

SECTION 01 2100**ALLOWANCES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General Conditions and Division-1 Specification sections, apply to work of this section.
 - 1. Coordinate allowance work with related work to ensure that it is completely integrated and interfaced with related work.
 - 2. **Include in Base Bid.**

1.2 DESCRIPTION OF REQUIREMENTS:

- A. Definitions and Explanations: Certain requirements of the work related to each allowance are shown and specified in contract documents. The allowance has been established in lieu of additional requirements for that work, and further requirements thereof (if any) will be issued by change order.
- B. Types of allowances scheduled herein for the work included the following:
 - 1. Cash Allowances.
 - 2. Contingency Allowances.
 - 3. Payment modification procedures relating to allowances
- C. Selection and Purchase:
 - 1. At earliest feasible date after award of Contract, advise Architect/Engineer of scheduled date when final selection and purchase of each product or system described by each allowance must be accomplished in order to avoid delays in performance of the work.
 - 2. As requested by the Architect/Engineer, obtain and submit proposals for the work of each allowance for use in making final selections; include recommendations for selection which are relevant to the proper performance of the work.
 - 3. Purchase products and systems as specified, and as selected (in writing) by the Architect/Engineer.
 - 4. Submit proposals and recommendations, for purchase of products or systems of allowances, in form specified for change orders.
- D. Change Order Data: Include in each change order proposal both the quantities of products being purchased and unit costs, along with total amount of purchases to be made. Where requested, furnish survey-of-requirements data to substantiate quantities. Indicate applicable taxes, delivery charges, amounts of applicable trade discounts, and other relevant details as requested by the Architect.

1. Each change order amount for allowances shall be based on the unit price difference between the actual purchase amount and the allowance, multiplied by the final measure or count of work-in-place, with reasonable allowances, where applicable, for cutting losses, tolerances, mixing wastes, normal product imperfections and similar margins.
2. When requested, prepare explanations and documentation to substantiate the quantities, costs, and margins as claimed.

E. Change Order Mark-Up:

1. Except as otherwise indicated, comply with provisions of General Conditions. For each allowance, Contractor's claims for increased costs (for either purchase amount or Contractor's handling, labor, installation, overhead, and profit), because of a change in scope or nature of the allowance work as described in contract documents, must be submitted within 60 days of initial change order authorizing work to proceed on that allowance; otherwise, such claims will be rejected.
2. Where it is not economically feasible to return unused material to the manufacturer/supplier for credit, prepare unused material for the Owner's storage, and deliver to the Owner's storage space as directed. Otherwise, disposal of excess material is the Contractor's responsibility.

F. Time and Allowance Amounts:

1. Nothing in the Bid or Contract Documents shall be so constructed or interpreted as to provide a Contract time extension, due to use or non-use of any Allowance amount.
2. Nothing in the Bid or Contract Documents shall be so constructed or interpreted as to allow unused Allowances or any portion thereof, nor any overhead and profit therefor to be retained by or paid to the Contractor.
 - a. Amount of unused allowances to be returned shall include unused amount plus 10% overhead and profit.

1.3 CASH ALLOWANCES:

- A. The Contractor shall include in their base bid the cash and/or material allowances as described herein after for the purchase of materials as described or as to be determined herein. All costs for overhead, profit, bond, insurance and taxes shall not be included as part of the specified allowances and these overhead amounts shall be carried as an additional cost, where applicable, in a separate line item on the contractor's bid and subsequent schedule of values.

- B. All specified allowances shall appear as a line item amount, matching either the amount specified herein or the calculated amount from the unit price and material amount indicated, on the contractor's AIA Document G703, schedule of values.
- C. Costs Included in Cash Allowances: Cost of product to Contractor or subcontractor, less applicable trade discounts
- D. General Contractor's Overhead and Profit is included in the Base bid.
- E. Architect/Engineer Responsibilities:
 - a. Consult with Contractor for consideration and selection of products, suppliers, and installers.
 - b. Select products in consultation with Owner and transmit decision to Contractor.
 - c. Prepare Change Order.
- F. Contractor Responsibilities:
 - a. Assist Architect in selection of products, suppliers, and installers.
 - b. Obtain proposals from suppliers and installers and offer recommendations.
 - c. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
 - d. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
 - e. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
- G. Differences in costs will be adjusted by Change Order.

1.4 CONTINGENCY ALLOWANCE:

- A. Specified allowance shall appear as a line-item amount, matching the amount specified herein, on the contractor's AIA Document G703, schedule of values.
- B. Use of contingency allowance shall be specifically authorized in writing upon approval by authorized Owner Representative. A final accounting of all contingency funds used will be made by issuance of a change order at the end of the project.
- C. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.
- D. Funds will be drawn from the Contingency Allowance only by Change Order.
- E. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order. In addition to the balance of the allowance, all applicable costs for overhead, profit, bond, insurance, and taxes will be added to the allowance change order

credit. Overhead amounts that can be clearly documented as being expended over the course of the project will be excluded from this added amount to the allowance credit. Refer to AIA 201 General Conditions for further information.

PART 2 - PRODUCT

Not Applicable.

PART 3 – EXECUTION

3.1 SCHEDULE OF ALLOWANCES - INCLUDE IN BASE BID:

1. Site Security Allowance

- a. Cash allowance of \$50,000.00 to design/build and install security cameras as indicated on the drawings

2. Site Furnishings Allowance

- a. Cash allowance of \$50,000.00 to design/build and install site furnishings, including but not limited to benches, picnic tables and bike racks, etc..

3. Wayfinding & Interpretive Signage

- a. Cash allowance of \$50,000.00 to design/build and install signage as indicated on drawings.

4. Owner Contingency Allowance:

- a. Include the stipulated sum/price of \$100,000.00 for use upon Owner's instructions.
 1. Contingency Allowance shall be used to cover unforeseen conditions or minor changes that are necessary to correct or supplement the design as detailed in the Contract Documents.

END OF ALLOWANCES

SECTION 012300**ALTERNATES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF REQUIREMENTS:

- A. Definition: An alternate is an amount proposed by Bidders and stated on the Bid Form that will be added to or deducted from Base Bid amount if the Owner decides to accept a corresponding change in either scope of work or in products, materials, equipment, systems or installation methods described in Contract Documents.
- B. Coordination: Coordinate related work and modify or adjust adjacent work as required to ensure that work affected by each accepted alternate is complete and fully integrated into the project.
- C. Notification: Immediately following award of Contract, prepare and distribute to each party involved, notification of the status of each alternate. Indicate whether alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to alternates, if any.
- D. Schedule:
 - 1. A "Schedule of Alternates" is included at the end of this section. Specification sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the work described under each alternate.
 - 2. Include as part of each alternate, miscellaneous devices, appurtenances and similar items incidental to or required for a complete installation whether or not mentioned as part of the alternate.

PART 2 - PRODUCTS**2.1 Not Applicable.**

PART 3 - EXECUTION**3.1 SCHEDULE OF ALTERNATES:****A. Alternate No. 1 – Wood Bollard Fence (W-102)**

- a. Refer to item W-102 along West Beach Blvd. in the Landscape Site Materials Plan for full extents of the alternate.
 - i. ~2,674 LF of Wood Bollard Fence (W-102) along west beach blvd. See Landscape Site Materials Plan for full extents of alternate. (Detail 8/L1.09)

B. Alternate No.2 – Western Boardwalk to Pavilion

- a. Refer to plan set for full extents of the alternate, including but not limited to:
 - i. ~6,536 sf of 8' wide boardwalk with handrail
 - ii. Pavilion Structure (to match central and eastern pavilion)
 - iii. Pavilion/Boardwalk Utilities
 - 1. Western Pavilion Lighting
 - 2. GFI Receptacle
 - 3. ¾" hose bib
 - 4. 817 LF of waterline w/bends, valves, and fittings)

C. Alternate No.3 – Site Landscaping

- a. Refer to sheets L5.00 – L5.09 of the plan set for the full extents of the alternate

END OF ALTERNATES

SECTION 017000**CLOSEOUT PROCEDURES****PART 1 - GENERAL****1.1 DESCRIPTION OF SCOPE AND INTENT**

- A. The intent of this section is to define minimum requirements to be satisfied and/or delivered in contract closeout procedures. Other items may be requested by Owner to supplement required data.

1.2 SECTION INCLUDES

- A. Closeout procedures.
- B. Final cleaning.
- C. Adjusting.
- D. Project record documents.
- E. Operation and maintenance data.
- F. Warranties.
- G. Spare parts and maintenance materials.

1.3 RELATED SECTIONS

- A. Contractor is responsible for coordination of work included in this specification with all other specification sections related to furnishing of all materials, labor, permit, fees and services necessary for completion of work in this section.

1.4 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's inspection.
- B. Provide submittals to Owner that are required by governing or other authorities.
- C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.5 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.

- B. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Clean equipment and fixtures to a sanitary condition.
- D. Replace filters of operating equipment.
- E. Clean site and premises; sweep paved areas, clean landscaped surfaces.
- F. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.6 ADJUSTING

- A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

PROJECT RECORD DOCUMENTS

- B. Maintain on site, one set of the following record documents; record actual revisions to the Work:
 - 1. Contract Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
- C. Store Record Documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and Modifications.
- F. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to first floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

4. Field changes of dimension and detail.
5. Details not on original Contract Drawings.

- G. Submit lien and claims release as provided in specifications.
- H. Submit documents to Owner with claim for final Application for Payment.

1.7 OPERATION AND MAINTENANCE DATA

- A. Submit two sets prior to final inspection, bound in 8-1/2 x 11 inch text pages, three D side ring binders with durable plastic covers.
- B. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project.
- C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified type on white paper.
- E. Part 1: Directory, listing names, addresses, and telephone numbers of Contractor, Subcontractors, and major equipment suppliers.
- F. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 1. Significant design criteria.
 2. List of equipment.
 3. Parts list for each component.
 4. Operating instructions.
 5. Maintenance instructions for equipment and systems.
 6. Maintenance instructions for finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
- G. Part 3: Project documents and certificates, including the following:
 1. Shop drawings and product data.
 2. Air and water balance reports.
 3. Certificates.
 4. Photocopies of warranties.
- H. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with

Architect/Engineer comments. Revise content of documents as required prior to final submittal.

- I. Submit final volumes revised, within ten days after final inspection.
- J. Provide on-site instruction of Owner's maintenance or engineering staff of all equipment operations and procedures.

1.8 WARRANTIES

- A. Provide duplicate notarized copies.
- B. Execute and assemble documents from subcontractors, suppliers, and manufacturers.
- C. Provide Table of Contents and assemble in three D side ring binder with durable plastic cover.
- D. Submit prior to final Application for Payment.
- E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.9 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
- B. Deliver to and place in location as directed.

1.10 WAIVER OF CLAIMS

- A. Submit waiver of claims in accordance with General Conditions of the Contract for Construction.
- B. Utilize Alabama Building Commission, Contractor's Affidavit of Payment of Debts and Claims and Consent of Surety to Final Payment.

1.11 ADVERTISEMENT FOR COMPLETION

- A. Upon Substantial Completion run advertisement of completion of the project as per State of Alabama and Alabama Building Commission requirements.
- B. Format for the advertisement shall be the DCM, "Form of Advertisement for Completion".

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

END OF CLOSEOUT PROCEDURES

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SECTION 03 3000**CAST-IN-PLACE CONCRETE****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
- B. Related Sections include the following:
 - 1. Division 2 Section "Cement Concrete Pavement" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.

- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.
- E. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.
 - 4. Curing compounds.
 - 5. Bonding agents.
 - 6. Adhesives.
 - 7. Vapor retarders.
 - 8. Semirigid joint filler.
 - 9. Joint-filler strips.
- F. Field quality-control test and inspection reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I.

- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For slabs-on-grade, provide all plastic type chairs with integral bottom bearing plate to prevent puncture of vapor barrier.
 - 2. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following at contractors option:
 - a. Fly Ash: ASTM C 618, Class C, F.
- B. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size:
 - a. 1½" maximum unless noted.
 - b. 1/2" maximum for pumped concrete
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

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

2.6 VAPOR RETARDERS

- A. Plastic Vapor Retarder: Plastic sheet of thickness required to comply with requirements indicated but not less than 10 mils. Furnish manufacturer's accessories including bonding tape or adhesive and mastic for sealing seams and penetrations. Comply with the following:
1. ASTM E 1745, Class A

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 20 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability and as specified on drawings and schedules.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Foundations and Slabs-on-grade: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.51.

3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Install keyways, reglets, recesses, and the like, for easy removal.
 2. Do not use rust-stained steel form-facing material.

- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
- B. Granular Course: Place granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.

3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed 1/8 inch in height.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
- C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

- b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
- 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
- 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one, six month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete, but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse

aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 6. Compression Test Specimens: ASTM C 31/C 31M.

- a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 03 30 00

SECTION 06 2013**EXTERIOR FINISH CARPENTRY****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:

1. Exterior stair guards.
2. Exterior trim.
3. Exterior siding.

- B. Related Requirements:

1. Section 06 1000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Section 06 1063 "Exterior Rough Carpentry" for elevated decks, including stairs and railing posts.
3. Section 07 2500 "Weather Barriers" for water-resistive barrier to be installed behind exterior siding.

1.3 ACTION SUBMITTALS

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

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

- B. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

1.4 INFORMATIONAL SUBMITTALS**A. Compliance Certificates:**

1. For lumber that is not marked with grade stamp.
2. For preservative-treated wood that is not marked with treatment-quality mark.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.6 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.

1. For exterior ornamental wood columns, comply with manufacturer's written instructions and warranty requirements.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design stair guards, including attachment to railing posts.

- B. Structural Performance: Stair Guards, including attachment to railing posts, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Top Rails of Guards:

- a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.

2.2 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated.
- B. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
 1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.
- C. Hardboard: ANSI A135.4.

2.3 PRESERVATIVE TREATMENT

- A. Pressure dimension lumber with waterborne preservative according to AWWA C2.
- B. Preservative Chemicals: Acceptable to authorities having jurisdiction.
- C. Use process that includes water-repellent treatment.
- D. Use process that does not include water repellents or other substances that might interfere with application of indicated finishes.
- E. Application: All exterior stair guard caps, top & bottom rails and balusters.

2.4 EXTERIOR TRIM

- A. Lumber trim for Painted Finish:
 1. Species and Grade: To match existing.
 - a. Minimum No. 2 Boards per SPIB rules; pressure-preservative-treated.
 2. Face Surface: To match existing.

2.5 EXTERIOR SIDING

- A. Lumber siding for Painted Finish:
 - 1. Species and Grade: To match existing.
 - a. Minimum No. 2 Boards per SPIB rules; pressure-preservative-treated.
 - 2. Pattern: To match existing.

2.6 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.
 - 1. For pressure-preservative-treated wood, provide hot-dip galvanized-steel fasteners.
- B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.
- C. Sealants: Latex, complying with ASTM C 834 Type OP, Grade NF and applicable requirements in Section 07 92 00 "Joint Sealants" and recommended by sealant and substrate manufacturers for intended application.

2.7 FABRICATION

- A. Ease edges of lumber to 1/8-inch radius.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
 - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 2. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 3. Coordinate exterior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.4 TRIM INSTALLATION

- A. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.5 SIDING INSTALLATION

- A. Preparation.
 - 1. Water-Resistive Barrier: Install water-resistive barrier behind exterior siding per Division 7 Section "Weather Barriers."
- B. Install siding to comply with manufacturer's written instructions.
- C. Install metal flashing as indicated by siding manufacturer.

3.6 ADJUSTING

- A. Replace exterior finish carpentry that is damaged or does not comply with requirements. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.7 CLEANING

- A. Clean exterior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.8 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 2013

SECTION 06 1063**EXTERIOR ROUGH CARPENTRY****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. Framing with dimension lumber.
 - 2. Framing with timber

1.3 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.
- B. Timber: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NLGA: National Lumber Grades Authority.
 - 3. SPIB: The Southern Pine Inspection Bureau.

1.4 ACTION SUBMITTALS

- A. Product Data: For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates:

1. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- B. Certificates of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.
- C. Evaluation Reports: For the following products, from ICC-ES.
 1. Wood-preservative-treated wood.
 2. Metal framing anchors.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review.
 1. Factory mark each item with grade stamp of grading agency.
 2. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content:
 1. Dimension Lumber: 19 percent
 2. Timber: 19 percent

2.2 FRAMING LUMBER

- A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.

- B. Dimension Lumber: No. 2 grade or better and the following species:
 - 1. Southern pine; SPIB.

2.3 POSTS

- A. Timber Posts: Southern pine; No. 1 or better; SPIB.

2.4 PRESERVATIVE TREATMENT

- A. Pressure treat dimension lumber with waterborne preservative according to AWP A U1; Use Category UC3B.
 - 1. Treatment with CCA shall include post-treatment fixation process.
- B. Preservative Chemicals: Acceptable to authorities having jurisdiction.
 - 1. Treat with CCA unless otherwise approved.
- C. After treatment, redry dimension lumber to 19 percent maximum moisture content.
- D. Mark treated wood with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
 - 1. For items indicated to receive a stained or natural finish, mark each piece on surface that will not be exposed or omit marking and provide certificates of treatment compliance issued by inspection agency.
- E. Application: Treat all wood unless otherwise indicated.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.
 - 1. Use stainless steel unless otherwise indicated.
 - 2. For pressure-preservative-treated wood, use stainless steel fasteners.
- B. Nails: ASTM F1667.
- C. Power-Driven Fasteners: ICC-ES AC70.
- D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.

- E. Stainless Steel Bolts: ASTM F593, Alloy Group 1 or 2 (ASTM F738M, Grade A1 or Grade A4); with ASTM F594, Alloy Group 1 or 2 (ASTM F836M, Grade A1 or Grade A4) hex nuts and, where indicated, flat washers.
- F. Postinstalled Anchors: Stainless steel, chemical anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing according to ASTM E488, conducted by a qualified independent testing and inspecting agency.
 - 1. Stainless steel bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Grade A1 or Grade A4).

2.6 METAL FRAMING ANCHORS AND ACCESSORIES

- A. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 316.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Cut to required lengths and treat cut surfaces of preservative treated limber to comply with AWP M4.

3.2 INSTALLATION

- A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.
- B. Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.
- C. Install metal framing anchors to comply with manufacturer's written instructions.
- D. Do not splice structural members between supports unless otherwise indicated.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- G. Apply copper naphthenate field treatment to comply with AWP M4, to cut surfaces of preservative-treated lumber.

- H. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. ICC-ES AC70 for power-driven fasteners.
 - 2. "Fastening Schedule" in ICC's International Building Code.
 - 3. "Fastener Schedule for Structural Members" and "Alternate Attachments" in ICC's International Residential Code for One- and Two-Family Dwellings.
- I. Use common wire nails unless otherwise indicated. Select fasteners of size that do not fully penetrate members where opposite side is exposed to view. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads unless otherwise indicated or required for fit-up.
- J. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
 - 1. Comply with approved fastener patterns where applicable.
 - 2. Use stainless steel torx drive screws for exposed work (stainless steel) unless otherwise indicated. Install fasteners so that head of screws are flush with the finished surface.

END OF SECTION 06 1063

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SECTION 061516**WOOD ROOF DECKING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes solid-sawn wood roof decking
- B. Related Requirements:
 - 1. Section 061063 "Exterior Rough Carpentry" for dimension lumber items associated with wood roof decking.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For preservative-treated wood products, include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
- B. Samples: 24 inches (600 mm) long, showing the range of variation to be expected in appearance of wood roof decking.

1.4 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD ROOF DECKING, GENERAL

- A. General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

2.2 SOLID-SAWN WOOD ROOF DECKING

- A. Standard for Solid-Sawn Wood Roof Decking: Comply with AITC 112.
- B. Roof Decking Species: Southern pine.
- C. Roof Decking Nominal Size: 2 by 6.
- D. Roof Decking Grade: Select Decking.
- E. Grade Stamps: Factory mark each item with grade stamp of grading agency. Apply grade stamp to surfaces that are not exposed to view.
- F. Moisture Content: Provide wood roof decking with [15] percent maximum moisture content at time of dressing.
- G. Face Surface: Smooth.
- H. Edge Pattern: Channel grooved

2.3 PRESERVATIVE TREATMENT

- A. Pressure treat wood roof decking according to AWPA U1; Use Category UC3A.
- B. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 1. For exposed items indicated to receive a stained or natural finish, use products that do not contain colorants, bleed through, or otherwise adversely affect finishes.
- C. Use process that does not include water repellents or other substances that might interfere with application of indicated finishes.
- D. After treatment, redry materials to 15 percent maximum moisture content.

2.4 ACCESSORY MATERIALS

- A. Fasteners for Solid-Sawn Roof Decking: Provide fastener size and type complying with AITC 112 for thickness of deck used.
- B. Nails: Common; complying with ASTM F1667, Type I, Style 10.
- C. Fastener Material: Hot-dip galvanized steel.
- D. Sealants: Latex, complying with applicable requirements in Section 079200 "Joint Sealants" and recommended by sealant manufacturer and manufacturer of substrates for intended application.
- E. Penetrating Sealer: Clear sanding sealer complying with Section 099300 "Staining and Transparent Finishing" and compatible with topcoats specified for use over it.

2.5 FABRICATION

- A. Shop Fabrication: Where preservative-treated roof decking is indicated, complete cutting, trimming, surfacing, and sanding before treating.
- B. Seal Coat: After fabricating and surfacing roof decking, apply a saturation coat of penetrating sealer in fabrication shop.
- C. Apply indicated finish materials to comply with Section 099300 "Staining and Transparent Finishing" in fabrication shop.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and support framing in areas to receive wood roof decking for compliance with installation tolerances and other conditions affecting performance of wood roof decking.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install solid-sawn wood roof decking to comply with AITC 112.
 - 1. Locate end joints for combination simple and two-span continuous lay-up.
 - 2. Nail each course of wood roof decking at each support with one nail slant nailed above the tongue and one nail straight nailed through the face.
 - a. Use 16d nails for 2-by-6 and 2-by-8 roof decking.

