizes indicated on the Drawings; either bell and spigot or tongue and groove pipe ends are acceptable.

C. Joint gaskets: Joint gaskets shall be bitumen type complying with AASHTO M 198, Type A or B, except that Type B shall have a specific gravity of 1.20 to 1.45. Joints shall be "Ram-Nek", ASTM C 990 or equal. When a primer is recommended by the manufacturer to be used with the gasket, primer shall be as specified by gasket manufacturer.

D. Flared End Sections: of the same material and strength as the pipe specified.

2.2 PLASTIC DRAINAGE PIPING

A. Corrugated Polyethylene Pipe: Comply with requirements of AASHTO M 294, Type S, minimum wall thickness B, of the sizes indicated on the Drawings (in lieu of the metric sizes indicated in AASHTO M 294). Pipe segments shall be joined by couplings.

B. Couplings shall be manufactured by the same manufacturer and shall be of the same material as the pipe being joined. Additional requirements for couplings shall be per AASHTO M 294. Couplings may be bell and spigot, split collar, or screw-on collar. Split couplings shall engage at least two full corrugations on each pipe section. Straps or ties for split couplings shall be made of non-corroding materials.

C. Couplings shall be designed for prevention of soil migration through the joint, for the type of bedding, haunching and initial backfill specified. If manufacturer's standard coupling will not prevent migration, provide filter fabric or other barrier to migration.

D. Flared end sections: of the same material and strength as the pipe specified.

2.3 ACCESSORIES

A. Any required accessories shall be manufactured of same materials, to similar strength and dimensions as for adjoining pipe.

2.4 PERFORATED PLASTIC DRAIN PIPE

A. Perforated plastic drain pipe shall be corrugated polyethylene tubing, heavy duty type, conforming to AASHTO M 252. Minimum pipe stiffness shall be 30 psi at 10 percent deflection. Sizes are indicated on the Drawings. Pipe shall be perforated to allow water that collects in the storm sewer trench to enter the drain pipe and flow to the nearest drainage structure. Locations of these pipes shall be as indicated on the Drawings or as determined by Owner or Owner's Representative based on field conditions.

B. Fittings shall be of the same material and have the same physical properties as the pipe and shall not restrict flow.

C. Perforations shall be approximately circular and cleanly cut; shall have nominal diameters not less than 3/16-inch nor more than 3/8-inch; and shall be arranged in at least two rows parallel to the axis of the pipe.

2.5 FRENCH DRAIN MATERIALS

A. Granular filter material, well-draining, complying with Department of Transportation requirements for material commonly called "concrete rock" or similar materials used for French drains in the area where the project is located.

B. Filter fabric shall be a non-woven geotextile as specified in Section 31 25 01, or on the Drawings.

2.6 CASTINGS

A. Iron castings for rings and covers shall comply with AASHTO M 105, Class 30A. Bearing surfaces between rings and covers or grates and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact.

2.7 SOURCE QUALITY CONTROL

A. Manufacturing plant shall have a standing quality control program in place that performs the tests required by AASHTO M 170 or AASHTO M 294.

B. Factory testing of the specific units to be supplied for this project is not required, except as they may be tested as part of standing quality control policy. Owner or Owner's Representative may require testing of specific units to be supplied for this project if there is evidence that the units supplied do not conform with the specified standards.

PART 3 - EXECUTION

3.1 STORM SEWERS

A. Install storm sewer piping and fittings as described in Sections 33 02 00.

3.2 PERFORATED PLASTIC DRAIN PIPE

A. Install perforated plastic drain pipe within storm sewer pipe trenches where groundwater is encountered, or where required to assure proper drainage of embedment material. Owner or Owner's Representative will make determination of where plastic drain pipe will be installed.

B. Upstream end of drain pipe shall be fitted with a cap to prevent embedment material from entering. Install drain pipe according to details indicated on the Drawings. Only granular material having good drainage characteristics shall be used in trenches where plastic drainage pipe is used.

3.3 FRENCH DRAINS

A. Install perforated plastic drain pipe as a French drain in the locations and to the lines and grades indicated on the Drawings.

B. Excavate trench to the width indicated on the Drawings. Place filter fabric in bottom of trench. Install granular bedding as indicated on the Drawings. Install pipe. Upstream end of pipe shall be closed with suitable plugs to prevent entry of soil materials. Install granular filter material around and above the pipe as indicated on the Drawings. Close filter fabric over pipe; overlap for full trench width. Backfill remainder of trench with excavated material and compact to 95 percent of standard Proctor density.