3.3 ADJUSTING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged roof decking if repairs are not approved by Architect.

3.4 PROTECTION

- A. Provide water-resistive barrier over roof decking as the Work progresses to protect roof decking until roofing is applied.

END OF SECTION 06 1516

SECTION 061600**SHEATHING****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. Roof sheathing.
- B. Related Requirements:
 - 1. Section 061063 "Exterior Rough Carpentry" for rough framing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preserved treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preserved-treated plywood.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

- A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC3b for exterior construction not in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings.

2.3 ROOF SHEATHING

- A. Plywood Sheathing: DOC PS 1 Exterior sheathing.
 - 1. Nominal Thickness: Not less than 15/32 inch

2.4 FASTENERS

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

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.

2.5 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated on the structural drawings, and complying with the following:
 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Wall and Roof Sheathing:
 - a. Nail to wood framing.
 - b. Space panels 1/8 inch (3 mm) apart at edges and ends.

END OF SECTION 06 1600

SECTION 07411**MANUFACTURED ROOF PANELS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related work specified elsewhere includes:
 - 1. Section 06100 - "Rough Carpentry"
 - 2. Section 07210 - "Building Insulation"
 - 3. Section 07212 - "Sprayed Insulation"
 - 3. Section 07600 - "Flashing and Sheet Metal"
 - 5. Section 07900 - "Joint Sealers"
 - 6. Section 09900 - "Painting" (for field painting of any roof mounted hoods, air supply or exhaust ducts, fans, or equipment which cannot be covered with metal counterflashing or provided prefinished to match roof.)

1.2 SUMMARY:

- A. This Section includes prefinished manufactured roofing system, with standing seam roof panels, trim, and all related work to be provided. The standing seam roof panels are to be the following type:
 - 1. Formed roof panels with machine seamed sealed joints, at 16-inches on-center.
- B. Scope - Roofing Systems: The work in the Section includes all labor, materials, accessories, services and incidentals necessary for supplying, installing and testing of the prefinished metal roofing system described herein. Provide prefinished - all flashing, fascia panels, caps, copings, curbs, trim, closures, etc., which are associated with and/or come in contact with roofing system's components, in same base metal as roofing panels, and panels, and make watertight junctions with work of other trades.
 - 1. General Requirements: Metal roofing system as specified and indicated is to be machine seamed and installed over continuous rosin paper over self adhered waterproofing underlayment, over tongue and groove plywood decking.
 - 2. Curbs for mechanical equipment and other work as indicated or required by project conditions.
- C. Extent of work under this Section 07411 is indicated herein and on the Drawings.

1.3 SYSTEM PERFORMANCE REQUIREMENTS:

- A. Provide certified test results by a recognized testing laboratory or agency in accordance with specified test methods for each system.
- B. Air Infiltration: Provide roof panel system with no air leakage when tested in accordance with ASTM E 283 at pressure differentials up to 1.57 psf.
- C. Water Penetration: Provide panel systems with no water penetration as defined in the test method, when tested in accordance with ASTM E 331 at an inward static air pressure differential of not less than 6.24 psf and not more than 12.0 psf.
- D. Wind Uplift: Provide Manufacturer's Wind Testing showing *actual tested pressures* as being in compliance with ASCE 7.
- E. All Perimeter Sheet Metal Details shall meet wind uplift requirements per ANSI-SPR ES-1.

1.4 SUBMITTALS:

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data including manufacturer's product specifications, standard details, certified product test results, installation instructions, and general recommendations, as applicable to materials and finishes for each component and for total panel system.
- C. Samples for Verification Purposes of Roof Panels: Provide sample panels 12-inches long by actual panel width, in the profile, style, color, and texture indicated. Include clips, any battens, fasteners, closures, and other panel accessories.
- D. Shop Drawings specific to this project showing layouts of panels on roofs, details of edge conditions, joints, corners, panel profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory and field assembly work. The manufacturer's technical engineering department shall approve the drawings before they are submitted.

1.5 QUALITY ASSURANCE:

- A. Wind Uplift: Provide roof panel system including supports meeting at least the requirements of Underwriters Laboratories, Inc. for Class 90 wind uplift resistance. Wind load at the project site is **160 mph**, unless a higher wind load is indicated on Structural Drawings or otherwise required by applicable codes.
 - 1. **NOTE** that design of metal roofing system shall include additional clips at corners and elsewhere as required following manufacturer's wind load analysis, so as to

provide for use of metal gauge specified and minimum code required basic wind load of **160 mph**.

- B. Field Measurements: Where possible, prior to fabrication of panels, take field measurements of structure or substrates to receive panel system. Allow for trimming panel units where final dimensions cannot be established prior to fabrication. Terminal edges of panels, closures, and turned-down caps shall be to a neat straight line.
- C. Manufacturer's Project Manager: The Manufacturer shall provide a Project Manager, who shall work with the personnel to develop the shop drawings for the project prior to installation of the roof. When beginning installation procedures, the manager shall be present at all times to instruct and manage the installer's crew. The entire installation shall be subject to the direction of the Project Manager, who shall be responsible for the proper and timely installation of the system.
 - 1. The Project Manager shall attend a required Pre-Roofing Conference, and return to the project site when requested by the installer, and at beginning of this work, and 50% and 100% roof completion stages.
- D. Installer Qualifications shall be the same as specified under Sections 01015 of the Project Manual.
- E. The Contractor shall hold a Pre-Roofing Conference prior to beginning roofing work, and provide typed minutes to Owner's Representative, Architect, Roofing Contractor, Roofing Manufacturer, who are all required to be present.

1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver panels and other components so they will not be damaged or deformed. Package panels for protection against transportation damage.
- B. Handling: Exercise care in unloading, storing, and erecting panels to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal panels so that they will not accumulate water. Do not store panels in contact with earth, water, or other materials that might cause staining, denting, or other surface damage.
- D. Deliver accessories, such as reglets, inserts, etc., which are to be installed by other trades and/or in conjunction with the work of other trades, far enough in advance so as not to delay the Work on the project.
- E. Refer to Division 1 Sections "Summary of Work" and "Special Conditions" for additional information and requirements regarding stored materials.

1.7 WARRANTIES AND GUARANTEES:

- A. Warranty: **20 year NDL**: The manufacturer/installer shall jointly, in writing, warrant that the roofing system shall remain intact (without perceptible deformation) and completely leak free for a period of **20-years** from the date of project Substantial Completion (this warranty need not cover damage from winds exceeding the velocities and/or loading required by the International Building Code as generated by a design velocity based on the 100-year probability wind speed, unless otherwise indicated and/or normally provided for the products specified).
1. Warranty provided shall be “No dollar limit (NDL)” weather-tightness, labor, materials and wind warranty.
 2. Paint Finish Warranty: **20 years** from date of Substantial Completion. Failures include, but are not limited to, cracking, deforming, fading, or otherwise deteriorating beyond normal weathering, and as otherwise indicated. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than 4 color-difference units as measured according to ASTM D 2244, and as otherwise indicated.
- B. Special Project Guarantee: Provide 3-fully executed copies of “Roofing Guarantee” on form included in the “General Conditions” section of the Project Manual, covering work of this Section, including in part, roof panels, concealed and exposed flashings, any fascia, provided accessories, etc., signed by General Contractor and Roofing Contractor.
- C. Repairs that become necessary, such as for leaks, wind damage or temperature stress while roofing is under warranty and/or guarantee, shall be performed by the installer within 7-days of notification. Should for any reason, the installer not be able to perform the repairs, it shall be incumbent upon the manufacturer to do so. If repairs are not begun on time, Owner shall have work done by others and costs will be charged to the Contractor, with no detrimental effect on the remaining warranty and no termination of warranty.
- D. The above warranty and guarantee shall be in addition to, shall be in effect simultaneously with, and shall not alter other project or product warranties or guarantees, nor shall they serve as limitations to other remedies available to the Owner.

1.8 PROJECT CONDITIONS:

- A. Weather: Proceed with roofing work when existing and forecasted weather conditions permit work to be performed in accordance with manufacturer’s recommendations and warranty requirements.
- B. Substrate Conditions: Do not begin roofing installation until substrates have been inspected and are determined to be in satisfactory condition.

PART 2 - PRODUCTS

2.1 PRODUCT/MANUFACTURER:

- A. Manufacturers: Vertical-Rib, Machine-Seamed Joint, Standing-Seam Metal Roof Panels; Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and mechanically seaming panels together. Roofing panels, closures, and all exposed trim, gutters, downspouts, and similar items shall be factory prefinished, with smooth texture (NOT embossed).

1. AEP-Span.
2. American Buildings Company.
3. Architectural Building Components.
4. Architectural Roofing and Siding, Inc.
5. ATAS International, Inc.
6. Butler Manufacturing Co.
7. CENTRIA Architectural Systems.
8. Copper Sales Inc.
9. Fabral, Inc.
10. Garland Company, Inc.
11. MBCI
12. McElroy Metal, Inc.
13. Merchant & Evans, Inc.
14. Metal-Fab Manufacturing, LLC.
15. Metal Sales Manufacturing Corporation.

- B. Product/Manufacturer: Subject to compliance with requirements, provide equivalent to standard machine seamed roofing system equivalent to one of the following, by one of the above named manufacturers, or other product properly submitted at least 10-days prior to original Bid Date (refer to Section 01015 - "Special Conditions") and subsequently pre-approved in writing by the Architect.

1. "Loc-Seam" roofing system, as manufactured by American Buildings Co.; Eufaula, Alabama; Phone: 334/687-2032.
2. "SDP 200" roofing system, as manufactured by Centria Roof Systems; Moon Township, Pennsylvania; Phone: 1-888-265-4084 or 1-770-465-1220 (rep).

2.2 MATERIALS:

- A. Prefinished Panels and Trim: Fabricate of **minimum 24-gage** metal, with minimum 50,000 p.s.i. yield, with prefinished roofing panels and closures, and 2-coat full strength (70-percent) Kynar 500 resin (20-year) finish for all roofing panels, exposed trim, gutters, downspouts, and similar items; Provide 2-coat finish on underside of panels where exposed to view in the finished work. Provide one of the following base metals:

1. ASTM A 792 aluminum-zinc alloy coated steel sheet ("Galvalume"), or

2. ASTM A 653, G-90 (galvanized) zinc-coated steel sheet.
 3. Panels shall be formed full length, without laps in a given run.
 4. Where indicated with standing seams, all roof panels shall be formed with a 2-inch high vertical seam and finished width of 16 inches, with two intermediate stiffening ribs. All roof panels shall be roll formed in a single length from panel-break to plane-break.
 5. Surface Texture: Smooth (NOT embossed).
- B. Vertical Seams: Fabricate panel vertical seams of the same material, finish and length as the panels. Vertical seams shall contain factory applied sealant and shall be designed so that neither the paint finish nor metal are damaged by the required machine seaming.
- C. Clips: Clips shall be 300-series SS (ASTM A-167) which shall provide for unlimited, unimpeded panel movement.
1. **NOTE that design of metal roofing system shall include additional clips at corners and elsewhere as required following manufacturer's wind load analysis, so as to provide for use of metal gauge specified and minimum code required basic wind load of 160 mph.**
- D. Ridge Caps, Flashing and Trim: All flashings and cover over all curbs, roof penetrations, etc., shall be of the same material, gauge and finish as the panels with which they are used, unless heavier gauge is required by project conditions.
- E. Fasteners: All fasteners in the plane of the roof deck shall be covered. No exposed fasteners which would penetrate the panels, flashings, etc., will be permitted. Penetrating type fasteners will be allowed only in the vertical plane (i.e. fastening of ridge caps, hip covers, etc., and then only if neoprene washers are used externally). Materials used in all fasteners shall be non-magnetic stainless steel. All exposed fasteners shall match adjacent material, finish and/or color. Length and diameter of screws shall be sufficient to meet design criteria.
- F. Closures: Precut closures from gray cross-linked closed-cell polyethylene composition foam to the exact profile of the members with which they are to function.
- G. Sealants: Non-skinning, non-hardening, non-oxidizing butyl sealant, designed for metal-to-metal concealed joints. Field applied adhesive tape sealants shall be extruded polymeric butyl tape, non-skinning. Use no exposed sealants.
- H. Bituminous Coating: Cold-Applied asphalt mastic, SSPC-12, compounded for 15-mil dry film thickness per coat, and approved for the intended use by both the mastic and roofing manufacturers.

2.3 METAL FINISHES:

- A. General: Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Protect coating either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to properly protect the finish. Furnish air-drying spray finish in matching color for touch-up, in the event touch-up is allowed by the Architect; However, it is probable that the Architect will require replacement of any materials which exhibit any damage to finishes.
- B. Roof Panels, Closures, Exposed Trim, Gutters, Downspouts, and Similar Items - Fluoropolymer Coating: Manufacturer's standard "Premium 70" **two-coat** (i.e.: primer, color coat and clear top coat), thermo-cured, full-strength 70 percent resin "Kynar 500" coating and 30 percent reflective gloss when tested in accordance with ASTM D 523, with minimum 2.4-mils dry film thickness); Provide 2-coat finish on underside of panels where exposed to view in the finished work.
 - 1. Durability: Provide coating that has been field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of No. 8 in accordance with ASTM D 659; and without fading in excess of 5 NBS units; and as otherwise indicated.
 - 2. Colors: As selected by Architect after Bid Date, from manufacturer's "standard" non-metallic colors; Minimum 15 colors to select from.

2.4 PANEL FABRICATION:

- A. General: Fabricate and finish panels and accessories at the factory, by manufacturer's standard procedures and processes, as required to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensional requirements and with structural requirements.
- B. Apply bituminous coating or other permanent separation materials on concealed panel surfaces where panels would otherwise be in direct contact with substrate materials that are noncompatible or could result in corrosion or deterioration of either material or finishes.
- C. Fabricate panel joints with captive gaskets or separator strips, which provide a tight seal and prevent metal-to-metal contact in a manner that will minimize noise from movements within panel system.
- D. Roll Forming: Field forming of panels is not acceptable.

PART 3 - EXECUTION**3.1 GENERAL:**

- A. Installer shall examine all substrates and verify that they are acceptable, which will be acknowledged and accepted by his beginning work. Installer shall verify that all penetrations, expansion joints, blocking, etc., are securely anchored into place, and that substrate is clean and free of all debris or other substance detrimental to the roofing work.
 - 1. Notify the Contractor in writing of conditions requiring corrections, for proper completion of the Work. Do not proceed until unsatisfactory conditions have been satisfactorily completed.
- B. The use of square head nails, staples, and pneumatic or electric nail guns are strictly prohibited.

3.2 PANEL SUPPORTS AND ANCHORAGE:

- A. When installed by the roofing contractor, all girts, purlin, and other secondary structural panel support members and anchorage (if any) shall be installed in accordance with AISC Manual of Steel Construction "Code of Standard Practice." When installed by others, compliance shall be field verified prior to proceeding with installation.

3.3 PANEL INSTALLATION:

- A. General: Comply with manufacturer's written instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the work securely in place, with provisions for thermal and structural movement and insulation system.
 - 1. Field cutting of exterior panels by torch is not permitted.
 - 2. Install panels with concealed fasteners.
 - 3. Install insulation support system, insulation, thermal spacer blocks, and other internal components as the work progresses.
 - 4. Use only non-magnetic stainless steel roofing nails and fasteners.
- B. Accessories: Install components required for a complete roof panel system, including in part, trim, copings, fascias, stops, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 - 1. Provide and install counterflashing to match roofing over flashing at vent stacks, flues, curbs, and other penetrations, except those indicated to be field painted.
- C. Joint Seals: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of panel systems and accessories. Provide types of gaskets, sealants, and fillers indicated or, if not otherwise indicated, types recommended by panel manufacturer.

1. Flash and seal roof panels at eave and rake with rubber, neoprene, or other closures to exclude weather.
 2. Counter-flash over otherwise exposed flashings with metal and finish to match adjacent roof metal.
 3. Refer to other sections of these specifications for product and installation requirements applicable to indicated joint sealers.
- D. Joint Sealers: Refer to other sections of these specifications for post-installation requirements on joint sealers; not work of this section.
- E. Lap-Seams: Provide sealant tape at lapped joints of ribbed or fluted roof sheets and between roof sheets and protruding equipment, vents, and accessories.
- F. Standing Seam Roof Panel Systems: Fasten roof panels to supports with concealed clip in accordance with the manufacturer's current written instructions and recommendations, and as required to meet site wind load conditions.
1. Install clips at each support with self-drilling/self-tapping fasteners.
 2. At end laps of panels, install tape caulk between panels.
 3. Install factory-caulked cleats at standing-seam joints.
 4. Seaming: Complete seaming of panel joints by operation of portable power-driven equipment of type recommended by panel manufacturer to provide a weathertight joint.
- G. Apply a continuous ribbon of sealant tape to clean, dry surface of the weather side of fastenings on end laps, and on side laps of corrugated nesting-type, ribbed, or fluted panels and elsewhere as needed to make roof sheets weatherproof to driving rains.
- H. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4-inch in 20'-0" on level/plumb/slope and location/line as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- I. Roofer shall install curbs supplied by other trades for roof mounted equipment and other items, and cover with metal to match roofing.

3.4 CLEANING AND PROTECTION:

- A. Damaged Units: Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures, as determined solely by the Architect.

- B. Cleaning: Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction.

END OF MANUFACTURED ROOF PANELS

SECTION 07600**FLASHING AND SHEET METAL****PART 1 - GENERAL****1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. Related work specified elsewhere includes:
 - 1. Section 06100 - "Rough Carpentry"
 - 2. Section 06200 - "Finish Carpentry"
 - 3. Section 07311 - "Asphalt Shingles"
 - 4. Section 07552 - "SBS Modified Bituminous Membrane Roofing"
 - 5. Section 07900 - "Joint Sealers"

1.2 SUMMARY:

- A. This Section includes the following, where indicated, and where required by project conditions, and which are not part of other Sections:
 - 1. Prefinished metal counter flashing and base flashing.
 - 2. Miscellaneous prefinished metal wall flashing, counterflashing, and reglets.
 - 3. Exposed prefinished metal trim/fascia units, parapet caps (copings), downspouts with connected to boots into storm drainage only where indicated on the Drawings (if any), and otherwise, onto precast concrete splashblocks at grade and onto corrugated splash pan at roofing, and other items as indicated on the Drawings.
 - 4. Elastic flashing at top of all curbs, top course of double wythe walls, at perimeters of all exterior wall openings (i.e.: doors, windows, louvers, etc.), through-wall flashing, and elsewhere as indicated.
 - 5. Miscellaneous sheet metal accessories as indicated and as required by project conditions.
 - 6. "Special Flashing" at locations indicated; Refer to Division 7 roofing and siding sections for additional information and requirements.
 - a. Where roofing planes intersect vertical walls and planes, turn edges up at least 8-inches.
 - 7. Where different roofing systems meet, provide **water-tight** prefinished metal perimeter flashings/gravel guards at terminal edges and at juncture of roofing systems, and coordinated with other roofing systems.

- B. Exposed metal flashing is intended to be factory formed, prefinished baked enamel, as specified, in manufacturer's standard non-metallic color(s) selected by Architect after bidding.

1.3 **SUBMITTALS:**

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for Flashing, Sheet Metal and Accessories: Manufacturer's current technical product data, installation instructions and general recommendations for each specified sheet material, fabricated product, coating system, and color selection data.
- C. Samples of the following flashing, sheet metal, and accessory items:
 - 1. 12-inch-long samples of factory-fabricated products exposed as finished work. Provide complete with specified factory finish.
 - 2. Physical samples for color selections, where color selection is required.
- D. Shop drawings showing layout, profiles, methods of joining, and anchorages details, including major counterflashings, trim/fascia units, expansion joint systems, and other fabricated work. Provide layouts at 1/4-inch scale and details at 3-inch scale.

1.4 **PROJECT CONDITIONS:**

- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 **SHEET METAL, TRIM UNITS, FLASHING, COPING, GUTTERS AND DOWNSPOUTS, AND TRIM MATERIALS:**

- A. Fabricate of **minimum 24-gage** metal, with minimum 50,000 p.s.i. yield, with **2-coat** full strength (70-percent) Kynar 500 resin (20-year) finish. Provide one of the following base metals, to be the same base metal used for other sheet metal applications and systems:
 - 1. ASTM A 792 aluminum-zinc alloy coated steel sheet ("Galvalume"), or
 - 2. ASTM A 653, G-90 (galvanized) zinc-coated steel sheet.
 - 3. Typical metal flashing, except where specifically indicated otherwise.
- B. Prefinished Metal Drip Edge: Brake-formed sheet metal with at least a 2-inch roof deck flange at shingles and at least 4-inch roof deck flange at any "flat" roofs; 1-inch flange extension to support any shingle roofing and 1/2" raised edge at single-ply roofing; with a 1-1/2-inch fascia flange with a 3/8-inch hemmed edge drip at lower edge at any shingle or

metal roofing, which is not already included with metal roofing system. Furnish in lengths of at least 10 feet.

1. Furnish for metal roofing systems and metal flashing systems over 6" wide, if indicated in addition to metal roofing trim.

C. Prefinished Metal Flashing and 2-Inch High Diverter Strips:

1. Install diverter strips 1'-0" above low roof edge(s) of sloped roofs, at all locations over exterior doors, and over exterior mechanical units where roof edge gutters or parapet walls do not occur.

D. Prefinished Coping System: Provide prefinished aluminum coping system, including chairs, "drainable gutters" at joints, clips, trim and all necessary accessories for a complete and properly installed water-tight system.

1. Product/Manufacturer: Manufactured or brake-metal system, equivalent to "AP Standard Coping" system, as manufactured by Architectural Products Co.; Covington, Kentucky; Phone: 1-606-341-1171.
 - a. Baked enamel finish on minimum 0.063" (1.6 mm) aluminum sheet or extrusion, with depths and widths indicated on the Drawings, including all necessary trim and accessories as recommended by manufacturer and required by project conditions.
2. At Contractor's option, provide similar profile, but from brake-metal coping system, with continuous clip across top of and length of parapets (full secondary concealed wall cap), with 1-inch high standing seam joints - filled with sealant, double-folded, and corners turned down at 45-degrees.

E. Finishes:

1. Finish for any exposed metal flashings, gutters, downspouts, coping systems, etc., shall be **2-coat** 70% resin "Kynar 500" coating (i.e.: primer and color coats); and note that the finish system may be a traditional liquid or powder coat, complying with AAMA 2605, with a total dry film thickness of not less than 1.6-mils, and manufacturer's standard 20-year minimum finish warranty; Manufacturer's standard primer or washcoat on back side, and inside gutters.
2. Colors: As selected by Architect after Bid Date, from manufacturer's standard non-metallic colors; Minimum 15 colors to select from, including color(s) to match similar metal panel applications on the existing or new buildings, or window framing.

2.2 LEAD FLASHING (AT VENT STACKS):

- A. 4-pound lead sheet, fabricated to extend 4 inches minimum onto roof and turn down 1 inch minimum down inside vent stacks.

1. For metal roofing, provide counterflashing over vent stacks, curbs, and other penetrations' flashings in same material and color as metal roofing.
2. Note that flashing at metal roofing shall also be as recommended by metal roof panel manufacturer and shall fully comply with applicable warranties.

2.3 **SPECIAL FLASHING:**

- A. Self-Adhering, Polyethylene-Faced Sheet: ASTM D 1970, 40 mils (1.0 mm) thick minimum, consisting of slip-resisting polyethylene-film reinforcing and top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied.
- B. Products - Shingle Roofing and Metal Siding Over Solid Substrates: Provide equivalent to "Ice and Water Shield" waterproofing underlayment, with self adhesive and self-sealing property, which will not crack, dry out, or rot and is resistant to fungus and bacteria, as manufactured by W.R. Grace & Company - Conn; Atlanta, Georgia, by one of the following:
 1. Atlas Roofing Corporation; StormMaster DG.
 2. Grace, W. R. & Co.; Grace Ice and Water Shield (*basis of design*).
 3. Henry Company; Perma-Seal PE.
 4. Johns Manville International, Inc.; Roof Defender.
 5. NEI Advanced Composite Technology; AC Poly Ice and StormSeal.
 6. Owens Corning; WeatherLock.
 7. Polyguard Products, Inc.; Polyguard Deck Guard.
 8. Protecto Wrap Company; Rainproof TM.
 9. TAMKO; TW Metal and Tile.
 10. CertainTeed WinterGuard Granular
- C. Products - Metal Roofs, and Horizontal or Sloped Metal Flashings Over 6" Wide, Occurring Over Solid Substrates: Provide continuous, equivalent to "Ultra" high temperature resistant waterproofing roofing underlayment, as manufactured by W.R. Grace & Company - Conn; Atlanta, Georgia.
 1. Self-Adhering, High-Temperature Sheet: 30 to 40 mils (0.76 to 1.0 mm) thick minimum, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 2. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
 3. Low Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
 4. Products:
 - a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri-Start "HR" High Performance Roofing Underlayment.
 - b. Grace, W. R. & Co.; Ultra (*basis of design*).
 - c. Henry Company; Perma-Seal PE.

- d. Metal-Fab Manufacturing, LLC; MetShield.
 - e. TC MiraDRI; WIP 300HT.
- D. Install 1-layer over entire substrates indicated above. Where roofing planes intersect vertical walls and planes, turn edges up at least 8-inches.
- E. Coordinate with, and refer to Division 7 Roofing and Siding Sections for additional information and requirements.

2.4 MISCELLANEOUS MATERIALS AND ACCESSORIES:

- A. Solder:
- 1. For use with steel or copper: Provide 50 - 50 tin/lead solder (ASTM B 32), with rosin flux.
 - 2. For use with stainless steel: Provide 60 - 40 tin/lead solder (ASTM B 32), with acid-chloride type flux, except use rosin flux over tinned surfaces.
- B. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
- C. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.
- D. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, non-drying, nonmigrating sealant.
- E. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07900 - "Joint Sealers."
- F. Paper Slip Sheet: 5-lb. rosin-sized building paper.
- G. Counterflashing and Reglets: Metal units of type and profile indicated, or if not indicated, as required for the intended use, compatible with flashing indicated, noncorrosive.
- 1. At surface-mounted parapet and wall flashing conditions, equivalent to **2-piece** "Springlok" Flashing Systems, as manufactured by Fry Reglet; Norcross, Georgia; Phone: 1-770-441-2337, except where brake-formed metal is specifically indicated.
- H. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.
- I. Fibered Aluminum Roof Coating: ASTM D 2824, Type II; FS TT-C-1079. Equivalent to Perma-Seal coating No. 3910; Brush applied only.

- J. Provide precast concrete splashblock sloped away from building, approximately 12-inches wide x 24-inches long x 2-inches thick x 3-inches high, with 3-raised edges and one “open” end turned toward building – at locations where downspouts would otherwise drain on grade.
1. Provide 1-precast concrete splashblock at each downspout which drains onto grade or paving;
 2. Provide 1-preformed metal pan with corrugated bottom and properly hemmed edges (minimum 12” x 24”) at each downspout which drains onto a roof below.

2.5 **FABRICATED UNITS:**

- A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA “Architectural Sheet Metal Manual” and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
1. At metal roofing and horizontal or sloped metal flashings over 6-inches wide, provide custom configurations and continuous brake-metal roofing system, with continuous concealed clip anchors rated for I-90 uplift conditions, with 1-inch high standing seam Pittsburgh lock-seam joints - filled with sealant, double-folded, and corners turned down at 45-degrees.
 2. Provide matching materials and finish for fascia metal covering, flashing, counterflashing and trim.
- B. Seams: Fabricate nonmoving seams in sheet metal with standing seam at exposed tops and lapped side or edge seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer. Pop-rivet joints for additional strength where required and at vertical faces.
- C. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
- D. Gutters: Form in “continuous” sections with the least number of joints, unless otherwise indicated, complete with end pieces, outlet tubes and other special pieces as required. Size as indicated on the Drawings, or if not indicated, size in accordance with SMACNA and submit for approval prior to fabrication. Join sections with riveted and soldered or sealed joints, concealed wherever possible. Provide expansion-type slip joint at locations indicated, or if not indicated, as recommended by SMACNA for the metal being used.

1. Furnish gutter supports spaced 36-inches on center, or 32-inches on center at 16" metal roofing panels, or 48-inches on center at 24" metal roofing panels, constructed of same metal as gutters.
 2. Provide bronze, copper, or aluminum wire ball strainers at outlets, which are slightly below front edge of gutters and not visible from normal view.
 3. Finish shall be as indicated, or if not indicated, to match roofing, roof edge fascia and rake, or as selected by Architect.
- E. Downspouts: Form in 10-foot-long sections, complete with elbows, offsets and other special pieces as required. Join sections with 1-1/2-inch telescoping joints. Provide off-set anchor straps / supports designed to hold downspouts securely 1-inch away from walls; locate anchor straps / supports at top and bottom and equally spaced at approximately 5-feet on center in between. Finish shall be as indicated, or if not indicated, to match gutters, roof edge fascia and rake, or as selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS:

- A. General: Except as otherwise indicated, comply with manufacturer's current written installation instructions and recommendations, with SMACNA "Architectural Sheet Metal Manual," and reviewed submittals and shop drawings.
1. Install manufactured, bought-out items in accordance with manufacturer's current written instructions and recommendations.
 2. Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
- B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.
- C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.
- D. Install reglets to receive counterflashing in manner and by methods indicated, in a straight line and single elevation.
- E. Install counterflashing in reglets, by snap-in seal arrangement for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure, or if not indicated, as recommended by referenced standards, flashing and roofing manufacturers, and otherwise as required for the intended application.

- F. Nail or anchor flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches o.c. Fabricate seams at joints between units with minimum 3-inch overlap, to form a continuous, waterproof system.
- G. Flashing:
 - 1. Comply with manufacturer's current written instructions and recommendations for installation of all systems components in all applications indicated on the Drawings, and as otherwise required by project conditions.
 - 2. At any parapet wall and roof curbs applications, extend flashing continuous, over top of wall or curb, and turn down one inch (1") minimum on exterior side of wall and mechanically anchor in place at side of top of wall, below and concealed by continuous metal clip anchor (acting as termination bar) and metal cap flashing or coping, and down over top edge of roofing flashing material at roof side.
- H. Provide 1-precast concrete splashblock at each downspout which drains onto grade, and 1-preformed metal pan at each downspout which drains onto roof below.

3.2 CLEANING AND PROTECTION:

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
 - 1. After cleaning, repair and restore damaged metal and metal finishes with prefinished paint manufacturer's special air-drying touch-up paint, in manner such that touch-up is not apparent.
 - 2. Replace damaged flashing and sheet metal work which cannot be repaired and when finish repair and restoration is not acceptable to Architect.
- B. Protection: Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF FLASHING AND SHEET METAL

SECTION 11120**PARKING CONTROL EQUIPMENT****PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Parking gates and operators.
 - 1. Basis of Design: DoorKing Model 1601.
- B. Electric gate operators.
- C. Sensors and controls.

1.2 RELATED SECTIONS

- A. Section 03300 – Cast-in-Place Concrete: Concrete mounting pads.
- B. Section 05570 – Ornamental Fences and Gates.
- C. Division 16 – Requirements for electrical connections.

1.3 REFERENCES

- A. Underwriters Laboratories (UL): UL 325 – Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.
- B. Underwriters Laboratories (UL): UL 991 – Standard for Tests for Safety Related Controls Employing Solid-State Devices.
- C. American Society Testing Materials (ASTM): ASTM F2200 – Standard Specification for Automated Vehicular Gate Construction.
- D. National Electrical Manufacturers Association (NEMA): NEMA ICS 6 – Industrial Control Systems: Enclosures.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01015 – Special Conditions.
- B. Product Data: Manufacturers data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements.
 - 3. Installation methods.
- C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, edge connections, and accessories.

1. Operation, installation, and maintenance manuals including wire diagrams.
2. Risers, layouts, and special wiring diagrams showing any changes to standard drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials and products in strict compliance with manufacturer's instructions and industry standards.
- B. Store products indoors in manufacturer's original containers and packaging with labels clearly identifying product name and manufacturer. Protect from damage.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Substantial transformation and final assembly shall occur in the United States of America per Section 1605 of the ARRA-09.
- B. Installer Qualifications: Installation performed by factory authorized dealer contractor specifically trained in gate operator systems of the type found within this section.
 1. Provide documentation of maintenance and repair service availability for emergency conditions.
 2. Provide quarterly maintenance for one year following Substantial Completion of the Project.

1.7 WARRANTY

- A. Manufacturers standard five (5) year warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: DoorKing, Inc.; 120 S. Glasgow Ave; Inglewood, CA 90301; Toll-Free Tel: 800-826-7493; Tel: 310-645-0023; Fax: 310-641-1586; Email: ghendrix@doorking.com; Web: doorking.com.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01015 – Special Conditions.

2.2 PARKING/BARRIER GATE OPERATORS

- A. Microprocessor based solid-state control board interacting with card readers, RF transmitters, access control systems, ticket machines, other activating devices as required, external devices for pedestrian sensing (photo-eyes) and vehicle (loop) sensing systems. Control board shall include built-in down timer (1-25 seconds), built-in ports for two (2) plug-in loop detectors, Up input memory buffer, down command options, programming switches to set various operating modes, PAMS sequencing inputs (Perimeter Access Management System), inherent current sensing reverse system.

1. Compliance: Compliant to UL 325, UL 991 and CSA C22.2 No. 247 and listed by Intertek Testing Laboratories NA, Inc. (ETL), a Nationally Recognized Testing Laboratory.
 - a. This model is intended for use in Class II, III and IV vehicular barrier gate applications.
2. Warranty: Five (5) year manufacturer's standard warranty.
3. Operator speed: 90-degrees in approximately 1.5 seconds.
4. Enclosure: 12 gage, 0.105 inch (2.6 mm) G90 hot-dipped galvanized steel, powder coated, full gloss smooth super TGIC, polyester white.
5. Configuration: Left or right hand mount. In the event of an obstruction close by the barrier gate, operator can be reversed to allow access to cabinet door.
6. Motor: 1/2 HP, continuous duty.
7. Gear Reduction: 60:1 worm gear running in a continuous oil bath with 360-degrees of gear travel.
8. Magnetic Limit Switches: No mechanical switches to wear out or break.
9. Operating Switches: Built-in power (on-off) and operating (up-down-normal) toggle switches.
10. Convenience Outlets: Two (2) 115 VAC for accessory transformers.
11. Electrical Power Requirements: 115/208/230/460/575 VAC.
 - a. 208/230/460/575 VAC requires DoorKing High Voltage Kit, P/N 2600-266.
12. Gate Arms: Fully retroreflectorized on both sides, vertical stripes alternately red and white at 16-inch intervals as required by the Manual on Uniform Traffic Control Devices (MUTCD).
 - a. 14-foot, 3 x 2.185-inch aluminum octagonal with contact reverse edge + Red/Green LED light strip (Red when arm is down, Green when arm is up).
13. Pedestrian Protection
 - a. Photo-electric eye / auxiliary loop detector relay switch.
 - 1) Requires DoorKing 9411 loop detector used in conjunction with photo-eye.
14. Accessories: Provide the optional accessories listed below.
 - a. Arm Breakaway Kit – aluminum arms only.
 - b. Folding arm kit for low ceiling applications.
 - c. Plug-in loop detectors.
 - d. Electric reversing edge – reverses rotation of arm on contact with an obstruction.
 - e. Gate Tracker Expansion – provides time and date stamped electronic record of cycles, input errors, loop detector input errors, obstruction hits and power cycles.
 - 1) Requires companion DoorKing 1830 Series access controller.
 - f. Backup power inverter – allows system to remain operation upon loss of primary (AC) power.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Product to be installed by a qualified technician who is certified by either the Accreditation and Certification Institute (ACI) or the Institute of Door Dealer Education and Accreditation (IDEA).
- B. Control equipment shall be mounted, firmly secured, plumb and level, as required.
- C. Wiring shall be uniform and in accordance with national electric codes and manufacturer's instructions.
- D. All splices shall be in easily accessible junction boxes or on terminal boards.
- E. All cable runs in all junction boxes shall be tagged and identified.
- F. Coordinate all work with other effected trades and contractors.

3.2 SYSTEM INITIALIZING AND PROGRAMMING

- A. System shall be turned on and adjustment made to meet requirements of specifications and on-site conditions.
- B. System shall function as specified.

3.3 SYSTEM TEST PROCEDURES

- A. System shall be completely tested to assure that all components and accessories are hooked-up and in working order.
- B. System shall be pre-tested by contractor and certified to function in accordance with plans and specifications.
- C. System shall be tested in presence of owner's representative.

3.4 OWNER INSTRUCTIONS

- A. Installation contractor shall conduct up to (1) hour of instruction in use and operation of the system to designated owner representatives, within (30) days of acceptance.
- B. Installation contractor shall conduct up to (1) hour of technical training, in troubleshooting and service of the system, to designated owner representatives within (90) days of system acceptance.

3.5 MANUALS AND DRAWINGS

- A. Contractor shall provide owner with (2) copies of standard factory prepared operation, installation and maintenance manuals. Manuals shall include typical wiring diagrams.

- B. Contractor shall provide owner with (2) copies of any risers, layouts, and special wiring diagrams showing any changes to standard drawings, if required on project.

3.6 MAINTENANCE

- A. The manufacturer recommends periodic maintenance at three month intervals as described in the installation and maintenance manual.
- B. External reversing devices should be checked at least once a month.

END OF SECTION

SECTION 31 6219**TIMBER PILES****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 square timber piles.

1.3 REFERENCE STANDARDS

- A. AWPA C3 – Piles – Preservative Treatment by Pressure Process
- B. AWPA M4 – Standard for the care of Preservative Treated Wood Products

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For timber piles. Show fabrication and installation details for piles, including details of driving shoes, tips or boots, and pile butt protection.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer
- B. Square timber pile treatment data as follows, including chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material:
 - 1. For each type of preservative-treated timber product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - 2. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.

- C. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion.
- D. Pile-Driving Records: Submit within three days of driving each pile.
- E. Material Certificates: For preservative-treated piles. Indicate type of preservative used and net amount of preservative retained.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent breaks, cuts, abrasions, or other physical damage and as required by AWWA M4.
 - 1. Do not drill holes or drive spikes or nails into pile below cutoff elevation.

1.7 FIELD CONDITIONS

- A. Protect structures, underground utilities, and other construction from damage caused by pile driving.
- B. Site Information: A geotechnical report has been prepared for this Project and is included elsewhere in the Project Manual for information only.

PART 2 - PRODUCTS

2.1 TIMBER PILES

- A. square Timber Piles: Unused, clean, one piece from butt to tip; of the following species and size basis:
 - 1. Species: Southern yellow pine.
 - 2. Size Basis: 10x10
- B. Pressure-treat square timber piles according to AWWA U1 as follows:
 - 1. Service Condition: UC5C Marine Use Southern Waters
 - 2. Treatment: CCA – 2.50 pcf retention

2.2 PILE ACCESSORIES

- A. Driving Shoes: Fabricate from ASTM A1011/A1011M, hot-rolled carbon-steel strip to suit pile-tip diameter, of the following type and thickness, and secure to pile tip so as to not affect pile alignment during driving:

1. Type: Arrow point.

2.3 FABRICATION

- A. Pile Tips: Cut and shape pile tips to accept driving shoes. Fit and fasten driving shoes to pile tips according to manufacturer's written instructions.
- B. Pile Butt: Trim pile butt and cut perpendicular to longitudinal axis of pile. Chamfer and shape butt to fit tightly to driving cap of hammer.
- C. Field-Applied Wood Preservative: Treat field cuts, holes, and other penetrations according to AWPA M4.
 1. Coal-tar roofing cement for treating drilled holes or sealing cutoffs shall be free of asbestos.
- D. Pile Splices: Splices are not permitted.
- E. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch (305-mm) intervals; label the distance from pile tip at 60-inch (1524-mm) intervals. Maintain markings on piles until driven.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Conditions: Do not start pile-driving operations until earthwork fills have been completed or excavations have reached an elevation of 6 to 12 inches (152 to 305 mm) above bottom of footing or pile cap.

3.2 DRIVING EQUIPMENT

- A. Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.
- B. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.
- C. Leads: Use fixed, semifixed, or hanging-type pile-driver leads that hold the full length of pile firmly in position and in axial alignment with hammer.

3.3 DRIVING PILES

- A. General: Continuously drive piles to elevations or penetration resistance indicated. Establish and maintain axial alignment of leads and piles before and during driving.
- B. Predrilling: Provide pre-excavated holes where indicated, to depths indicated. Drill holes with a diameter less than the largest cross-section dimension of pile.
 - 1. Firmly seat pile in predrilled hole by driving with reduced energy before starting final driving.
- C. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.
- D. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:
 - 1. Location: 2 inches from design location after pile driving is completed.
 - 2. Plumb: Maintain 1 inch (25 mm) in 60 inches from vertical, or a maximum of 2 inches, measured when pile is aboveground in leads.
- E. Withdraw damaged or defective piles and piles that exceed driving tolerances, and install new piles within driving tolerances.
 - 1. Fill holes left by withdrawn piles using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact in lifts not exceeding 72 inches.
- F. Abandon and cut off rejected piles as directed by Architect. Leave rejected piles in place and install new piles in locations as directed by Architect.
- G. Cut off butts of driven piles square with pile axis and at elevations indicated.
 - 1. Cover cut-off piling surfaces with minimum three coats of preservative treatment according to AWPA M4.
- H. Pile-Driving Records: Maintain accurate driving records for each pile. Include the following data:
 - 1. Project name and number.
 - 2. Name of Contractor.
 - 3. Pile species.
 - 4. Pile location in pile group and designation of pile group.
 - 5. Sequence of driving in pile group.
 - 6. Pile dimensions.
 - 7. Ground elevation.
 - 8. Elevation of tips after driving.
 - 9. Final tip and cutoff elevations of piles after driving pile group.
 - 10. Records of redriving.
 - 11. Elevation of splices.
 - 12. Type, make, model, and rated energy of hammer.

13. Weight and stroke of hammer.
14. Type of pile-driving cap used.
15. Cushion material and thickness.
16. Actual stroke and blow rate of hammer.
17. Pile-driving start and finish times, and total driving time.
18. Time, pile-tip elevation, and reason for interruptions.
19. Number of blows for every 12 inches (305 mm) of penetration, and number of blows per 1 inch (25 mm) for the last 6 inches (152 mm) of driving.
20. Pile deviations from location and plumb.
21. Preboring, jetting, or special procedures used.
22. Unusual occurrences during pile driving.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 1. Pile foundations.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

3.5 DISPOSAL

- A. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner's property.

END OF SECTION 31 6219

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SECTION 31 2316**TRENCHING****PART 1 - GENERAL****1.1 SUMMARY:**

- A. Section Includes:
 - 1. Excavating trenches for utilities
 - 2. Compacted fill from top of utility bedding
 - 3. Backfilling and compaction
- B. Related work specified elsewhere includes:
 - 1. 31 1000 – Site Clearing
 - 2. 33 3000 – Sanitary Sewerage
 - 3. 331416 – Water Service Piping
 - 4. 334211 – Storm Drainage

1.2 REFERENCE STANDARDS:

- A. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- B. ASTM D2487 – Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- C. ASTM D488 – Standard Sizes of Coarse Aggregate
- D. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400-ft-lbf/ft³ (600 kN-m/m³))
- E. AASHTO T 99 – Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in) Drop
- F. AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances
- G. 29 CFR PART 1926 (OSHA) – Safety and Health Regulations for Construction
- H. CITY OF AUBURN STANDARD DETAILS

1.3 SUBMITTALS:

- A. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural

calculations to support plan. The plan shall be stamped by a qualified professional engineer registered in the State of Alabama.