3.4 DRAINAGE STRUCTURES

A. Construct drop inlets, junction boxes and drop inlet extensions with reinforced or non-reinforced concrete, as shown on the Drawings. Owner or Owner's Representative may make slight adjustments in the plan locations of drop inlets and junction boxes as required by project conditions.

B. Concrete shall not be placed until Owner or Owner's Representative has inspected the forms and the placement of reinforcing steel and rings or frames.

C. Round drop inlets may have the floors cast monolithically with the walls. All other concrete floors shall be placed at least 24 hours before beginning construction of the walls.

D. Concrete finish and curing shall be as specified in Section 03 31 60.

E. Walls shall be constructed to form a tight joint with the floor and around the inlet and outlet pipes. Pipes shall be cut flush with the inside surfaces of the walls.

F. The faces of drop inlets and drop inlet extensions shall be placed as a part of the curb in order to preserve the proper alignment.

G. Metals rings or frames shall be set accurately to the finished elevations so that no subsequent adjustments will be necessary. Set rings or frames in a full mortar bed with firm bearing on the walls or securely fastened to the forms so that no movement will occur when concrete is placed.

H. Iron castings for rings and covers or grates and frames shall not be painted.

I. Backfilling around structures shall be in accordance with Section 31 23 01.

END OF SECTION 334100

SECTION 334900 – STORM SEWER STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cast-in-place concrete storm sewer structures with cast-iron lid and frame.

B. Preparation and installation of lid frame, covers, anchorage, and accessories.

1.2 RELATED SECTIONS

A. Section 31 23 02 – Excavation, Backfill, and Compaction for Utilities

B. Section 33 41 00 – Storm Sewer Systems

C. Section 03 31 60 – Miscellaneous Concrete Work

D. Local governing authority and code requirements

E. Drawings

1.3 REFERENCE STANDARDS

A. ASTM International (ASTM) latest edition
   1. A 48 Gray Iron Castings
   2. C 923 Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

1.4 SUBMITTALS

A. Shop Drawings: Indicate reference to the Drawings regarding structure locations, elevations, piping with sizes, locations, and elevations of structure penetrations.

B. Product Data: Provide data for lids, steps (if included in project), component construction, features, configuration, and dimensions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structure: Nonreinforced cast-in-place concrete in accordance with Section 03 31 60.
   1. Cast-in-place structures shall be the size indicated on the drawings and constructed of 3500 psi concrete.
   2. Forms shall be accurately shaped and fabricated or supported to be of sufficient strength to form dense watertight walls to true dimensions.

B. Mortar and Grout: Mortar for finishing and sealing shall be Class "C". Honeycombing less than 2 inches deep shall be repaired using Class "D" mortar.

2.2 COMPONENTS

A. Lid and Frame: Lid and frame shall comply with ASTM A 48, Class 35B heavy duty cast iron construction, machined flat bearing surface, removable lid, closed or open as indicated on Construction Drawings with sealing gasket and manufactured by Neenah Foundry Company or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify items specified by other Sections are properly sized and located.

B. Verify that items associated with structures are in proper location and ready for connection to other work and/or structure construction.

C. Verify that the excavation for structures are correct.

3.2 PREPARATION

A. Coordinate placement pipe connections to structure as indicated on Construction Drawings.

3.3 CONFIGURATION

A. Storm sewer structures shall be of the size and configuration indicated on the drawings. Rectangular or square structures are called for. Circular structures conforming to State DOT details and specifications may be used in locations approved by Owner or Owner's Representative.

B. Circulary Type Barrel Construction:
   1. Concentric barrel with concentric cone top section.
   2. Shape: Cylindrical
   3. Clear Inside Dimensions: 48-inch diameter or as indicated on the Drawings.

C. Depth: As indicated on the Drawings.

D. Clear Lid Opening: 22-inch diameter minimum

E. Pipe Entry: Provide openings as indicated on the Drawings. Pipes shall enter along flat part of walls, not at corners of structure. For circular structures, pipe shall be fully through wall, and then cut flush with inside of wall.

F. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of structure where they enter structure walls. Point up irregularities and rough edges with nonshrinking grout.

G. Inverts: Shall not hold water. If required, use concrete and mortar or grout to eliminate non-draining areas. Finish surface with fine textured wood float.