- B. Method of dewatering including type of systems, equipment, material, and other pertinent data of dewatering system. The system shall be designed by a qualified professional engineer registered in the state of Alabama
- C. Product Data:
 - 1. Geotextile fabric.
 - 2. Bedding materials.
 - 3. Restoration materials.
- D. Materials Source: Name and location of imported fill materials suppliers.
- E. Classification of imported materials by Laboratory analysis or other certification.
- F. Submit information found from test boring and pits.

1.4 QUALITY ASSURANCE:

- A. Perform Work according latest requirements of OSHA excavation safety standards and all applicable state and local requirements.
- B. Design of excavation support and stabilization systems shall be performed by a professional engineer, registered in the State of Alabama, with at least five (5) years of experience in design of similar excavation support systems.
- C. Design of the dewatering system shall be performed by a professional engineer, registered in the State of Alabama with at least five (5) years of experience in design of similar dewatering systems.

1.5 FIELD MEASUREMENTS:

- A. Prior to construction, the Contractor shall be responsible for taking sufficient measurements, horizontal and vertical, to ensure that all existing facilities, which includes but is not limited to; pavements, curbs, gutters, drainage facilities, fences, gates, mailboxes, signs, guardrails, markers, and monuments are restored to their original lines and grades.

1.6 COORDINATION:

- A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.
- B. The Contractor shall comply with the requirements of all encroachment permits obtained for the work, if applicable. If the Contractor wishes to deviate from the permit requirements he shall obtain a revision to the permit at no additional cost to the Owner.

- C. If applicable, any additional Permit applications from State or County Highway Departments, Municipal Street Departments, Railroads, and Utility Companies shall be prepared by the Contractor. Permit applications shall be prepared by the Contractor even though the permanent contract agreement is made between the Controlling Authority and the Owner.
- D. If any encroachment permits are required, the Contractor will be required under the terms of this contract to furnish the performance bond, insurance coverage, and any other security required by the Controlling Authority, either directly from him or indirectly from the Owner.
- E. If any encroachment permits are required, the Contractor shall include in the total amount bid all costs related to field staking, measurements and surveys, sketches and drawings, and permit application form completion, bonds and insurance as required by the Controlling Authority. The Contractor shall also pay the cost of any supervision by an Inspector of the Controlling Authority if such is stipulated in the permit.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. All excavation shall be “unclassified” unless described elsewhere in these specifications.
- B. Soils type shall be based upon ASTM D2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- C. Stone or Coarse Aggregate type shall be based upon ASTM D488, Standard Sizes for Coarse Aggregates.
- D. Rip rap type shall be in accordance with the latest edition of the ALDOT Standard Specifications for Highway Construction.

2.2 MATERIALS:

- A. Structural backfill shall be imported or excavated trench material meeting the requirements of the geotechnical report. if no report is provided, structural backfill shall meet the following requirements:
 - 1. Class I through III per ASTM D2321
 - 2. Free of clay lumps, roots, debris, rubbish, frozen material, and stones larger than one inch in diameter, have < 35% fines, and capable of being compacted to 95% density per AASHTO T-99.
- B. Common backfill material shall consist of excavated materials meeting the following requirements:
 - 1. Class I through IV per ASTM D2321
 - 2. Highly organic silts, clays and Class V materials shall not be used.
 - 3. Materials shall be free roots, stumps, debris, rubbish, frozen material, and stones larger than one inch in capable of being compacted to 85% density per AASHTO T-99.

4. Contain no stone blocks, broken concrete, masonry rubble, or other similar materials.
 5. Physical properties such that it can be readily spread and compacted during filling.
 6. Snow, ice, and frozen soil will not be permitted.
- C. Crushed Stone:
1. Crushed stone for pipe bedding, structure bases, and other used indicated on the Drawings shall be angular, clean-washed, crushed stone graded in accordance with size #67 or #57 in ASTM D488 (ALDOT #67 or #57).
- D. Foundation Conditioning Material: Crusher-run rock, conforming to ASTM D448.
- E. Geotextile Fabric shall be used as directed by the Engineer or as indicated on the Drawings and shall conform to the following requirements:
1. Geotextile fabric shall be non-woven Mirafi, Type HP570, Type 140N; Dupont, Type PAR, Style 3401; as required by the drawings, or approved equal.
- F. Trench Plugs:
1. Trench plugs shall be concrete filled sacks, Bentonite Clay or material having a "GC" soil rating per ASTM D2487 and shall have a coefficient of permeability no greater than 0.001 cm/sec per ASTM D2434.
 2. If excavated material is to be used the Contractor shall submit verification and test results from a qualified laboratory that the material meets the classification and permeability specification above.

PART 3 - EXECUTION

3.1 LINES AND GRADES:

- A. Lay pipes to lines and grades indicated.
1. The Engineer may make changes in lines, grades, and depths of utilities when changes are required for Project conditions
- B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION:

- A. Ensure sediment and erosion control measures are installed per the Drawings and Section 31 2500 prior to performing any disturbing activity.
- B. Complete site clearing operations per the Drawings and Section 31 1000.
- C. Contact local utility line information service not less than three working days before performing Work.
1. Request underground utilities to be located and marked within and surrounding construction areas.

- D. Identify required lines, levels, contours, and datum locations.
- E. All trees, telephone and power line poles along the line of the work must be protected, and at night a sufficient number of barricades and lights to prevent accidents shall be provided. Where pipelines are laid between the curb and the sidewalk or in other places where shrubbery and grass lawns are encountered, the Contractor shall carefully remove and replace the shrubbery and cut the grass sod in sections, laying it to the side and replacing it after the trench has been backfilled and allowed to settle.
- F. Unless otherwise indicated on the Drawings, protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- G. Maintain and protect above and below grade utilities indicated to remain.
- H. Establish temporary traffic control and detours when trenching is performed in public rights-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 SHEETING AND SHORING:

- A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- B. All sheeting and shoring shall furnished and placed in accordance with the requirements of OSHA Standards, Subpart P, Part 1926, of the Code of Federal Regulations.
- C. Design sheeting and shoring to be left in place as part of completed Work, cut off minimum of 6" above the top of pipe and 18 inches below finished grade.
- D. No sheeting installed closer than one (1) pipe diameter or 2 feet (whichever is greater) from the outside edge of the pipe shall be withdrawn if driven below mid-diameter of any pipe. Any sheeting beyond these limits which is withdrawn shall be done in a manner in which the sheeting slides smoothly out of position without any disturbance of adjacent bedding. The remaining hole shall immediately be filled by hand with sand.
- E. If trench sloping is substituted for shoring, the slope shall be in accordance with all OSHA requirements. Sloping of the pipe trench shall only be allowed at depths of 10 feet or less below existing grade. The sloping of the trench wall shall terminate twelve inches above the top of the pipe and, from that point to the trench bottom, the trench wall shall be vertical.
- F. All excavations deeper than 10 feet below grade shall have appropriate excavation support systems from the bottom of the excavation to within a minimum of 10 feet from the top of the excavation.
- G. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing at no additional cost to the Owner.
- H. The Contractor may, at his option, use movable earth retaining devices (trench boxes) to stabilize excavations for pipes where these devices can be effectively used. Trench boxes shall not be considered as a substitute for sheeting systems specifically called out on the drawings. Trench boxes shall not be used for tunnel launch and exit shafts.

- I. Where movable earth retaining devices such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and backfill.
- J. Trench box systems shall be designed by a professional engineer registered in the State of Alabama. Design drawings and computations for non-commercial trench boxes shall be submitted to the Engineer for information prior to construction.

3.4 **DEWATERING:**

- A. The Contractor shall, at all times during construction, provide and maintain ample means and devices with which to promptly remove and properly dispose of all water entering the excavation or other parts of the work and shall keep said excavation and work dry until the structures to be built therein are completed, or until the Engineers direct the Contractor to discontinue dewatering operations. Wherever judged necessary by the Engineer, the Contractor shall employ well points to insure a dry excavation. No claims for an amount of money in excess of the bid price for the work will be entertained or allowed on account of the character of the ground in which the trench or other excavations are made.
- B. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the sub-grade soils at the proposed bottom of the excavation. Groundwater shall be lowered to at least 2 feet below the excavation level at all times.
- C. The Contractor shall provide for the disposal of the water removed from the excavation in such a manner as not to cause erosion, siltation, or turbidity increases in any water course; injury to public health; degradation or damage to private or public property, to any portion of the work completed or in progress, or to roads or streets; or cause any impediment to the reasonable use of the site by others.

3.5 **EXCAVATION & TRENCHING:**

- A. Underpin adjacent structures which may be damaged by excavation work.
- B. Trenches and excavations shall be open cut to proper depth and alignment for the installation of pipe, structures, and appurtenances as shown on the plans.
- C. The minimum trench width shall be at least the nominal pipe diameter plus 24 inches or as shown in the table below, whichever is greater:

Trench Width Table			
Pipe Diameter	Depth < 6'	6' < Depth < 12'	12' < Depth
3"	2.4'	4.4'	6.4'
4"	2.4'	4.4'	6.4'
6"	2.6'	4.6'	6.6'
8"	2.7'	4.7'	6.7'
10"	2.9'	4.9'	6.9'
12"	3.1'	5.1'	7.1'
14"	3.3'	5.3'	7.3'
16"	3.4'	5.4'	7.4'
18"	3.6'	5.6'	7.6'

20"	3.8'	5.8'	7.8'
24"	4.1'	6.1'	8.1'

- D. Remove lumped subsoil, boulders, and rock up of 6 feet in diameter.
- E. Slope banks with machine to angle of repose or less until shored.
- F. Grade top perimeter of excavations to prevent surface water from draining into excavation.
- G. Excavated material shall be stockpiled within the construction easement or other location(s) approved by the Engineer.
 - 1. The excavated material shall be piled on the side of the trench at least 4 feet (horizontally) extending away from the top of the excavated trench so that a clear walkway will be maintained at the edge. Excavated material shall be kept clear of the sidewalks except where unusual conditions prevent this being done. All driveways shall be backfilled as soon as the pipe is laid and no driveway shall remain inaccessible at the end of the day's work.
 - 2. Excavated material which has suitable characteristics for backfill shall be stockpiled in such a manner that it will not collect either surface water or rainwater. The stockpile top surface shall be sloped to drain away from the excavation site and graded smooth and compacted to drain rainwater rapidly. It shall be the Contractor's responsibility to control or adjust the moisture content of excavated materials to the requirements for common fill before such materials may be used for backfill at no additional cost to the Owner.
- H. Excess excavation shall be disposed of offsite by the Contractor. All handling, hauling, and disposal costs shall be considered incidental to the work. Disposal shall be in compliance with all applicable regulations. Excess excavation shall be as described below:
 - 1. All rocks, stumps, roots, and organic muck, clay, or silt lenses removed in the preparation of the excavation for common fill.
 - 2. Soils which cannot qualify as common fill after preparation such as muck soils, high organic soil, or non-granular soil high in silt and clay content.
 - 3. Excavated material remaining at the end of the work after all stockpiles, and prepared backfill has been utilized as needed.
- I. Do not advance open trench more than 60 feet ahead of the pipe laying unless prior approval is given by the Engineer
- J. Excavate trenches to the bottom elevation of the bedding for structures and pipes. The width shall be at least 2 feet beyond the neat lines of structure footings and as shown on the Drawings for sewer pipes. Over-excavation that is not directed in writing by the Engineer shall be backfilled with structural fill at no additional cost to the Owner.
- K. Do not interfere with 45-degree bearing splay of foundations.
- L. When subsurface materials at bottom of trench are loose or soft, excavate to; a depth of no more than 2 feet below the trench bottom, unless additional depth is authorized by Engineer, or until suitable material is encountered. Backfill with foundation conditioning material to the original trench bottom compacted to 95% maximum density.

- M. Underlay foundation conditioning material with geotextile overlapping each seam by a minimum 18 inches.

3.6 FOUNDATION, BEDDING AND EMBEDMENT:

- A. Foundation stone for structures and pipe shall be #57 or #67 stone placed to the minimum excavation widths as shown on the Drawings, and shall be at least 6 inches deep below the bottom of footings, base slabs, and to a depth as shown on the Drawings below the bottoms of pipe.
- B. Foundation stone shall be placed only on dry, stable, compacted subgrade or on rock.
- C. Loose earth in the sub-grade shall not be acceptable. Where required, sub-grade compaction shall be with a vibratory type mechanical compactor.
- D. Trim excavation. Hand trim for bell and spigot pipe joints.
- E. No foundation contamination with earth shall be allowed. Immediately remove any earth mat that falls into the foundation during placement or compaction.

3.7 TRENCH PLUGS:

- A. An impervious clay ditch check or trench plug shall be required on the downstream side of all stream crossings, on both sides of all wetland crossings, where shown on the Drawings or as directed by the Engineer.
- B. The trench plug shall be constructed for a length of 3 feet as measured along the centerlines of the pipe and the full width of the trench excavation from the trench bottom to 6 inches above the top of the pipe.

3.8 BACKFILLING:

- A. All trenches and excavations shall be backfilled immediately after the pipe has been laid and inspected. Backfill material shall be approved in all cases by the Engineer and shall be free of objectionable debris. Backfilling shall include the refilling and compacting the fills in the trenches or excavation to the existing ground surface or to the existing road subgrade.
- B. Following the laying of the pipe, the pipe shall be centered in the trench, adjusted to line and grade and the initial bedding material shall be carefully placed on both sides of the pipe so as not to disturb the alignment and grade of the pipeline. The bedding material shall be sliced under the haunches of the pipe and compacted to fill all voids.
- C. Backfill structures carefully, bringing the fill up evenly on all sides.
- D. Bedding material shall consist of #57 or #67 stone and extend from the foundation stone to 6-inches above the top of the pipe.
- E. Backfill material shall consist of crushed stone, structural, or common backfill depending upon location as detailed on the Drawings.

- F. Cut out soft areas of subgrade not capable of compaction in place. Backfill with common backfill and compact to density equal to or greater than requirements for subsequent backfill material.
- G. Maintain optimum moisture content of fill materials to attain required compaction density.
- H. Do not leave trench or excavation open at end of working day.

3.9 COMPACTION:

- A. Foundation and bedding stone shall be installed in maximum 6-inch lifts, as placed, and compacted with suitable compaction equipment to at least 85% of maximum dry density or as required by pipe manufacturers. Lift thickness shall be reduced to 4 inches in confined areas accessible only to hand-guided compaction equipment.
- B. Structural backfill shall be placed in maximum 6-inch level layers and compacted to at least 95% of maximum dry density as determined by ASTM D698, or as detailed in the geotechnical report.
- C. Common backfill shall be placed in maximum 12-inch layers and compacted to at least 85% of maximum dry density or as shown on the Drawings.
- D. Trench Plugs shall be placed in maximum 6 inch lifts and compacted to 95% density per ASTM D698.
- E. Compaction shall be by a vibratory-type mechanical compactor adjacent to structures and including between the pipe and trench sides, sheeting or trench box. Larger compaction equipment may be used as desired after backfill has reached at least two feet above the top of the pipe. For structures, the mechanical compactor shall be used between the structures and sheeting until the elevation at which sheeting is withdrawn, at which elevation the entire excavated area may be compacted with larger equipment if desired.

3.10 PROTECTION OF UTILITIES:

- A. The Contractor shall locate and protect all utilities which could be affected by the Work including but not limited to; overhead cables, poles, buried cables, duct banks, wastewater pipes, gas pipes, water pipes, and drainage pipes and appurtenances. Before working in any area the Contractor shall contact the local utility locating service to mark the locations of underground utilities. Any underground utilities that could interfere with the work shall be staked and flagged.
- B. Underground pipes and cables which cross the excavations shall be carefully exposed and temporarily supported by the Contractor to the satisfaction of the utility owner. The utility shall be carefully incorporated in the backfill with full support and protection. Length of utility support shall be based on actual field conditions.
- C. Utility relocation shall be discussed at a meeting with the Engineer and utility owner.

- D. Before operating any equipment near a buried or overhead electric cable, the contractor shall contact the owner of the cable to arrange for protection of the cable and the Contractor's personnel and equipment.
- E. At least 48 hours prior to operating any equipment near a buried gas pipe line, the Contractor shall contact the owner of the line and inform them of the work.
- F. Compliance with the conditions of the Owner of an electric or gas utility shall be considered a subsidiary obligation under the Contract.
- G. The Engineer shall be invited to attend all meetings between the Contractor and utility owner for information only.

3.11 FIELD QUALITY CONTROL:

- A. The Contractor will have compaction tests performed by the Engineer on the compacted backfill to verify compliance with these specifications.
- B. Perform laboratory material tests according to ASTM D698, or AASHTO T 99 Method A.
- C. Perform in place compaction tests according ASTM D2167 for density and ASTM D3017 for moisture content.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.
- E. Frequency of Tests:
 - 1. Trenches: One location every 500 feet.
 - 2. Structures (Manholes): Two locations around each manhole in separate lifts.
 - 3. Structures: At least two-density tests shall be made beneath each structure, or as directed by the Engineer.

3.12 MAINTENANCE:

- A. The Contractor shall maintain all project areas during the specified warranty period. Maintenance shall include the following:
 - 1. Immediately filling and reseeding any eroded areas.
 - 2. Reseeding any areas where a full stand of grass does not develop.
 - 3. Removal and replacement of any trees which die or show distress.
 - 4. Refilling and reseeding any backfilled areas which settle and develop depressions.

END OF SECTION TRENCHING

SECTION 31 2500**EROSION AND SEDIMENTATION CONTROLS****PART 1 - GENERAL****1.1 SUMMARY:**

- A. This Section covers the installation and maintenance of erosion control measures for the project.
- B. All necessary precautions to prevent erosion and siltation, as required by the Alabama Department of Environment Management (ADEM). Storm Water Best Management Practices shall be followed, including items specified herein, and other items as required by the Permit.
- C. The Contractor shall maintain all erosion control measures installed on a regular basis. The Contractor shall repair or replace damaged measures at the direction of the Engineer at no additional cost to the Owner.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related work specified elsewhere includes:
 - 1. Section 32 9219 – Seeding and Restoration
- C. Sedimentation and erosion control measures shall conform to the requirements of the most current edition of the following:
 - 1. Alabama NPDES Construction General Permit
 - 2. ADEM
 - 3. Alabama Department of Transportation Standard Specifications for Highway Construction (ALDOT), Current Edition.
 - 4. Alabama Handbook for Erosion Control, Sediment Control, and Storm Water Management on Construction Sites and Urban Areas
 - 5. City of Auburn Standard Details for Erosion Control
- D. An approved project BMP Plan hereby incorporated by reference has been developed for this project. The Contractor will receive a copy of the BMP Plan at the mandatory pre-construction meeting. The Contractor shall become the day to day operator of the BMP Plan and assume responsibility for the requirements of the BMP Plan including inspections and record keeping.

1.3 SUBMITTALS:

- A. The Contractor shall keep on-site an updated copy of the BMP Plan in accordance with NDPEs permit requirements.

1.4 QUALITY ASSURANCE:

- A. All NPDES permit required inspections shall be performed by the Owner's QCI certified inspector (Inspector).
- B. Any cost incurred by the Contractor for inspection due to delays in construction or overrun of the contract time shall be paid for by the Contractor and shall not be the responsibility of the Owner or Engineer.
- C. Contractor shall be responsible for compliance with the storm water permit, including the BMP Plan. Any fines incurred by the Owner stemming from the storm water permit shall be paid by the Contractor.

PART 2 - PRODUCTS**2.1 MATERIALS:**

- A. Furnish Stone and Aggregate materials per current ALDOT standards.
- B. Stone for Check Dam: Stone conforming to Division 800 of the current ALDOT Standard Specifications. Size range from 2-inches to 10-inches equally distributed.
- C. Stone for Rip Rap: Class 2 rip rap conforming to Section 814 of the current ALDOT Standard Specifications. Sizes ranging from 10 pounds to 200 pounds equally distributed.
- D. Aggregate for Construction Entrance: Coarse aggregate, with size range of 1.5-inches to 3.5-inches, conforming to Division 800 of the current ALDOT Standard Specifications.
- E. All rolled erosion control products (RECPs) including Temporary Erosion Control Blankets (ECB), and Turf Reinforcement Mat (TRM) shall meet the requirements of Section 860 of the current ALDOT Standard Specifications.
 - 1. Excelsior matting (ECB) shall be installed on all seeded drainage swales, ditches, slopes of 3:1 or steeper, or as directed by the Engineer.
 - a. Provide Curlex® III Long-Term Erosion Control Blanket as manufactured by American Excelsior Company or approved equivalent. The ECB shall provide seed and topsoil protection for up to 36 months.
- F. Non-Woven Geotextile Fabric underlaying construction entrances and rock ditch checks shall meet the requirements of the current ALDOT Standard Specifications.

2.2 SILT FENCE:

- A. The height of silt fence shall not exceed 36 inches (0.9 m). Storage height and ponding height shall never exceed 18 inches (0.5 m).
- B. The standard-strength filter fabric shall be stapled or wired to the fence, and 6 inches (0.2 m) of the fabric shall extend into the trench.

- C. When standard-strength filter fabric is used, a 4"x4" 12-x12-gauge steel wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy duty wire staples at least 1-inch (25.4 mm) long, tie wires or hog rings. The wire shall extend into the trench a minimum of 2-inches (51 mm) and shall not extend more than 36-inches (0.9 m) above the original ground surface.
- D. When extra-strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In such a case, the filter fabric is stapled or wired directly to the posts.

2.3 **INLET FILTER:**

- A. A filter shall be used at any storm water inlet during construction to filter runoff where soils have been disturbed.
- B. The filter shall be a weighted sediment tube filter with a diameter of 9.5-inches at the ends and tapering to 5 inches in the center. Lengths shall be 6 to 9 feet with a build-in triangular overflow for relief during high-intensity storm events.
- C. Unit Weight: 13 lbs/ft
- D. Interior Filter
 - 1. Materials: Shredded, recycled tire rubber particles with less than 2% metal and the rubber shall be washed during manufacturing.
 - 2. Particle Size: ½ inch to ¾ inch particle size
- E. The geotextile bag shall have
 - 1. Percent Open Area: 8%
 - 2. Apparent Opening Size: 30 U.S. Sieve
 - 3. Grab Tensile Strength: 400 lbs
 - 4. Flow Rate: 115 gal/min/ft²
 - 5. Puncture Strength: 125 lbs

2.4 **TURBIDITY CURTAINS:**

- A. Turbidity Curtains shall be placed at locations shown on the Drawings or as deemed necessary by the Engineer.
- B. Curtains shall be Type I DOT with 6" or 8" square foam filled floats. The fabric shall be 18 oz. PVC, as manufactured by GEI Works or approved equivalent.