H. Tops: Shall be slightly sloped to eliminate ponding. If required by site grading, tops shall be sloped toward street or parking lot.

3.4 CONSTRUCTION

A. Construct cast-in-place storm sewer structures of ready-mix concrete.

B. As much as possible, structure walls shall be constructed in one continuous pour.

C. For circular structures, construct in one continous pour, including base, barrell, and cone section. If depth of structure or site conditions require more than one pour, provide a roughened construction joint to assure wall integrity.

D. Forms shall be provide wall thicknesses as indicated on the Drawings. Forms shall be set plumb, and checked for plumbness before pouring.

E. Concrete shall be deposited in evenly distributed layers of about 18 inches. Consolidate each layer of concrete with a vibrator of sufficient size.

F. Lid shall be set in formwork and leveled or set to slope conforming to top of structure.

G. Remove forms only after concrete has obtained sufficient strength to support its own weight.

H. Patch any honeycombing inside and outside after forms are removed.

I. Backfill structure only after concrete has obtained sufficient strength to support the soil loads. Final grade area around structure so that run-off flows away from structure top.

END OF SECTION 334900

SECTION 335100 – NATURAL GAS SERVICE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and fittings for natural or propane gas distribution.

B. Connection of natural gas system to utility company system.

1.2 RELATED SECTIONS

A. Section 31 00 20 – Earthwork

B. Section 31 23 02 – Excavation, Backfill, and Compaction for Utilities

C. Section 32 16 14 – Concrete Curbs and Sidewalks

D. Construction Drawings

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME) latest edition
   1. B 16.18 Cast Copper Alloy Solder Joint Pressure Fittings
   2. B 16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
   3. B 16.26 Cast Copper Alloy Fittings for Flared Copper Tubes
   4. Boiler and Pressure Code: Sec. 8D Pressure Vessels and Sec. 9 Welding and Brazing Qualifications

B. ASTM International (ASTM) latest edition
   1. A 120 Pipe, Steel, Black and Hot-Dipped, Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses
   2. A 234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperature
   3. B 32 Solder Metal
   4. B 75 Seamless Copper Tube
   5. B 88 Seamless Copper Water Tube
   6. D 2513 Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
   7. D 2517 Reinforced Epoxy Resin Gas Pressure Pipe and Fittings
   8. D 2683 Socket-Type Polyethylene Fittings For Outside Diameter-Controlled Polyethylene Pipe and Tubing
   9. F 678 Polyethylene Gas Pressure Pipe, Tubing and Fittings

C. American Welding Society (AWS) latest edition
   1. A 5.8 Brazing Filler Metal

D. American Water Works Association (AWWA) latest edition
   1. C105 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids

E. American National Standards Institute (ANSI) latest edition
   1. B16.3 Malleable Iron Threaded Fittings
   2. B16.11 Forged Steel Fittings, Socket Welding and Threaded
   3. B31.2 Fuel Gas Piping
   4. B31.8 Gas Transmission and Distribution Piping Systems

F. National Fire Protection Agency (NFPA) latest edition
   1. 54 National Fuel Gas Code

1.4 QUALITY ASSURANCE

A. Perform installation in accordance with applicable utility company requirements.

B. Gas Cock: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME Boiler and Pressure Vessel Code and applicable state regulations.

D. Welders Certification: In accordance with ASME Sec 9.

E. Conform to NFPA 54, ANSI B31.2, or ANSI B31.8.

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of pipe mains, valves, connections, and top of pipe elevations.

B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to be included.

B. Deliver and store valves in shipping containers with labelling in place.

PART 2 - PRODUCTS

2.1 PIPE

A. Steel Pipe Below Ground: ASTM A 120, Schedule 40 black:
   1. Fittings: ANSI B16.11, forged steel, or ASTM A 234 forged steel welding type.
   2. Joints: Welded and seamless.
   3. Jackets: AWWA C105 polyethylene jacket, Double layer, half lapped, 10 mil polyethylene tape.

B. Steel Pipe Above Ground: ASTM A 120, Schedule 40 black:
   1. Fittings: ANSI B16.3, malleable iron, ANSI Bl6.11, forged steel, or ASTM A 234, forged steel welding type.
   2. Joints: Threaded.

C. Polyethylene Pipe: ASTM D 2513, SDR 11.5 or ASTM F 678 Series 125:
   1. Fittings: ASTM D 2513
   2. Joints: Mechanical or Compression fit.
   3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.