2.5 **SEDIMENT TUBES:**

- A. Sediment tubes shall conform to the requirements of the current ALDOT specifications.
 - 1. Sediment tubes shall be composed of compacted geotextile, curled excelsior wood fiber, natural coconut fiber, hardwood mulch, growing media or a mixture of these materials enclosed by a flexible netting material and utilize an outer netting that consists of

- seamless high-density polyethylene, photodegradable material treated with ultraviolet stabilizers or a seamless, high-density polyethylene, non-degradable material.
2. Straw, straw fiber, straw bales, pine needles and/or leaf mulch shall not be used.
 3. Curled excelsior wood fiber or natural coconut fiber RECPs rolled up to create a sediment tube device shall not be used.
 4. Anchor posts shall be steel posts minimum of 48" long
 5. Sediment tube diameter shall be between 18" and 24". The mass per unit length shall be 3-lb/ft for 18" tubes and 4-lb/ft for 24" tubes with a 10% margin of error.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install all Erosion and Sediment Control BMPs in accordance with BMP Handbook, the project BMP Plan, and local requirements.
- B. Check Dam
 1. Determine length required for ditch or depression slope and excavate, backfill, and compact foundation area to firm, even surface.
 2. Install filter fabric prior to rock installation.
 3. Place Class B erosion control stone in an even distribution of rock pieces with minimum voids to the indicated shape, height, and slope.
- C. Temporary Construction Entrances
 1. Install construction entrances per the details shown on Drawings. Minimum thickness is 6 inches.
 2. Mound aggregate near intersection with public road to prevent site runoff entering road.
 3. Periodically dress entrances with 2-inch thick course aggregate when aggregate becomes clogged with soil.
- D. Silt and Turbidity Curtain
 1. Install per manufacturer's recommendations.
- E. Erosion Control Blanket
 1. Install per manufacturer's recommendations.
- F. Turf Reinforcement Mat
 1. Install per manufacturer's recommendations.
- G. Silt Fence
 1. The fence line shall follow the contour as closely as possible.

2. If possible, the filter fabric shall be cut from a continuous roll to avoid the use of joints. When joints are necessary, filter cloth shall be spliced only at a support post, with a minimum 6 inch (0.2 m) overlap and both ends securely fastened to the post.
3. Posts shall be spaced a maximum of 10 feet (3.1 m) apart and driven securely into the ground (minimum of 12 inches (0.3 m)). When extra-strength fabric is used without the wire support fence, post spacing shall not exceed 6 feet (1.8 m).
4. Turn the ends of the fence uphill.
5. A trench shall be excavated approximately 4 inches (101 mm) wide and 6 inches (0.2 m) deep along the line of posts and upslope from the barrier.
6. The trench shall be backfilled and the soil compacted over the toe of the filter fabric.
7. Silt fences placed at the toe of a slope shall be set at least 6 feet (1.8 m) from the toe in order to increase ponding volume.
8. Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized and any sediment stored behind the silt fence has been removed.
9. Silt fences and filter barriers shall be inspected weekly after each significant storm (1 inch (25.4 mm) in 24 hour). Any required repairs shall be made immediately.
10. Sediment should be removed when it reaches 1/3 height of the fence or 9 inches (0.3 m) maximum.
11. The removed sediment shall conform to the existing grade and be vegetated or otherwise stabilized.

3.2 CLEANING:

- A. When sediment accumulation in sedimentation structures has reached a point one-half depth of sediment structure or device, remove and dispose of sediment.
- B. Do not damage structure or device during cleaning operations.
- C. Do not permit sediment to erode into construction or site areas or natural waterways.
- D. Clean channels when depth of sediment reaches approximately one-half channel depth.

3.3 INSPECTION AND MAINTENANCE:

- A. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.
- B. It is the Contractor's responsibility to perform all required inspections in accordance with all Authorities having Jurisdiction.
- C. Contractor is responsible for continually maintaining all temporary erosion control measures until permanent measures are properly installed and performing as required.

3.4 TEMPORARY AND PERMANENT SEEDING:

- A. Apply temporary or permanent seeding to restrain erosion on all disturbed areas as soon as practical but in no case longer than 14 calendar days following temporary or permanent cessation of construction whether or not the area is being used for construction access.

3.5 REMOVAL AND FINAL CLEANUP:

- A. Soil and erosion measures are to be maintained and remain in place until the disturbed area is stabilized and inspected by the Owner.
- B. Once the Notice of Termination has been submitted by the Engineer, the Contractor shall remove and dispose offsite all erosion and sediment control device and other remaining items. Dispose of all silt and waste materials offsite in a proper manner. Complete final restoration activities.

END OF SECTION EROSION AND SEDIMENTATION CONTROLS

SECTION 32 9219 – SEEDING AND RESTORATION

PART 1 - GENERAL

1.1 SUMMARY:

- A. Work described in this section includes site restoration material and general installation.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related work specified elsewhere includes:
 - 1. Division 02 – 33 Sections

1.3 SUBMITTALS:

- A. Submit the following items in accordance with Section 01 3300 – Submittal Procedures
 - 1. Product Data for fertilizer and seeds.

PART 2 - PRODUCTS

2.1 TOPSOIL:

- A. This Contractor shall furnish topsoil in sufficient quantity, to complete grading and planting operations as specified.
- B. Characteristics of topsoil to be furnished:
 - 1. Fertile, friable, naturally occurring. Free of stones, clay, lumps, hardpan, roots, stumps, branches, sticks and other debris larger than two (2) inches in any dimension; free of noxious weeds, grasses, seeds, plants, extraneous matter and any substance harmful to plant growth.
 - 2. pH: 5.0 to 7.0
 - 3. Organic Matter: 5% to 10%
 - 4. Permeability Rate of 5 x 10 ⁻³ centimeters or greater at 85% compaction.
 - 5. Topsoil from project site may stockpiled and used if it meets the above criteria. Stockpiled topsoil must be protected from weather and construction traffic until it is placed.

2.2 SEEDING MIXES:

- A. All seed shall meet the requirements of these specifications and comply with applicable state law. The type of grass seed to be planted shall meet the approval of the Owner. Seed shall be delivered in sealed bags, properly labeled. Seeds of legumes shall be inoculated just before use with the appropriate culture. Seed mixtures shall be applied at the rate in pounds per acre and with the seasonal limitations shown in the Drawings.

2.3 FERTILIZER AND LIME:

- A. After ground preparation is complete, the area to be seeded shall have commercial fertilizer (800 lbs./acre: 13-13-13) and lime (1.5 ton/acre: dolomitic or calcitic lime) applied at the applicable rate.

2.4 HYDRO SEEDING:

- A. Hydro seeding may be used in areas deemed necessary by the Engineer. Under this method, spread the seed, fertilizer, and wood fiber mulch in the form of a slurry. Seeds of all sizes may be mixed together.

2.5 MULCHING:

- A. Areas with permanent grass seed and covered with slope mats or blankets will not require mulch.
- B. Mulching shall consist of covering areas that have been grassed or as otherwise specified with straw. Straw shall be threshed oats, pine, wheat, or rye, and shall be applied at the rate of 1-1/2 tons per acre. Mulch materials shall be free of seeds detrimental to the project.
- C. Mulch shall be free from leaves, twigs, insects, grasses, weeds, plants and their seeds, other foreign material and any substances harmful to plant growth.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

- A. Bring the planting area to final grade and install the necessary erosion control measures.
- B. Divert concentrated flows away from the seeded area.
- C. Conduct soil test to determine pH and nutrient content. Roughen the soil by harrowing, tracking, grooving or furrowing.
- D. Apply amendments as needed to adjust pH to 6.0-7.5. Incorporate these amendments into the soil.
- E. Prepare a 3-5 inch (76-127 mm) deep seedbed, with the top 3-4 inches (76-102 mm) consisting of topsoil.

- F. The seedbed should be firm but not compact. The top three inches of soil should be loose, moist and free of large clods and stones.
- G. The topsoil surface should be in reasonably close conformity to the lines, grades and cross sections shown on the grading plans.

3.2 SEEDING:

- A. Seed to soil contact is the key to good germination.
- B. Furnish, sow, establish and maintain an acceptable growth of specified grass over all disturbed areas not otherwise designated to receive planting, mulch or sod.
- C. Sowing seed shall, in general, follow promptly after incorporation of fertilizer in a uniform manner.
- D. Sowing shall be done by approved mechanical seeders. Without prejudice to power equipment or seeders of other types and makes, hand operated cyclone sowers, in sufficient number, will be considered mechanical seeders. No sowing shall be done during windy weather, or when the prepared surface is crusted, or when the ground is frozen, wet or otherwise in a non-tillable condition.
- E. Immediately after sowing, the seeded area shall be harrowed, dragged, raked, or otherwise worked so as to cover the seed with a layer of soil one and one fourth inches (1-1/4") thick. After seed is properly covered, the seeded area shall be compacted immediately by means of a cultipacker, light roller, or approved drag.
- F. Care shall be exercised during covering operations to preserve the line, grade and cross-section of the seeded areas and to see that areas adjacent to pavement, curbs, etc., are not left higher than the paved surface.
- G. The Contractor shall water, fill washes, and otherwise protect and maintain the seeded areas until the contract is accepted. It shall be the responsibility of the Contractor to establish and maintain a satisfactory stand of grass, a satisfactory stand being defined as a complete cover of living grass (limited to species expected to germinate in the current season).
- H. Should the site be ready for seeding during a season when, in the opinion of the Engineer, the specified grass will not form a satisfactory cover, establish a cover of Winter Rye and reseed specified grass at earliest time when acceptable growth can be established at no additional cost to the Owner.

3.3 HYDRO SEEDING:

- A. Apply hydro seeding as follows:
 - 1. Use wood fiber mulch as a metering agent and seed bed regardless of which mulching method is chosen. Apply wood fiber mulch with seed and fertilizer at a minimum coverage of 1,500 to 2,000 lbs/acre.
 - 2. Prepare the ground for hydro seeding the same as for conventional seeding.

3. Use specially designed equipment to mix and apply the slurry uniformly over the entire seeding area.
4. Agitate the slurry mixture during application.
5. Discharge slurry within one hour after being combined in the hydro seeder. Do not hydro seed when winds prevent an even application.
6. Closely follow the equipment manufacturer's directions unless the Engineer modifies the application methods.

3.4 MULCHING:

- A. Apply mulch to seeded areas at specified rate within 24 hours after the area has been seeded.
- B. Evenly apply straw or hay mulch between $\frac{3}{4}$ inch and $1\frac{1}{2}$ inch deep, according to the texture and moisture content of the mulch material.
- C. Mulch shall allow sunlight to penetrate and air to circulate as well as shade the ground, reduce erosion, and conserve soil moisture. If the type of mulch is not specified on the Plans or in the Specifications, use any of the following as specified.
 1. Mulch with Tackifier: Apply mulch with tackifier regardless of whether using ground or hydro seeding equipment for seeding.
 - a. Mulch uniformly applied manually or with special blower equipment designed for the purpose.
 - b. After distributing the mulch initially, redistribute it to bare or inadequately covered areas in clumps dense enough to prevent new grass from emerging (if required).
 - c. Do not apply mulch on windy days.
 - d. Apply enough tackifier to the mulch to hold it in place. Immediately replace mulch that blows away. If distributing the mulch by hand, immediately apply the tackifier uniformly over the mulched areas.
 2. Walked-in-Mulch: Apply walked-in-mulch on slopes ranging in steepness from 5:1 to 2:1 and treat as follows:
 - a. Immediately walk it into the soil with a cleated track dozer. Make dozer passes vertically up and down the slope.

3.5 INSPECTION AND MAINTENANCE:

- A. Newly seeded areas need to be inspected frequently to ensure the grass is growing.
 1. Repair damage caused by pedestrian and/or vehicular traffic, or other causes.
 2. If the seeded area is damaged due to runoff, additional stormwater measures may be needed.
- B. Satisfactory Stand
 1. The acceptance of areas designated to be seeded under this Section will be based on verification of a satisfactory stand of grass as determined by an on-site observation by the Engineer.

2. A satisfactory stand is defined as a cover of living grass of specified species, after true leaves are formed in which no gaps larger than five (5) inches square occur. Areas viewed by the Engineer to be solid rock will be exempt from this requirement.
 3. If a satisfactory stand is not established in any area, the area shall be reseeded until a satisfactory stand is established, without additional compensation.
- C. Spot seeding can be done on small areas to fill in bare spots where grass did not grow properly.

END OF SECTION 32 9219

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SECTION 33 1200 – WATER UTILITY DISTRIBUTION

PART 1 – GENERAL

1.1 SUMMARY:

A. This Section includes:

1. Pipes, valves, fittings and accessories for water distribution system.

1.2 RELATED DOCUMENTS:

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

B. Related work specified elsewhere includes:

1. Section 31 2000 – Excavation & Grading
2. Section 32 9219 – Seeding and Restoration

1.3 SUBMITTALS:

A. Contractor shall submit to the Engineer for approval:

1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
3. Manufacturer's certifications and laboratory test reports required.
4. Shop drawings, prepared in accordance with pertinent provisions of these specifications.
5. Product warranties

PART 2 – PRODUCTS

2.1 DUCTILE IRON PIPE:

- A. Ductile iron pipe shall be Pressure Class 350 unless otherwise noted in the Bid Proposal, and shall be manufactured and marked in accordance with AWWA C151. Unless otherwise noted in the Proposal, the pipe shall have single gasket push on joints manufactured in accordance with AWWA C111, an interior cement mortar lining manufactured in accordance with AWWA C104, and an exterior asphaltic coating of not less than 1 mil thickness. Flanged pipe shall conform to AWWA C115.

2.2 PVC PIPE:

- A. PVC pipe shall be supplied in 20 foot lengths unless otherwise specified and shall be furnished with integral bell and spigot push-on joints. Gaskets shall be locked in. The pipe and the coupling must both be manufactured by the same company. The pipe shall comply with ASTM D 1784 for PVC compounds, and ASTM D 3139 and ASTM F 477 for Joints using Flexible Elastomeric Seals. Potable Water Pipe shall also comply with NSF Standard 61 for Drinking Water systems Components – Health Effects.
- B. **PVC pipe shall be AWWA C900, DR18 CL 235 Pipe, BLUE in color**, unless otherwise specified.

ASTM D 2241 (IPS)	AWWA C900 (CIOD)	AWWA C905 (IPS/CIOD)
PR 160 psi – SDR 26	PC 165 psi – DR 25	PR 165 psi – DR 25
PR 200 psi – SDR 21	PC 235 psi – DR 18	PR 200 psi – DR 21
PR 250 psi – SDR 17	PC 250 psi – DR 17	PR 235 psi – DR 18
PR 315 psi – SDR 13.5	PC 305 psi – DR 14	PR 305 psi – DR 14
Pipe size 1/8” – 36”	Pipe size 4” – 12”	Pipe size 14” – 30”

- C. Marker wire shall be installed on all PVC, Fusible PVC and Polyethylene pipe and service tubing. The wire shall be 10 gauge THHN insulated solid copper, installed with electrically continuous joints. The marker wire shall be brought up into all valve and meter boxes so as to be readily accessible to water system operators. All wire splices and connections shall be made with an underground splice with resin, such as 3M Scotchcast Inline Splice Kits, or approved equal. **Marker wire shall be extended up into all valve boxes.**
- D. Blue Metallic Marker Tape shall be used for marking all new water main pipe installed by open cut. The Marker Tape shall have a minimum thickness of 5 mil, shall be marked “CAUTION WATER MAIN BURIED BELOW”, and shall be buried 1.0 to 1.5 feet above the crown of the carrier pipe. All costs associated with the Marker Tape shall be included in the total price bid.

2.3 HIGH DENSITY POLYETHYLENE PIPE:

- A. General: Materials used for the manufacturing of polyethylene pipe and fittings shall be 4710 High Density Polyethylene (HDPE) meeting the ASTM D3350 cell classification of 445474C.
- High Density Polyethylene Pipe (HDPE) and fittings will be used in accordance with the materials specifications. All additional appurtenances such as tees, gaskets, flange adaptors, etc. will meet the material specifications. The Contractor will supply the pipe and fittings and will include its price in the bid. All pipe installed by guided boring will be joined by an approved butt fusion or electrofusion technique according to the manufacturers specifications.
 - HDPE pipe shall be produced from resins with a material designation PE4710, and a cell classification PE445474C as specified within ASTM D3350, and dimensions and workmanship as specified by ASTM F714. It will also meet the requirements of AWWA ASTM D3350. Pipe will be legibly marked at intervals of no more than five feet with the manufacturer’s name, trademark, pipe size, HDPE cell classification, appropriate legend such as SDR 9, ASTM D3035, AWWA C901 or C906, date of manufacture and point of origin. Pipe not marked as indicated above will be rejected.

3. The material used in the production of potable water pipe shall be approved by the National Sanitation Foundation (NSF).
- B. Pipe Thickness: The material shall have a minimum Hydrostatic Design Basis (HDB) of 1600 psi at 73°F when tested in accordance with PPI TR-3 and shall be listed in the name of the pipe and fitting manufacturer in PPI TR-4.

Polyethylene pipe shall be manufactured in accordance with AWWA C906 for sizes 4” through 54”.

Permanent identification of piping service shall be provided by co-extruding longitudinal blue stripes into the pipes outside surface. The striping material shall be the same material as the pipe material except for color.
- C. Joints: Butt fusion or Electrofusion welded in accordance with ASTM D3261.
- D. Marking: The net weight, pressure class or nominal thickness, sampling period and manufacturer shall be marked on each pipe.

2.4 FLEXIBLE JOINT PIPE:

- A. Flexible joint pipe shall be cast of 60-42-10 ductile iron and shall conform with ANSI A21.51 Class 8. The joint shall be of the ball and socket type with the sockets either cast or screwed on the pipe and may be either bolted or keyed. If of the bolted type, the bolts and nuts shall be made of either stainless steel or low alloy steel conforming to ANSI 21.11.
- B. The joint shall be capable of a full 15° free turning deflection with no reduction in the flow.

2.5 RESTRAINED JOINTS:

- A. Where restrained joint pipe is required, the pipe shall be single gasket push-on joints as required in Paragraph 1.1 of this section. The joints shall be restrained using a “Gripper” style gasket. All restrained joints shall be suitable for a 350 psig working pressure.
- B. Restrained joints gaskets shall be US Pipe Field Lok 350®, American Fast-Grip®, or other pre-approved equivalent. Mechanical joints with Megalug 2000PV assemblies, or pre-approved equivalent, will also be approved where restrained joint fittings are required.

2.6 CASING PIPE:

- A. Where water mains are to be installed under railroad tracks, etc. and in some cases where they are to be installed under paved highways, they shall be laid inside a casing pipe of the size shown on the plans and listed in the Bid Proposal. As a general rule, the locations and approximate lengths of the encasements are indicated on the plans for the information of bidders, but the precise location, length of the encasement will be specified in the permit issued by the Railroad or Highway Department involved.
- B. The casing pipe shall be new and made of steel in accordance with API 5L standard weight line pipe and be provided with continuous welded joints. The casing pipe shall be jacked through a hole of the proper size that has been previously bored for the purpose, or be installed by excavating and installing liner plates as the hole is advanced. It may also be installed by the continuous boring and jacking method.

- C. The wall thickness of the steel casing pipe shall be 0.25" for all sizes 24" and smaller, 0.375 for sizes 26" through 36" and shall conform to ALDOT Section 862 for larger diameter.
- D. The casing pipe shall be complete with stainless steel spacers behind each pipe bell and at 10 foot intervals inside the casing pipe. Spacers shall be provided with ribbed EPDM/PVC/PE lining with a minimum thickness of 0.1" and shall prevent electrical contact between the carrier pipe and the metal spacer.
- E. The ends of each casing pipe shall be sealed with a flexible synthetic rubber seal, PSI Model S or approved equivalent.

2.7 FITTINGS:

- A. Ductile iron fittings with mechanical joint retainer glands shall be provided. Ductile iron fittings 12" and smaller shall be rated for 250 psi working pressure, and fittings larger than 12" shall be rated for 150 psi working pressure. Fittings shall be manufactured in accordance with AWWA C153 and provided with mechanical joints. All fittings shall be provided with a thin cement lining in accordance with AWWA C104.
- B. All mechanical joint retainer glands shall be MEGALUG 2000PV as manufactured by Ebaa Iron, Inc.
- C. All fittings shall be wrapped in 6 mil polyethylene encasement extending 6" beyond connection in accordance with AWWA C105.
- D. Thrust restraints shall be 2500 psi concrete poured in place against undisturbed soil unless otherwise approved by the Engineer. In addition to restrained joints and thrust blocks, all fittings shall have a vertical piece of 4" diameter galvanized pipe driven 4ft into the ground behind the fitting for extra support.

2.8 VALVES:

- A. All valves shall be furnished with a valve box and shall be furnished with a concrete collar in accordance with Paragraph 9. The Owner shall also be furnished with one (1) adjustable valve wrench for every five (5) valves installed.
- B. Valves for use with ductile iron pipe shall have mechanical joint end connections unless otherwise shown. Valves used with PVC pipe shall be equipped with end connections and transition gaskets especially made for this type of pipe.
- C. Gate valves shall be iron body, brass mounted, epoxy coated interior and exterior, and be of the resilient seat type. Gate valves shall have a non-rising stem, "O ring" stem seal, a 2" square operating nut and shall open by turning counterclockwise. Gate valves thru 12" diameter shall be manufactured in accordance with AWWA C509. Gate valves 12" and smaller shall be suitable for a working pressure of 200 psig and shall be tested to 400 psig.
- D. Gate valves larger than 12" diameter shall conform to AWWA C500 and C504. Gate valves larger than 12" shall be suitable for a working pressure of 150 psig and shall be tested to 300 psig.

- E. Butterfly valves shall be manufactured and tested in accordance with AWWA C504, Class 150 B. Butterfly valves shall be provided with operators suitable for underground service that meet all AWWA standards.
- F. Where the contract involves extensions to an existing system the Contractor shall verify the direction of opening of existing valves and if this is opposite to the direction specified herein he shall confer with the Owner and the Engineer regarding the direction of opening to be provided on the valves furnished under this contract.
- G. Tapping valves and sleeves may be of the mechanical joint or hub end type, Mueller H-615 and H-667, or pre-approved equivalent. Tapping valves shall be non-rising stem. Working pressure for 2"-12" valves shall be 200 psi with 400 psi test pressure. For valves greater than 12", the working pressure shall be 150 psi with test pressure of 300 psi. Valves and sleeves shall be cast tapping SCV's and valves shall be air tested for duration of 5 minute and 50 PSI.

H. Valves shall be manufactured by Mueller.

- I. Air Release Valves (ARV) shall be 1" ball type valves to be field located at high points in the water main. The valve shall operate through a compound lever system and shall have a 5/64" orifice with valve sealing faces of an adjustable BUNA-N rubber valve and stainless steel or PVC and shall operate at 150 psig. The valve shall be 1" NPT screwed of ANSI Class (125,250) flanged inlet connection and shall be cast iron body, top and inlet flange (where required), stainless steel float and trim. Valves which use a needle valve to seal the orifice will not be acceptable. The valve shall be CRISPIN Model AR10, Pressure Air Valve, Type N (PVC seat and BUNA-N rubber valve), APCO Model 50, or approved equivalent.

2.9 VALVE BOXES:

- A. Valve boxes shall be made of cast iron and be of the two (2) piece adjustable heavy roadway type. They shall have an inside diameter not less than 5 1/4" and be of the screwed type. They shall be provided with a cast iron cover on which the word "WATER" is embossed and shall be suitable for installation on mains laid at the depths specified elsewhere in these specifications.
- B. Valve boxes shall be set vertically over the valve and centered about the operating nut. The cover shall be flush with the street or ground surface unless otherwise directed by the Engineer. Backfill shall be carefully tamped around the box to prevent it from being moved out of position. The bottom flared edge of the box shall not rest directly on the valves or pipe. A concrete block shall be installed under the box. Where the standard depth valve box is not high enough to make the cover flush with the ground surface the Contractor shall provide and install, without additional compensation, valve box riser sections of the required length to achieve this result.
- C. After the valve box has been set correctly, a square or round concrete collar shall be poured around the top of the valve box. The concrete shall be neatly formed to 18" square or diameter, poured 4" thick with the surface finished parallel to the surrounding ground surfaces. The concrete shall be Class C 2500 pound mix.

2.10 FIRE HYDRANTS:

- A. Fire hydrants shall be manufactured in accordance with AWWA C502. The main valve shall open against the water pressure and all operating threads shall be isolated from the water. **Hydrants shall be Mueller Super Centurion (A423), and shipped Red in color.**
- B. Hydrants shall have a main valve opening of not less than 5-1/4", two 2-1/2" hose connections and one 4-1/2" pumper connection. Hydrants shall be provided with a permanent lubricating device and "O-ring" packing seals. Hydrants shall open by turning counterclockwise. Operating nuts shall be of the National Standard pentagon type, 1-1/2" point to flat. Hydrants shall be provided with a 6" mechanical joint shoe and shall be equipped with a retainer gland follower.
- C. Fire hydrants shall be sized to connect with pipelines laid with a minimum cover of 36". In cases where the standard length of hydrant is not sufficient to leave a distance of at least 18" between the ground surface and the bottom of the lowest connection, the Contractor shall provide and install an extension section of the proper length.
- D. Hose and pumper connections shall be furnished with Underwriters National Standard threads in the case of hydrants to be installed in new systems. Hydrants furnished for extensions to existing systems shall be furnished with threading similar to the existing hydrants except in cases where an effort at standardization of the use of National Standard threading is being made. In these cases, the Contractor and his material supplier are required to investigate the existing conditions and to furnish hydrants equipped with the direction of opening and the type of threads desired by the Owner. Where the contract covers a new water works system, two operating wrenches and a main valve assembly wrench shall be furnished with the hydrants. These items shall be delivered to the Owner.
- E. Hydrants shall be set perfectly plumb on the precast slab, using a spirit level on two sides of the barrel. The gravel shall be placed around the base to permit drainage from the waste opening.
- F. Fire hydrants shall be factory painted in the color **(Red)** chosen by the Owner.

2.11 BLOW-OFF HYDRANTS:

- A. Blow-off Hydrants shall be Dry Barrel Type Hydrants. The Main valve shall be open against water pressure and all operating threads shall be isolated from the water. Post Type Hydrants shall be M&H Style 33 or an approved equal and Flush Type Hydrants shall be Eclipse #85 or an approved equal.
- B. Blow-off Hydrants shall have a main valve opening of not less than 2-1/4", with one 2-1/2" hose connection. Hydrants shall be provided with a permanent lubricating device and "O-ring" packing seals. Hydrants shall open by turning counterclockwise. Operating nuts shall be of the National Standard pentagon type, 1-1/2" point to flat. Hydrants shall be provided with a 3" mechanical joint shoe and shall be equipped with a retainer gland follower.
- C. Blow-off Hydrants shall be sized to connect with pipelines laid with a minimum cover of 36". In cases where the standard length of Post Type Hydrant is not sufficient to leave a distance of at least 16" between the ground surface and the bottom of the lowest connection, the Contractor shall provide and install an extension section of the proper length. Flush Type

Hydrants shall be furnished with a high strength cast iron box and cover. The location of the Flush Type Hydrants shall be marked with a water valve marker.

- D. Hose connections shall be furnished with Underwriters National Standard threads in the case of hydrants to be installed in new systems. Hydrants furnished for extensions to existing systems shall be furnished with threading similar to the existing hydrants except in cases where an effort at standardization of the use of National Standard threading is being made. In these cases, the Contractor and his material supplier are required to investigate the existing conditions and to furnish hydrants equipped with the direction of opening and the type of threads desired by the Owner.
- E. The hydrant lead to post type hydrants shall be made with ductile iron pipe extending from the cast iron anchoring tee installed in the main to the hydrant shoe regardless of the type of pipe used in the construction of the main to which the hydrant is connected.
- F. Mechanical joint shoe on flush type hydrants shall be connected to one section of ductile iron pipe regardless of the type of pipe used in construction of the main to which the hydrant is connected.
- G. Hydrants shall be perfectly plumb on the precast slab, using a spirit level on two sides of the barrel. Gravel shall be placed around the base to permit drainage from the waste opening.

2.12 SERVICE CONNECTIONS:

- A. Corporation stops shall be 3/4" size unless otherwise noted and shall comply with AWWA C800-66, Ford, Mueller, or approved equal. Corporation stops shall be compatible with type of service pipe specified.
- B. Curb stops shall be 3/4" size unless otherwise noted and shall comply with AWWA C800, Ford B-43-232W complete with lock out wing, or other approved equal. A full 3/4" opening curb stop shall be provided.
- C. Service clamps shall be used when connecting to PVC mains, "Mueller Bronze Service Clamp" or approved equal, especially designed for use on PVC pipe and provided with a corporation cock thread.
- D. Meters shall conform to AWWA C700-90, shall be a first line meter and shall have an hermetically sealed and magnetically driven register. All meters shall be manufactured and assembled in the United States, shall be provided with all bronze case, and shall be of the positive displacement type. Each meter shall be provided with a leak detector separate from the sweep hand, and shall be calibrated in gallons unless otherwise noted in the Special Specifications.
- E. Meters shall be Neptune T-10 or Sensus SR, both with ALL BRONZE cases unless otherwise specified in the Special Specifications.
- F. Backflow preventors shall be 3/4" Ford Model HHS-31-323, Watts No. 7 dual check valve, rated for 150 psig, or other approved equal, as required by the latest ADEM regulations.

- G. Meter boxes shall be approximately 12" x 17" x 12" deep, rectangular in shape, complete with plastic top and metal hinged reading lid. The plastic shall be of the fiber reinforced polyolefin type. The box and cover shall be Carson Brooks, or approved equal.
- H. Water meters shall be located as specified by the Owner.
- I. Service pipe used in making service connections and service transfers will be paid for separately on a unit price basis and is not included in the price of the service connection assembly or the unit price for a service transfer.
- J. When the service pipe is connected to ductile iron pipe 3" and larger, the connection at the main shall consist of a 3/4" tap in the main and a corporation cock. When connected to mains smaller than 3", the connection at the main shall consist of a 3/4" hole drilled in the main, a single strap service clamp and a corporation cock.
- K. Where taps larger than 1" diameter are to be installed on ductile iron pipe, a split tapping sleeve or tapping saddle shall be provided and a disc shall be cut from the pipe wall by a special tapping machine.
- L. When copper or plastic service tubing is used, it may be connected directly to the corporation cock.
- M. The tap or drilled hole in the main shall be made at an angle of not more than 30 degrees to the horizontal in order to keep service pipe adjacent to the main at the required depth.
- N. The curb stop shall be installed inside the meter box immediately adjacent to the inlet side of the meter and under general conditions the box shall be set with the top flush with the ground surface.
- O. Where service taps are installed on ductile iron pipe, the price bid shall include wrapping the brass corporation stop and not less than three feet of connected copper service tubing with two wraps of Tapecoat dielectric insulating tape to prevent corrosion.
- P. When the furnishing of a meter larger than 1" is called for in the Proposal, the price bid shall include a cutoff valve with handwheel of the same size as the meter inlet, and a meter box, Carson Brooks, or equal. The box shall be 15" by 20" and equipped with a rectangular hinged reading lid set in the cover.

2.13 SERVICE PIPE:

- A. The types of service pipe to be used are specified in the Proposal.
- B. Copper tubing shall conform to Federal Specifications WW-T-799, Type K. Unless otherwise noted in the Proposal, service pipe shall be 3/4" in diameter. The cost of fittings shall be included in the price of the pipe.
- C. Plastic service pipe in 3/4" through 2" shall be high density (HDPE) polyethylene SDR 9 Copper Tubing Size suitable for maximum 200 psig working pressure, Charter Plastics 'Blue Ice' or approved equivalent. HDPE tubing shall comply with all applicable requirements of ASTM standards D-1248, D-2239, D-2737, D-3350, AWWA C-901, and shall be extruded from compounds of the Type III Grade PE 34, Class C, PE 3408 very high molecular weight

polyethylene plastic material as specified in ASTM D-1248, cell classification 355434C as per ASTM D-3350, and marked in accordance with ASTM D-2737, and shall also be sealed by NSF. Inserts shall be used at all fittings.

- D. Service pipe shall be laid with a cover not less than 24", and the requirements for trenching and backfilling shall be the same as specified for mains. Where the service pipe crosses a paved street or sidewalk it shall be laid by means of pushing or boring. The cutting of pavements or sidewalks will not be permitted. The requirement for a cover of 24" over the pipe shall be maintained under side ditches and at the high point of the curve in the pipe where it connects to the main. On Highway rights-of-way the minimum cover shall be as specified by the Highway Department but in no case less than 30".

2.14 VALVE & PIPELINE MARKERS:

- A. The location of water main pipe and valves shall be marked with concrete marker posts. The marker posts shall be 4" square concrete set to stand approximately 40" above ground. The markers shall be inscribed "WATER VALVE" or "WATER LINE" as appropriate, and include an aluminum disc on top for stamping the distance to the valve (line). Markers shall be installed for all type valves including isolation valves, air release valves, electric control valves, etc. Markers shall also be set at all locations where pipeline crosses streets and highways.

2.15 FLANGES:

- A. Flanges shall conform to the dimensions shown in Table 10.14 of AWWA C110, and shall be adequate for a working pressure of 250 pounds. The bolt circle and bolt holes of these flanges shall match those of the Class 125 flanges shown in ANSI B161. Gaskets shall be of 1/8" thick rubber. Machine bolts shall be of high strength steel and shall have hexagon heads and nuts.

2.16 CONSTRUCTION EQUIPMENT:

- A. The Contractor shall be responsible for any damage done to paved surfaces or lawns, whether at the site of the work or when moving the equipment from one place to another.

2.17 SAFETY PRECAUTIONS:

- A. During the prosecution of this contract the Contractor shall at all time employ all necessary safety precautions to ensure the complete protection of both lives and property of his own forces as well as those of the general public. Flagmen shall be placed along public streets and highways as work is being installed along them and the necessary warning barricades and blinking lights shall be set out each night to clearly mark the areas under construction.
- B. All ditches shall be shored and braced where necessary and the excavated material shall be kept a safe distance away from the ditch. Safety precautions instituted along State Highway rights-of-way shall conform to the requirements of the State Highway Department at all times and such additional flagmen or other precautions as may be deemed necessary will also be provided by the Contractor.

- C. The Contractor, and he alone, shall be solely responsible for the adoption of all necessary safety standards and precautions, and for the implementation institution, maintenance, supervision of and payment for all devices and arrangements required to carry out the requirements of such standards. He shall hold and save harmless the Owner, the Engineer, or any employees thereof against all actions or suits filed in connection with any accidents or damage to property caused by inadequate or insufficient safety precautions being placed in effect by him to ensure the complete safety of all construction, inspection or supervisory forces employed around the project, or of the general public.

2.18 PERMITS AND BONDS:

- A. In the event of the Department of Transportation requires a bond or certified check to guarantee the replacement of highway paving the Contractor shall furnish this security at his own expense.

2.19 MILL CERTIFICATES:

- A. When required by the Owner, mill certificates showing the results of hydrostatic pressure tests made on all types of pipe as required by the manufacturer's specifications shall be furnished.

PART 3 - EXECUTION

3.1 EXCAVATION AND TRENCHING:

- A. All excavation and trenching shall be bid on an unclassified basis.
- B. Trenches for the mains shall be excavated in the locations indicated on the plans or as directed by the Engineer. All trees, telephone and power line poles along the line of the work must be protected, and at night a sufficient number of barricades and lights to prevent accidents shall be provided. Where mains are laid between the curb and sidewalk or in other places where shrubbery and grass lawns are encountered the Contractor shall carefully remove and replace the shrubbery and cut the grass sod in sections, laying it to the side and replacing it after the compacted trench has been backfilled.
- C. In general, the excavated material shall be kept clear of the sidewalks except where unusual conditions prevent this being done. Unless otherwise approved by the Engineer, all pipe shall be installed under driveways by boring and jacking, but where the driveway is cut it shall be backfilled as soon as the pipe is laid. No driveway shall remain inaccessible at the end of the day's work and all street crossings shall be backfilled and opened to traffic before work is stopped for the night.
- D. On paved streets, wherever possible, the mains will be located between the curb and the sidewalk, and in all cases the mains will be located so as to keep cutting and replacing pavement to a minimum.
- E. The width of the trenches shall be in accordance with the manufacturer's recommended installation procedures. The depth of the trenches shall be such that all pipe will have a cover of at least 36". When underground obstructions occur on other than State or County highway

rights-of-way, the Contractor will be permitted to lay ductile iron pipe over the obstruction if a minimum cover of 24" over the top of the pipe may be obtained after providing a cushion at least 3" thick between the bottom of the pipe and the top of the obstruction. Where this minimum cover cannot be obtained the pipe shall be laid under the obstruction without additional compensation.

- F. Unless approved by the Engineer, all trenches shall be closed at the end of the work day.
- G. All signs shall be re-erected in a manner satisfactory to the Engineer at the end of each work day. Signs shall be permanently re-installed back to the original condition at the end of the project.
- H. All travelways shall be kept clean of mud, dust, dirt, or other debris. This requires a daily cleaning of travelways to the extent that dust is not a nuisance and roadways do not become hazardous. The amount of cleaning required is strictly left to the direction of the Engineer. No additional compensation shall be allowed for any cleaning required.

3.2 INSTALLING PIPE:

- A. All pipe shall be laid in accordance with procedures outlined by the Ductile Iron Pipe Research Association or Uni-Bell PVC Pipe Association. A copy of these procedures shall be kept by the Contractor on the job site at all times that pipe laying operations are occurring.
- B. Before the pipe is lowered into place, the bottom of the trench shall be uniformly graded so that the pipe will have a bearing on earth for its full length. Where the excavation is in rock or other hard material, sufficient loose earth shall be shoveled into the trench to form a bed for the pipe. Each section of pipe shall be carefully examined for defects and the inside cleaned with a swab to remove all dirt and mud before it is installed.
- C. At each joint shall be excavated a hole sufficient large to receive the bell or coupling so that the pipe barrel will rest uniformly in its bed of loose earth. Where pipe equipped with joints of the push on type utilizing a rubber ring is used, the bell shall be wiped clean before the ring is fitted in position, following which the spigot shall be coated with a thin film of lubricant, if so required by the manufacturer, and then pushed home.
- D. On iron pipe equipped with mechanical type joints, before the section of pipe is pushed home the bell into which it fits shall be wiped clean, the end of the pipe being placed shall be wiped with a soapy water solution and the cast iron gland and rubber ring slipped on. After the section of pipe is in its final position, the rubber ring and gland shall be slid up to the joint, bolts inserted and the nuts tightened uniformly so that the bolts, particularly on the underside, shall be provided. In the case of pipe smaller than 4" in diameter being laid in a wet or muddy ditch bottom, the Contractor will be permitted to joint not more than 100 feet together on the ditch bank provided that the pipe is then carefully lowered into position with one man at each joint to preserve the alignment.
- E. Where pipe laying is suspended at the lunch hour, at night, during inclement weather or at any other time, the open end of the pipeline shall be provided with a plug in order to prevent the entrance of dirt, mud and animals.
- F. All fittings installed in the mains and the ends of all dead end lines shall be restrained by pouring a concrete block as shown on the drawings at the point where it will resist the

pressure. Thrust blocks will be sized in accordance with the Uni-Bell Handbook of PVC Pipe: Design & Construction, or Thrust Restraint Design for DUCTILE IRON PIPE published by Ductile Iron Pipe Research Association.

3.3 INSTALLING APPURTENANCES:

- A. Valves, fittings, hydrants and other appurtenances shall be placed in the locations shown on the plans or in the manner designated by the Engineer. Any omission of these appurtenances shall be corrected by the Contractor without additional cost to the Owner. All valves and hydrants shall be carefully examined to see that the working parts are in good order and that no grit or dirt is present in the valve seats before they are placed in position.
- B. Over each valve less than 16" in size shall be placed a valve box, and over valves 16" and larger shall be provided a valve box both for the main valve and the bypass valve. Valve boxes shall be set concentrically around the valve operating nut and the top of the box shall be level with the ground surface.

3.4 GRAVEL ROADS:

- A. Surfaces of all gravel roads where water lines are laid shall be brought back to their original condition. If necessary, additional base material as specified by the Alabama Department of Transportation shall be spread, smoothed and compacted to the satisfaction of the Engineer.

3.5 SERVICE TRANSFERS:

- A. Where an item for service transfer is provided in the Proposal, the Contractor will be required to disconnect the service pipe from the existing main, make a tap in the new main, insert a corporation cock, install sufficient service pipe to reach the existing, new or relocated meter and make the connection. The unit price bid shall include all labor, material and equipment needed with the exception of the service pipe which will be paid for as a separate item.

3.6 SURFACE OBSTRUCTIONS:

- A. Each building, wall, fence, pole, bridge, railroad, driveway or other property or improvement encountered is to be carefully protected from all injury, and in the event that any of the foregoing are damaged or removed during the progress of the work the same shall be repaired or replaced within a reasonable time, and before final acceptance of the work shall be returned to as good condition as before the work started. Special care must be exercised in trenching under or near railroads in order to avoid or minimize delays and the danger of injury resulting therefrom, and the Contractor must use care in all phases of the construction work, for he will be held liable for damages caused by carelessness.

3.7 SUBSURFACE OBSTRUCTIONS:

- A. In excavating, backfilling and laying pipe care must be taken not to remove, disturb or injure any water or sewer pipes or other conduits or structures. If necessary, the Contractor, at his own expense, shall sling, shore up and maintain such structures in operation. Before final acceptance of the work, he shall return all such structures to as good condition as before the work started.

- B. When necessary, the Contractor shall give sufficient notice to the interested utility of his intention to remove or disturb any pipes, conduits, etc., and shall abide by their regulations governing such work. In the event that any subsurface structure becomes broken or damaged in the prosecution of the work, the Contractor shall immediately notify the proper authorities, and shall be responsible for all damage to persons or property caused by such breaks. Failure of the Contractor to promptly notify the affected authorities shall make him liable for any needless loss or for interference with the normal operation of the utility.
- C. When pipes or conduits are broken during the progress of the work, the Contractor shall repair them at once at his own expense, or if required by the utility involved, shall pay the utility the proper charges for having such repairs made by the utility's own forces. Delays, such as would result in buildings being without service overnight or for a needlessly long period during the day, will not be tolerated, and the Owner reserves the right to make repairs at the contractor's expense without prior notice. Should it become necessary to move the position of pipe, conduit or structure it will be done by the Contractor in strict accordance with the instructions given by the Engineer or utility involved.
- D. The Owner or the Engineer will not be liable for any claim made by the Contractor based on underground obstructions being different to that indicated in these contract documents or plans. Where ordered by the Engineer, the Contractor shall uncover subsurface obstructions in advance of construction so that the method of avoiding them may be determined before pipe laying reaches the obstruction. Furthermore, the Contractor shall notify all utility companies involved of his intention to excavate in the locations specified and request that any underground cables be located in advance of construction work.