D. Reinforced Epoxy Resin Piping: ASTM D 2517:
   1. Fittings: ASTM D 2517.
   2. Joints: Bell and spigot with epoxy resin.

3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.

2.2 GAS COCKS

A. 2-inches and Smaller: 150 psig (1,040 kPa) WOG, bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends with cast iron curb box, cover, and key.

B. 2-inches and Larger: 125 psig (860 Kpa) WOG, Steel or Cast iron body and tapered plug, non-lubricated, Teflon packing, threaded ends, with cast iron curb box, cover, and key.

C. For applications with line pressure greater than 60 psig (415 KPA) and over 2-inches (50 mm): Cast iron body and plug, pressure lubricated, Teflon packing, flanged ends, with cast iron curb box, cover, and key.

2.3 PRESSURE REGULATING VALVES

A. Valves: Single stage, malleable iron body, corrosion-resistant, pressure regulator with atmospheric vent, elevation compensator; with threaded ends for 2-inches and smaller or flanged ends for larger than 2-inches.

B. Capacity: For inlet and outlet gas pressures, specific gravity, and flow rate indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions.

B. Verify that building service connection and utility gas main size, location, and depth are as indicated on Construction Drawings.

3.2 PREPARATION

A. Ream pipe ends and remove burrs. Bevel plain end ferrous pipe over 2-inches diameter or thread ferrous pipe 2-inches diameter and under.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections with flanges or threading for threaded unions connections.

3.3 BEDDING

A. Excavate pipe trench and place bedding material in accordance with Section 31 23 02.

3.4 INSTALLATION – PIPING

A. Maintain separation of gas line from sanitary sewer, water, or storm sewer piping in accordance with state or local code.

B. Install piping to conserve space and not interfere with efficient use of site space.

C. Install piping to allow for expansion and contraction without stressing pipe or joints.

D. Install cocks and other fittings as required.

E. Establish elevations of buried piping in accordance with Section 31 23 02.

F. Wrap couplings and fittings of steel pipe with polyethylene tape and heat shrink over pipe.

G. For Nonmetallic Pipe: Install trace wire continuous over top of pipe.

H. Backfill trench in accordance with Section 31 23 02.

I. Center and plumb valve box over valve. Set box cover flush with finished ground surface. Prevent shock or stress from being transmitted through valve box to valve.

J. Wrap valve and valve box with polyethylene tape and heat shrink or paint valves and valve boxes with red anti-rust primer and 1 coat of epoxy paint.

3.5 SERVICE CONNECTIONS

A. Provide sleeve in foundation wall for gas service main. Caulk enlarged sleeve watertight.

B. Anchor service main to interior surface of foundation wall.

C. Install service regulator adjacent to building wall at service entrance location indicated on Construction Drawings.

D. Install service regulator and riser pipe in a manner that prevents undue stress on service pipe. For plastic service pipe, use steel pipe riser from below ground to regulator.

E. Provide regulator vent with rain and insect proof opening, terminating not less than 5 feet away from building openings.

END OF SECTION 335100

SECTION 337173 – ELECTRICAL UTILITY SERVICES

PART 1 - PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical Utility Services

1.2 SUBMITTALS

A. Product Data: Provide ratings and dimensions of transformer cabinets and meter bases.

B. Submit utility company-prepared drawings.

1.3 QUALITY ASSURANCE

A. Perform work in accordance with utility company written requirements and NFPA 70.

B. Maintain one copy of each document on site.

C. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.4 PRE-BID REQUIREMENT

A. Prior to Bid, Contractor shall verify requirements for a location of new or existing (as per utility company) electrical transformer with utility company at initiation of the project as per specifications.

1.5 PRE-INSTALLATION MEETING

A. Convene one week prior to commencing work of this section. Review service entrance requirements and details with a Utility Company representative.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Utility Transformer Pad: Concrete or as required by Utility Company.

B. Other Components: As required by Utility Company.

PART 3 - EXECUTION

3.1 PREPARATION

A. Arrange with utility company to obtain permanent electric service to the Project.

B. Verify that field measurements are as indicated on utility company drawings.

3.2 INSTALLATION

A. Install service rack, weatherhead, transformer pad, metering transformer cabinets, and meter base as required by utility company.

B. Install in accordance with NECA “Standard of Installation.”

END OF SECTION 337173