3.8 DEWATERING:

- A. The Contractor shall, at all times during construction, provide and maintain ample means and devices with which to promptly remove and properly dispose of all water entering the excavation or other parts of the work and shall keep said excavation and work dry until the structures to be built therein are completed, or until the Engineers direct the Contractor to discontinue de-watering operations. Wherever judged necessary by the Engineer, the Contractor shall employ well points to insure a dry excavation. No claims for an amount of money in excess of the bid price for the work will be entertained or allowed on account of the character of the ground in which the trench or other excavations are made.
- B. The trench shall be so drained that workmen can work safely and efficiently therein. The Contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property owners. It is essential that the discharge from trench pumps be led to natural drainage channels.

3.9 ROCK EXCAVATION:

- A. Rock is defined as hard material which cannot be removed by conventional excavating equipment, including a tracked excavator.
- B. Where rock is encountered in trenches, the excavation shall be carried to a depth of 6-inches below the barrel of the pipe; and the excavation shall be backfilled with approved firmly compacted bedding material. In no case shall any rock be left nearer than 6-inches from the outside of the pipe.

- C. Where rock is encountered the Contractor shall "mattress" the trench during blasting operations and shall use all precautions necessary to protect adjacent property against damage resulting from his operations. Rock excavation in proximity to other pipes or structures shall be conducted with the utmost care to prevent damage to the existing structures, and any such damage caused shall be promptly repaired by the Contractor at his expense. Blasting operations shall not be conducted within 24-feet of installed pipe; and rock excavation shall be completed at least 24-feet ahead of pipe laying.
- D. The Contractor shall be fully responsible for the protection of lines and property from any harm or damage as would result from exposure to the construction work. The Contractor shall, in all his acts and work, comply with the safety and health regulations referred to hereinabove and with all local ordinances and regulations pertaining to the work. The area of the work shall be isolated by warning signs and barricades; guards shall be stationed to prevent entry into the area; and efficient and adequate signal system shall be employed to give warning before blasting; and it shall be the responsibility of the Contractor to determine that the area is clear before the signal to fire is given. The handling, storing, loading, and firing of explosives shall be performed only by workmen experienced in blasting work. The Contractor hereby agrees to indemnify and save harmless the Owner and the Engineer against all claims, damages, and expense arising from or caused by, in any manner whatsoever, the handling, storage, or use of explosives on the work, or by any blasting on the work.
- E. No extra payment will be made for removal of rock and other hard material will be made, and all costs for this type of work shall be included in the amounts bid in the Bid Form. The Contractor is required to inspect the area to his satisfaction prior to turning in a Bid.

3.10 BLASTING:

- A. The Contractor or his insurer shall perform pre-blast surveys of all structures within 500 feet of the blasting areas to document and photograph the pre-existing conditions. The cost of this work is incidental and no specific payment will be made.
- B. The Contractor shall employ the services of a registered engineer in the state of Alabama with a minimum of five years of experience in pipeline construction to design and approve all blasting procedures used in the removal of rock. All primary and secondary blasting shall be monitored by a registered blasting consultant to conduct daily blast noise, vibration and overpressure surveys during the progress of blasting operations. These surveys will be delivered to the Engineer daily. The cost of this work is incidental and no specific payment will be made.
- C. The limit for each charge will be set to limit the effects to air concussion or air blast of 0.03 psi maximum (140 dBL), particle velocities shall be a maximum of 1.00 inch/second measured from locations directed by the blasting consultant.
- D. The Contractor is reminded that he has sole and complete responsibility for the conditions on, in, or near the jobsite, including safety of all persons and property during performance of the work.
- E. The required duty of the engineer to conduct construction review of the contractor's performance does not, and is not intended to, include review of the adequacy of the contractor's safety measures in, on, or near the construction site.

- F. The observation of safety provisions of applicable laws and local building and construction codes shall be the responsibility of the Contractor. The blasting consultant shall be present and supervise all blasting design, loading and shot firing at all times.

3.11 PIPELINES UNDER PAVEMENT:

- A. Where mains are to be laid under paved streets or parking lots, and the installation of casing pipe or the use of cast iron pipe inserted in a bored hole is not required or specified, the Contractor will be permitted to cut and replace this pavement. In the event that subsurface operations result in injury or damage to the pavement, the necessary repairs shall be made by the Contractor at no additional cost to the Owner. In the event of the pavement on either side of the pipeline trench cracking or otherwise becoming disturbed or broken due to the Contractor's operations he shall repair or replace same at his own expense and without additional compensation.
- B. Paving replacement shall conform to the plans. No paving replacement shall be installed without first notifying the Owner at least eight hours in advance so his representative may be present while the work is performed.
- C. All backfill under areas where paving will be replaced shall be mechanically tamped to the following densities as defined by AASHTO T-99 Standard Proctor Density:
- | | |
|----------------------|--------|
| Backfill around pipe | - 95% |
| Remaining Subgrade | - 95% |
| Select Base Material | - 100% |
- D. In the price bid for paving replacement shall be included all costs related to a commercial testing laboratory approved by the engineer to perform all tests of materials, design job mixes, provide batching plant control, and perform tests and inspections of material producing and processing equipment as required by these specifications and in accordance with AHD Section 106.02. Two copies of the results of tests and inspections shall be submitted to the Engineer and the Owner in report form. The testing laboratory shall maintain an office within 100 miles of the construction site.

3.12 PIPELINES UNDER SIDEWALK:

- A. Where pipelines are to be laid underneath paved sidewalks, the Contractor will be required to install them by means of a boring machine, auger or other suitable apparatus wherever possible, and where it becomes necessary to cut and replace the sidewalk it shall be replaced as soon as practicable after the trench has been backfilled and tamped. The replaced surface shall be 12 inches wider than the width of the trench, the excess width being equally distributed on both sides.
- B. The Contractor will receive no additional compensation for laying pipe or fittings under sidewalks.

3.13 CONNECTIONS TO EXISTING MAINS:

- A. Where "cut in" connection is indicated on the plans or directed by the Engineer, the Contractor shall connect the new mains to, and install valves in, the existing mains. These connections will normally be made in the afternoon, but where required to do so the

Contractor shall be prepared to make them at night. Before any existing mains are cut the Contractor will work out a plan of procedure with the Owner's superintendent, so that all customers who will be without water during the process will be notified and the valves to be closed will be located and uncovered.

- B. The Contractor will not be permitted to cut the existing main until he has everything ready to make the connection. The Contractor shall be fully and properly equipped to do the work entirely with his own resources and under no conditions shall he place himself in the position of having to borrow any material, equipment or labor from the Owner. Failure to have everything in readiness to the satisfaction of the Owner may result in a postponement of the connection.
- C. Where indicated on the plans, tapping sleeve and valves shall be used to make the connection. Where used, the tapping sleeve and valve shall be subjected to an air pressure test of 240 psi for 29 minutes.

3.14 PRESSURE TESTING:

- A. Refer to Section 01 0300 – Special Project Provisions for testing requirements. If no requirements are given in Section 01 0300, then the requirements below shall apply.
- B. After the mains and appurtenances have been installed, they shall be subjected to a hydrostatic pressure test. The pressure shall be applied by a motor driven test pump and an accurate recording pressure gauge shall be provided at a suitable point on the main. The test shall be conducted at 150% of the working pressure or a minimum of 100 psi, whichever is greater, but no more than the pressure rating of the pipe. The test pressure shall be applied for not less than three hours on uncovered pipe and for not less than eight hours on covered pipe. The test pressure must be maintained at a constant pressure and continuously recorded by a chart recorder.
- C. The allowable leakage for water mains shall be measured in gallons per hour per one thousand feet of pipe. Allowable leakage shall not exceed the following formula:

$$L = \frac{SD\sqrt{P}}{148,000} \quad \text{when} \quad \begin{array}{l} L = \text{Allowable Leakage, GPH} \\ S = \text{Length of Pipeline Section, LF} \\ D = \text{Diameter of Pipe (Nominal), Inches} \\ P = \text{Average Test Pressure, psig} \end{array}$$

Hydrostatic testing allowance per 1,000 ft of pipeline*:

Avg. Test Pressure <i>psi</i>	Nominal Pipe Diameter – <i>in.</i>							
	3	4	6	8	10	12	14	16
300	0.35	0.47	0.70	0.94	1.17	1.40	1.64	1.87
275	0.34	0.45	0.67	0.90	1.12	1.34	1.57	1.79
250	0.32	0.43	0.64	0.85	1.07	1.28	1.50	1.71
225	0.30	0.41	0.61	0.81	1.01	1.22	1.42	1.62
200	0.29	0.38	0.57	0.76	0.96	1.15	1.34	1.53
175	0.27	0.36	0.54	0.72	0.89	1.07	1.25	1.43
150	0.25	0.33	0.50	0.66	0.83	0.99	1.16	1.32
125	0.23	0.30	0.45	0.60	0.76	0.91	1.06	1.21

100	0.20	0.27	0.41	0.54	0.68	0.81	0.95	1.08
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- * If the pipeline under test contains sections of various diameters, the testing allowance will be the sum of the testing allowance for each size.
- D. The Contractor shall be responsible for maintaining accurate records of each pressure test. The date, time, length of line tested, a recording of the test pressure, the times and amounts of make-up water required, and a comparison of actual leakage versus allowable shall be compiled in a neat and organized format, certified by the inspector for the Owner, and delivered to the Engineer in triplicate. All pressure testing must be witnessed by the Engineer or the Owner and recorded by a continuous automatic chart recorder.
- D. The Contractor shall leave a hydrant nozzle or other connection open when the pressure is first applied in order to exhaust air from the line. If no connection near the high point of the section being tested is available, he shall tap the main and install a corporation cock through which to exhaust the air.
- E. All breaks, leaks or defects in the main and appurtenances, dripping valve glands and hydrant gaskets shall be repaired, following which the test pressure shall be again applied. If the pressure gauge then remains steady the Contractor will notify the Engineer that the main is ready for inspection. The Contractor shall make the preliminary test and repair all defects before requesting an inspection by the Engineer.
- F. In cases where the Contractor has elected to backfill the main prior to testing, it shall be his responsibility to fulfill the test requirements even if it becomes necessary to uncover any or all of the pipe in order to find the cause of a leak or other defect. Where practicable the mains shall be tested in sections not exceeding 1500 feet in length.

3.15 DISINFECTION:

- A. After the pipelines, valves, fittings and appurtenances have been installed and tested, they shall be disinfected in accordance with the method set forth in the latest edition of AWWA C651, and all applicable ADEM regulations.
- B. This procedure involves a preliminary flushing of the mains at a velocity of at least 2.5 feet per second, pumping a 50 ppm chlorine solution into the main through a corporation cock, filling the main slowly, allowing the chlorinated water to stand for 24 hours and then flushing out the main until the heavily chlorinated water has been discharged and a chlorine residual of 0.2 ppm has been achieved.
- C. The cost of disinfecting the mains shall be included in the price bid, and the Contractor shall provide all required equipment and the chlorinating agent. He shall also make a tap in the main at the beginning of each section to be tested and shall provide the necessary corporation cocks. The responsibility of ensuring satisfactory bacteriological samples shall be the Contractor's and he shall if necessary repeat the disinfection procedure until satisfactory results are obtained.
- D. When cross connections to existing mains have been made, there is a tendency for contaminated water to gather in the main between the cross or tee and the valve on the existing main. When the new main is flushed to remove the heavily chlorinated water the valves on the cross mains shall be partly opened to allow the pressure from the distribution

system to force out any contaminated water that might have gathered in these sections of the mains.

- E. Water samples shall be taken by the Contractor in the presence of the Engineer or Owner. All bacterial testing shall be done at an ADEM approved laboratory.

3.16 BACKFILLING AND CLEANUP:

- A. All backfill under areas where paving will be replaced shall be mechanically tamped to the following densities as defined by AASHTO T-99 Standard Proctor Density:

Backfill around pipe	- 95%
Remaining Subgrade	- 95%
Clay gravel base 4" thick	- 100%

- B. After the pipe has been installed and tested, the trench shall be immediately backfilled. However, the Contractor may backfill the trenches prior to testing if he so desires but in this case he will comply with the requirements for testing the mains as specified elsewhere. Where pavement or sidewalk has not been cut to lay the pipe the backfill shall be tamped around and over the pipe to a depth of 12 inches over the top of the pipe. The remaining earth may be filled in and neatly mounded over the trench. Where the pavement or sidewalk has been cut to lay the pipe the backfill shall be thoroughly tamped in six-inch layers for the full depth of the trench.
- C. Where the trench is excavated in rock or other hard material which remains in lumps or pieces after being excavated, dry earth shall be provided and tamped around and over the pipe to a height of 12" above the top of the pipe. No large chunks or fragments of rock shall be placed into the backfill of the ditch.
- D. In places where the trench has been excavated along the side of a paved street not provided with curb and gutter or where construction operations or the weather have spread the excavated material over the surfaces of unpaved streets, the Contractor shall employ a heavy duty motor grader to clean out the side ditches, shape the shoulders and restore the smoothness of the street surface to as good a condition as existed before the work was started. In the event that excavations on the shoulders of streets indicate that washouts or collapse of the shoulder are liable to occur, the backfill shall be carefully tamped and any earth washed out prior to the date of final acceptance shall be replaced. The use of mechanical equipment for this work does not remove from the Contractor the obligation to employ hand labor for the final dressing up.
- E. Before final acceptance of the work all surfaces shall be returned to as good condition as before the work started.
- F. All excavated material shall be cleared from adjacent street surfaces, gutters, sidewalks, parkways, railroads, grass plots, etc., using hand labor where necessary to achieve a satisfactory result, and the whole left in a tidy and acceptable condition.
- G. The Contractor shall at all times keep the backfilled trenches, particularly those across streets and driveways, filled to grade, and shall make a daily inspection to see that those needing additional fill are attended to. He shall maintain them in a good and safe condition and will

be held responsible for any connection up to the date of final acceptance of the work by the Owner.

- H. Where mains are laid across State or County highways or City streets and the pavement has been cut to make the installation, the Contractor shall backfill the section under the pavement with an acceptable backfill and tamped in 6" layers for the entire depth of the trench to the densities specified above.

3.17 INSPECTION OF VALVES:

- A. After all work has been completed the Contractor shall make a careful inspection of all valves, either previously existing or new, which have been opened or closed during the course of the work, to make sure that all valves that should be opened are open and vice versa. No valve shall be opened or closed without the consent of the Owner.
- B. At the same time all valve boxes shall be inspected to make sure that they are still plumb, centered over the operating nut, at the correct elevation and the cover in position.

3.18 GRASSING AND SEEDING:

- A. Refer to Section 32 9219 – Seeding and Restoration for grassing and seeding requirements.

3.19 EROSION AND VEGETATION DAMAGE:

- A. Wherever possible, topsoil shall be removed from all areas to be disturbed by construction, and stockpiled. Land exposure shall be minimized in terms of area and time. All exposed areas subject to erosion shall be covered as quickly as possible by the grassing and seeding specified elsewhere or by mulching or vegetation. Natural vegetation shall be retained whenever possible.
- B. The Contractor shall prepare and implement a firm and accurate construction schedule with regard to land clearing and grading for each section of pipeline to be installed. If possible, clearing shall immediately precede construction activity.
- C. The Contractor shall prepare and submit to the Engineer a list containing chronological completion dates for each measure for controlling erosion and sediment, the location, type and purpose for each measure, and dates when these measures will be removed or replaced.
- D. Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

END OF SECTION 33 1200

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SECTION 31 1000**SITE CLEARING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Erosion control best management practices (BMP's).
 - 2. Protecting existing trees and vegetation designated to remain.
 - 3. Clearing and grubbing.
 - 4. Topsoil stripping.
 - 5. Demolition of existing above-grade and below-grade site improvements.
 - 6. Disconnecting, capping or sealing, and abandoning site utilities in place.
 - 7. Demolition of existing site utilities.
- B. Related Sections:
 - 1. Division 31 Section "Earth Moving"

1.3 DEFINITIONS

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
- D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects

more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

- E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction.
- G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIALS OWNERSHIP

- A. Anything of value found during the progress of the work, as determined by the Owner, shall become the property of the Owner.
- B. Except for anything of value, materials indicated to be stockpiled or materials indicated to remain the Owner's property, cleared materials shall become the Contractor's property, be removed from the site and legally disposed of by the Contractor.

1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
 - 1. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - a. Use sufficiently detailed photographs or videotape.
 - b. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction over the site.
- B. Limit of Construction Activity: Unless specifically authorized by the Owner, the Contractor shall confine all construction activity within the boundary of the Project property, adjacent public rights-of-way and prescribed rights-of-way or easements. Work within public rights-of-way is subject to permit. If clearing and grubbing limits are indicated, the Contractor shall confine all construction activity within those limits.
- C. Improvements on Adjoining Property: Authority for performing any indicated work on property adjoining the Owner's property shall be obtained by the Owner before award of the Contract.
- D. Items to be Salvaged: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- E. The Contractor shall utilize utility locator services for the Project site before any site clearing work is commenced.

PART 2 - PRODUCTS

2.1 EROSION CONTROL MATERIALS

- A. Silt Fence Materials: Silt fences shall consist of a geotextile filter fabric attached to posts by means of adjustable belts or loops or other means that will securely hold the fabric in an upright position. The filter fabric shall be a polymeric fabric formed from a plastic yarn of long-chain synthetic polymer composed of at least 85% by weight of propylene ethylene, amide, ester or vinylidene chloride and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure for at least six months. The filter fabric roll shall be a minimum of three feet in width.

1. The filter fabric shall conform to the following physical requirements:

PhysicalProperty	Test Method	Test Results
Grab Tensile Strength, lbs, min.	ASTM D-4632	120
Grab Elongation, %, max.	ASTM D-4632	40
Mullen Burst Strength, psi, min.	ASTM D-3786	175
Apparent Opening Size, max., U.S. Standard Sieve	ASTM D-4751	30
FlowRate,max. gal/minute/ft ²	ASTM D-4751	30
UV Resistance, %, min.	ASTM D-4355	
ASTM D-4632		
70		

B. Riprap Materials:

1. Riprap shall be limestone conforming to the requirements of ALDOT Specifications Section 814.01, Class 2 Riprap (unless otherwise specifically shown on Drawings).
2. Riprap bedding, where required, shall consist of gravel or crushed stone ALDOT Size #467. All stone for riprap and bedding, such as shot rock, quarry rock, quarry waste or other materials, shall be sound, durable, and free from seams, cracks or other structural defects.

C. Grouted-In Riprap Materials: Riprap stone to be grouted in place shall be of the same size and placed in the same manner as specified for riprap. Grout for grouted-in riprap shall consist of 1 part hydraulic cement to 3 parts sand, thoroughly mixed with water to produce a thick, creamy consistency.

D. Geotextile Riprap Bedding Materials: The geotextile shall be of nonwoven construction. The geotextile shall be mildew, insect, and rodent resistant and shall be inert to chemicals commonly found in soil.

1. The geotextile shall conform to the physical property requirements listed in the table below:

Physical Property	Test Method	Test Results
Grab Tensile Strength, lbs, min.	ASTM D-4632	120
Puncture Strength, lbs, min.	ASTM D-4833	70
Grab Elongation, %, max.	ASTM D-4632	50
Mullen Burst Strength, psi, min.	ASTM D-3786	240
Apparent Opening Size, max., U.S. Standard Sieve	ASTM D-4751	70
Flow Rate, max. gal/minute/ft ²	ASTM D-4751	135

2. The geotextile shall be furnished in a protective wrapping which shall protect the fabric from ultraviolet radiation and from abrasion due to shipping and handling. The fabric shall be ultraviolet stabilized.
- E. Hay Bale Materials: Hay bales shall be rectangular and may be either hay or straw securely bound with twine or wire. Bales shall contain a minimum of 5 cubic feet of material and shall weigh a minimum of 35 pounds when dry.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain and to be protected. All work shall be performed within the limits shown.
- C. Protect existing site improvements to remain from damage during construction.
 1. Restore damaged improvements to their original condition, as acceptable to the Owner.

3.2 EROSION CONTROL BEST MANAGEMENT PRACTICES (BMP's)

- A. General:
 1. The Contractor shall utilize erosion control best management practices (BMP's) to prevent the discharge of sediment-bearing water runoff or airborne dust from the project site in accordance with all federal, state and local regulations during construction.
 2. The Contractor shall be responsible for transferring an NPDES Permit, which will be obtained by the owner prior to award of the contract, for storm water discharge from the construction site(s) for all work described in these Specifications and shown on the Drawings. It shall be the Contractor's responsibility to meet all requirements and obligations of the Permit. The Contractor shall be responsible for all costs associated transferring the permit and for meeting the requirements of the Permit.
 3. The Contractor shall be responsible for the inspection and maintenance of all BMP's in accordance with the requirements of the permitting authority.
 4. The Contractor shall ensure that all downslope BMP's are installed and functional before any land disturbing activity is commenced on any portion

of the site.

5. The Contractor shall be responsible for the installation and maintenance of additional BMP's if required by field conditions, the Engineer or a permitting authority having jurisdiction over the site.

B. Silt Fence:

1. The installation of silt fences shall be in conformance with the silt fence manufacturer's recommendations. Particular care shall be exercised to ensure that all silt fencing is properly keyed into the earth at the toe.
2. The Contractor shall maintain, clean, repair or replace silt fence as may be required during the construction period. If a line of silt fencing exceeds its capacity to function properly and the need for a back-up fence becomes evident, the Contractor shall install a secondary line of silt fence at the affected area as required and authorized by the Engineer. Failure to maintain a silt fence shall not be cause for the Contractor to claim additional compensation.

C. Riprap:

1. Placement: Riprap shall be placed in accordance with ALDOT Specifications Section 610 for Class 2 riprap. Riprap shall be placed in such a manner as to produce a reasonably well graded mass or rock having the minimum practical percentage of voids. Riprap shall be placed to its full course thickness in one operation, and in such a manner as to avoid displacement of bedding material if bedding is required. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. The dumping of riprap shall be allowed provided that riprap bedding material, if required, is not displaced and that mechanical equipment is used to dress the stones to a reasonably uniform slope.
2. Riprap placed in unauthorized locations without prior approval of the Engineer shall be considered to have been wasted, and, therefore, placed at no cost to the Owner.
3. The Contractor shall maintain all riprap protection until the project is accepted, and any material displaced by any cause prior to acceptance of the project shall be replaced at the Contractor's expense.

D. Grouted-In Riprap:

1. Care shall be exercised during placement to keep fine materials from filling the voids between the stones.
2. After the stones are in place, the voids between them shall be completely filled with grout from bottom to top and the surface swept with a stiff broom.
3. No riprap shall be grouted in freezing weather. In hot, dry weather the grout

- work shall be protected and kept moist for at least 3 days by the use of saturated burlap.
4. Grouted-in riprap placed in unauthorized locations without prior approval of the Engineer shall be considered to have been wasted, and, therefore, placed at no cost to the Owner.
 5. The Contractor shall maintain all grouted-in riprap protection until the project is accepted, and any material damaged or displaced by any cause prior to acceptance of the project shall be replaced at the Contractor's expense.
- E. Geotextile Riprap Bedding: The fabric shall be placed in the manner described and in accordance with the manufacturer's recommendations.
1. The surface to receive the geotextile shall be prepared to a smooth condition free of obstructions, depressions and debris.
 2. The fabric shall be placed loosely, not in a stretched condition.
 3. The riprap shall be carefully placed so that the geotextile is not punctured.
 4. The riprap shall completely cover the fabric.
 5. The fabric shall be placed on the slopes so as to provide a minimum overlap of 18 inches at seams.
 6. The geotextile may be placed with seams either parallel or perpendicular to the direction of the flow. If placed perpendicular to the flow, the upstream or higher panel shall overlap the downstream or lower panel. At the top of the bedding installation the fabric shall be keyed into the ground a minimum of 18 inches.
 7. If a cushion layer is required, the bottom toe shall be finished by lapping the fabric back onto the cushion layer and securing with riprap.
- F. Hay Bales: Hay bales shall be installed using keyways cut into grade or aggregate fill bedding as required. All hay bales shall be properly oriented and staked. Hay bales shall be removed and properly disposed of when the project area upslope from them has been stabilized.
1. The Contractor is responsible for the periodic checking and maintenance of hay bale installations. Silt trapped by hay bale installations shall be removed and properly disposed of.
- G. Rock Check Dams: Rock check dams shall be carefully installed in the drainage ditch. Rock check dams shall be removed and properly disposed of when the project area upslope from them has been stabilized.
1. The Contractor is responsible for the periodic checking and maintenance of rock check dam installations. Silt trapped by rock check dam installations shall be removed and properly disposed of.
- H. Sediment Traps: Sediment traps shall be backfilled and any associated granular

material removed and properly disposed of when the project area upslope from them has been stabilized.

1. The Contractor is responsible for the periodic checking and maintenance of sediment trap installations. Silt trapped by sediment trap installations shall be removed and properly disposed of.
- I. Temporary Sediment Basins: Temporary sediment basins which are installed at locations other than permanent storm water detention basins shall be backfilled and any associated granular material removed and properly disposed of when the project area contributing runoff to them has been stabilized.
1. Permanent storm water detention basins with temporary modifications to their outlet structures may serve as temporary sediment basins. The Contractor shall remove the temporary outlet structure modifications and properly dispose of the associated materials when the project area contributing runoff to the permanent storm water detention basin has been stabilized.
 2. The Contractor is responsible for the periodic checking and maintenance of temporary sediment basin installations. Silt trapped by temporary sediment basin installations shall be removed and properly disposed of.
- J. After stabilization of the disturbed area has been achieved, the Contractor shall remove and dispose of all temporary BMP's and dress out those areas to the proper line and grade.

3.3 PROTECTION OF DESIGNATED VEGETATION OR INDIVIDUAL TREES

- A. The Contractor shall erect and maintain a clearly marked temporary fence around designated areas of the site, the perimeter drip line of groups of trees or the drip line of individual trees designated to remain and be protected.
1. Do not store construction materials, debris, or excavated material within the above-described fenced areas.
 2. Do not permit vehicles, equipment, or foot traffic within the above-described fenced areas.
 3. Remove temporary fencing around the above-described areas upon substantial completion.
- B. Where excavation for new construction is required within areas designated to remain and be protected, the Contractor shall hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to the excavation limits as possible.
1. Cover exposed roots with burlap and water regularly.

2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
 3. Clean cut limbs which obstruct the work. Minimize limb cutting as much as practicable.
 4. Coat cut faces of roots or limbs more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 5. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.
- C. Repair or replace trees and vegetation indicated to remain and be protected that are accidentally damaged by construction operations.
1. Replace trees that cannot be repaired and restored to full-growth status, as determined by the Engineer.

3.4 UTILITIES

- A. The Contractor will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing.
1. Contractor shall coordinate with utility companies to shut off indicated utilities.
 2. Contractor shall arrange for utility company to locate, identify, disconnect, and seal or cap off utilities indicated to be removed, or shall receive written permission from utility companies to perform work.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify utility companies in accordance with their policies in advance of any proposed utility interruption.
 2. Do not proceed with utility interruptions without written permission from the Engineer.

3.5 CLEARING AND GRUBBING

- A. Clearing and grubbing shall consist of cutting, removing and disposal of all trees, tree stumps, brush, grass, roots and other organic material within areas to be subject to earthwork and/or occupied by proposed structures or facilities. If clearing and grubbing limits are indicated, those lines shall define the extent of clearing and grubbing activity on the site.
1. Do not remove trees, shrubs, and other vegetation indicated to remain or to

- be relocated. Contractor shall replace all damaged trees, shrubs, or other vegetation at no cost to the Owner.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
 - 4. Roots projecting from the walls of excavations shall be either cut or removed to provide a minimum clearance of 3 feet for the outside line of structures.
- B. Fill depressions caused by clearing and grubbing operations with fill material in accordance with Division 2 Section "Earthwork" unless area is designated for further excavation.

3.6 TOPSOIL STRIPPING

- A. Strip topsoil to the depths indicated in the geotechnical report or a minimum depth of 6 inches.
- 1. The stripping layer may include topsoil, muck, trash, debris, grass, weeds, roots and other organic materials.
 - 2. The stripping process should result in a clean subgrade surface free from organic material and ready for earthwork operations.
- B. Stockpile topsoil materials in areas which will prevent intermixing with subgrade or fill soils. If topsoil is stockpiled on site, the stockpile locations must be acceptable to the Engineer and the Owner. Stockpile locations shall allow for access for the re-loading and spreading of topsoil.
- 1. Grade and shape stockpiles to drain surface water.
 - 2. Stockpiles shall be protected from wind erosion by periodic water sprinkling, covering or temporary seeding.
 - 3. Dispose of excess topsoil as specified for waste material disposal.

3.7 DEMOLITION OF EXISTING SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate construction. Break holes in structures as required to prevent collection of groundwater.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
- C. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement.

Saw-cut faces vertically.

3.8 DISPOSAL

- A. Disposal: The Contractor shall remove cleared vegetation, surplus soil material, surplus topsoil, demolition debris, and waste materials including trash and dispose of them off of the Owner's property. All disposal shall conform to all applicable federal, state and local regulations.

END OF SECTION 311000

SECTION 312000**EARTH MOVING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. This Section includes excavation and backfill for structures, pipelines, embankments and other areas.
- B. Related Sections include the following:
 - 1. Division 31 Section "Site Clearing"
 - 2. Division 03 Section "Cast-in-Place Concrete"

1.3 DEFINITIONS

- A. Backfill: Suitable soil materials used to fill an excavation.
- B. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- C. Base Course: Layer placed between the subgrade and slabs-on-grade, walkways, and pavements.
- D. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- E. Borrow: Suitable soil imported from off-site for use as fill or backfill.
- F. Crushed Stone Backfill: Crushed stone, where specified to be used as backfill or a stone cushion for structures shall be crushed stone meeting Alabama Department of Transportation Gradation #8910.
- G. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

- H. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Earth Excavation: Removal of all materials, not including that specified under the "Clearing and Grubbing" and "Rock Excavation" items. Rocks and boulders eight (8) cubic feet or less in volume shall be classified as earth.
 - 2. Rock Excavation: loosening, removing, and disposing of all rock in original bed, in well defined ledges, or in boulder form. Boulders having a volume of eight (8) cubic feet or less shall not be classified as rock. Material that can be loosened, separated, or ripped by means of heavy duty power tools or excavating equipment shall not be classified as rock.
 - 3. Additional Excavation: Excavation below subgrade elevations as directed by Engineer.
 - 4. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
- J. Fill: Suitable soil materials used to raise existing grades.
- K. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- L. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- M. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- N. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.
- O. Suitable Soils: As defined in the geotechnical report (if applicable), or the following ASTM D 2487 soil classification groups as a minimum; GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- P. Unsuitable Soils: As defined in the geotechnical report (if applicable), or the following soil classification groups as a minimum; ASTM D 2487 soil

classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols. Unsuitable soils also include suitable soils not maintained within 2 percent of optimum moisture content at time of compaction.

- Q. Utilities include on-site underground pipes, conduits, ducts, and cables.

1.4 PROJECT CONDITIONS

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

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.
3. Contact utility locator service for area where Project is located before excavating.
4. All existing underground utilities may not be indicated. Contractor is responsible for locating all underground utilities before beginning excavation.

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

PART 2-PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient suitable soil materials are not available from excavations.

- B. Structural Backfill:

1. Suitable backfill materials shall be within moisture limits required for compaction; silty-clay, weathered shale or other suitable soil mixtures; and such soils shall not contain rock or stone in sizes greater than ½".
2. Native soils as excavated from the site may be used provided that they satisfy the criteria specified herein. If native soils are unsuitable, then Contractor shall furnish and install suitable soils from off-site at Contractor's expense.
3. Material for structural and general backfill may be that excavated on the site; but in the event that the excavated material is not in suitable condition at the time when it is required for backfilling purposes, or the quantity of material excavated is not sufficient to make the finished fills indicated, the

Contractor shall provide, at his own expense, such additional suitable material as is required.

4. If paved areas (or areas to be paved) abut structures, then backfill material under these areas shall be crushed stone.
5. Contractor is responsible for removing and disposing of unsuitable materials off-site, unless otherwise specifically shown to be disposed of on-site.

C. Utility Trench Bedding and Backfill:

1. Bedding Materials

- a. Where trenches are excavated in soil, bedding material shall be silty sand to a depth of approximately 4" under barrel of pipe.
- b. Where trenches are excavated in rock, bedding material shall be silty sand, placed and compacted to a depth of approximately 6" under barrel of pipe.

2. Backfill Materials

- a. Where trenches are excavated in soil, backfill material shall be silty sand to $\frac{1}{2}$ the depth of the pipe, then the remainder shall be suitable soil placed and compacted as described in these Specifications.
- b. #57 stone shall be used in the following locations:
 - 1) As surge stone to provide adequate bearing on unsuitable soil as required.
- c. The top foot of depth of all trenches (except under slabs, footings, roads, walks and paved areas, along road shoulders and other areas) shall be backfilled with soil that can be smoothly dressed to match surface of ground adjoining the edges of the trench, and that will support the vegetation desired for the finished surface and required by the finished grading and grassing requirements.

D. Embankment and Fill Work:

1. The material used in embankments and fills shall be free from frost, stumps, trees, roots, sod, muck or debris of any kind.
2. Only materials as specified herein and/or approved by the geotechnical engineer shall be used.
3. Fill and embankment materials shall not be placed on frozen ground.
4. Embankment and fill materials shall be provided as follows:
 - a. Underneath grass and planted areas: Use suitable soils.
 - b. Underneath walks and pavements: Use suitable soils.

- c. Underneath footings, foundations, building slabs, steps and ramps: Use suitable soils, crushed stone, or ALDOT #57 stone or as indicated in the geotechnical report.
 - d. Dikes and/or Embankments Intended to Hold Water: Use an impervious fill such as a sandy-clay or clayey sand or as indicated in the geotechnical report.
- 5. Rock greater than two (2) inches in any dimension shall not be placed in compacted fills for embankments, dikes or earth sections forming the walls of water containing structures (holding ponds, reservoirs, lagoons, etc.) unless all voids are filled with fine material and the complete fill is compacted to a dense mass as specified hereinabove.
 - 6. Rock greater than one (1) cubic foot in volume, or having any dimension greater than one (1) foot, shall not be placed in compacted fills in areas to be occupied by structures, bearing slabs, footings, roadways, walks, etc.
 - a. Rock of permissible size deposited in such fills shall be placed in layers not greater than one (1) foot in depth, and such rock layers shall be separated by not less than one (1) foot (compacted thickness) of clay or other acceptable backfill material.
 - b. Rock shall not be placed nearer than two (2) feet to the surface of any fill, nor nearer than three (3) feet to the wall or surface of any structures.
 - 7. Rock shall not be placed in fill areas which pipes, conduits, cables, etc., are to be laid, nor shall rock be placed in trench backfill except as described in these Specifications.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways in accordance with Division 2 Section "Site Clearing."

3.2 SITE DRAINAGE

- A. Prevent surface water and ground water from entering excavations, from ponding

on prepared subgrades, and from flooding Project site and surrounding area.

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

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.
3. The Contractor shall complete all dewatering operations and dispose of the water from the work in a manner that will not cause damage to adjacent properties or environment, nor restrict access to any new or existing facilities. No water shall be drained into work under construction.
4. The Contractor shall keep excavations and work dry until the structures or facilities to be constructed are completed and the Engineer is in agreement with the Contractor to discontinue dewatering operations.

C. Drainage Ditches:

1. New ditches shall be cut and existing ditches shall be cleaned out and extended as required to provide for surface drainage around structures and to divert water away from excavations.
2. New (permanent) ditches:
 - a. Flowlines shall be graded as indicated.
 - b. The cross-sections of the ditches shall conform to details specified.
3. Temporary ditches:
 - a. When temporary ditches have served their purpose, all such ditches shall be filled and finished to conform to existing contours or finished contours.
 - b. It shall be the Contractor's responsibility to provide and maintain drainage ditches during the progress of the work.

3.3 EXPLOSIVES

- A. Explosives: The use of explosives will not be allowed.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.

1. All excavation for this Project is unclassified.
2. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

B. General Rock Excavation:

1. All rock excavated from the site shall be designated as rock spoil. Rock spoil must be removed and disposed of off-site unless Contractor receives written permission from Engineer to use it for rip rap on-site, or to dispose of it on-site in non-structural fill areas.
2. The permission of the Owner shall be secured before any rock spoil is disposed of on site.

- C. The Contractor is reminded that all excavation is under the protective guidelines and requirements of OSHA "Safety and Health Regulation for Construction", as set forth in the Federal Register, latest revision, and all such protections are the responsibility of the Contractor and shall be provided at the Contractor's expense.

3.5 SHEETING, SHORING, AND BRACING

- A. Sheet piling, shoring, bracing and sloping are methods of excavation, and such methods may vary according to the Contractor's methods of dewatering, excavating and installing the work.
- B. All such methods of accomplishing the work are the sole responsibility of the Contractor, in accordance with the OSHA guidelines referred to hereinabove, and the sole responsibility of the Engineer is to review the finished work for compliance with the requirements of the Plans and Specifications.

3.6 EXCAVATION FOR UTILITY TRENCHES

- A. All trenches for pipe shall be excavated in open cut to such depths as indicated or as required to secure the specified minimum cover over the pipe.
- B. Where trenches are excavated in native soil, excavation shall be carried to a depth of approximately 4" under barrel of pipe for placement of the specified bedding material.
- C. The trench shall have a uniform cross section and bottom conforming to the grades as indicated.
- D. The pipe shall be laid on firmly compacted approved bedding material, and the barrel of the pipe shall have uniform bearing for its full length.
- E. Any part of the trench excavation below the grade specified shall be corrected with bedding material placed and compacted in accordance with the

requirements of these Specifications.

- F. Where unsuitable or unstable material is encountered at the elevation indicated, the Contractor shall excavate below the grade (or elevation) shown and backfill such excavation with bedding or stabilizing material.
- G. Boulders and large stones, rock or shale, shall be removed to provide a clearance of at least six (6) inches below all parts of the pipe or fittings and to clear width of at least six (6) inches on each side of all pipe and appurtenances.
- H. Where the trench is excavated in rock or shale, the six (6) inch space below the pipe shall be filled with crushed stone firmly compacted in accordance with these Specifications to form a cushion for the pipe.
- I. Bell holes of ample dimensions shall be dug to permit joining to be properly made and to insure that the pipe is evenly supported throughout its length rather than on joints or couplings.

3.7 SUBGRADE

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer.

3.8 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Engineer.
- B. In the event that the Contractor should excavate below the grade specified, and excess excavation is not authorized by the Engineer, such excess excavation shall be backfilled to the grade specified and/or indicated with compacted crushed stone or compacted backfill material. All such backfilling of excess excavation shall be done at the Contractor's expense.

- C. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

3.9 STORAGE OF SOIL MATERIALS

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

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
2. Stockpile soil materials in a manner that will not cause damage to adjacent properties or environment, nor obstruct access to any new or existing facilities.
3. Drainage lines shall not be obstructed nor shall natural drainage of the surrounding ground be altered or obstructed.
4. If Contractor mixes suitable and unsuitable soil materials, then Contractor shall furnish and install equivalent amount of suitable materials from off- site at no additional cost to the Owner.

3.10 BACKFILL, EMBANKMENTS, AND FILL WORK

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

1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for record documents.
3. Inspecting and testing underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Embankments and fills shall not be started without the concurrence of the Engineer.
8. If embankment or fill is to be placed on a surface which slopes more than 4:1, the surface shall be scarified and compacted to provide bond with the new material.
9. Steep slopes may require the existing surface to be benched.
10. Wet ground to be covered by fill shall be drained.

- B. Compaction Requirements:

1. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
2. Under structures, building slabs, steps, and pavements, scarify and recompact top 6 inches of existing subgrade and each layer of backfill or fill material at 98

percent.

3. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 95 percent.
4. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 90 percent.
5. Place base course material over subgrade.
6. Compact base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 1557.
7. Shape base to required crown elevations and cross-slope grades.
8. When thickness of compacted base course is 6 inches or less, place materials in a single layer.
9. When thickness of compacted base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

C. Drainage Courses: Under slabs-on-grade, place drainage course on prepared subgrade and as follows:

1. Compact drainage course to required cross sections and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698.
2. When compacted thickness of drainage course is 6 inches or less, place materials in a single layer.
3. When compacted thickness of drainage course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

3.11 STRUCTURAL BACKFILL

A. General:

1. Backfill shall be made around the walls of the structures as indicated; and backfill shall be placed only after the walls have gained sufficient strength to support the load.
2. No rock shall be placed in fill within three (3) feet of the walls of structures.
3. In all fill work the best dirt shall be used as top soil for any planting, sprigging, or sodding that may be required.
4. Backfill material shall be placed within foundation walls, under footings or slabs, under and around piping installed under footing or slabs, under and around piping located in areas of general excavation (where because of proximity of several pipe lines individual trenches could not be excavated) as indicated.
5. All such backfill material for purposes specified hereinabove, whether obtained from suitable on-site soils, crushed stone, or from suitable off-site soils, shall be furnished and placed by the Contractor at the Contractor's expense.
6. The Contractor shall be responsible for maintenance of the backfill; and shall promptly re-work and/or refill any areas where settlement of backfill has

occurred.

7. All backfill around structures shall be sloped and graded as indicated or as requested by the Engineer.
8. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand- operated tampers.
9. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
10. The surface of each layer shall be kept parallel to the elevation of the finished compacted fill by use of blade graders. In proximity to existing structures, leveling shall be accomplished by use of small spreaders, bulldozers, or hand method.
11. Each layer shall be compacted by use of heavy earth compaction equipment suitable for the particular type of soil/stone.
12. Each layer shall be rolled and compacted to the specified density before the succeeding layer is placed.
13. The final layer shall be brought to elevation of finished compacted fill before topsoil or pavement is placed to conform to the finished contour specified.

3.12 UTILITY TRENCH BACKFILL

A. General:

1. The Contractor shall notify the Engineer prior to backfilling any trench in which pipe has been installed.
2. No extra compensation will be allowed for backfill as specified herein.
3. Trench backfill materials shall be thoroughly compacted by means of pneumatic tampers or mechanical tampers.
4. Each layer of trench backfill shall be carried up to the same level on both sides of the pipe so as to avoid unbalanced loading.
5. Each layer of trench backfill shall be evenly compacted on both sides of pipe before the next layer is placed.
6. Backfill for pipe line trenches shall be placed in 4" layers from the bottom of the trench to a level 12" above the top of the pipe.
7. Backfill above a level 12" above the crown of the pipe shall be placed in layers not exceeding 6" in areas beneath pavement, slabs, footings, etc. and 12" in thickness elsewhere.
8. After the pipe has been covered to elevation three (3) feet above top of pipe, backfilling may be accomplished by use of bulldozer, bucket or other mechanical equipment if carefully performed in a manner suitable to the Engineer.

- B. Special Trench Conditions: Where the character of the soil is such that the employment of proper and adequate drainage of the work will not enable the Contractor to secure a suitable bed for the pipe, the Engineer may request the Contractor to excavate below the specified bedding depth, and backfill the

excess excavation with #57 stone. Backfill throughout remainder of trench depth shall be as specified.

3.13 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.14 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Provide a smooth transition between adjacent existing grades and new grades. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- C. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will select a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
 - 1. The cost of initial sampling and testing shall be borne by the Owner.
 - 2. Subsequent re-testing of any samples or locations failing the initial test shall be performed at the expense of the Contractor.
- B. Allow testing agency to inspect and test subgrades and to test each lift of fill or backfill as frequently as recommended by the geotechnical engineer, or as recommended by Engineer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements. Contractor shall be responsible for scheduling testing at the required intervals as work progresses.
- C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved

degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: The Contractor shall remove waste material, including unsuitable soil, trash and debris, and legally dispose of it off of the Owner's property. All surplus satisfactory soil is to be hauled to the Owner's on-campus spoils area as noted in the plans.
- B. The Contractor shall make all necessary arrangements for disposal areas, and pay all costs incidental to securing permission for their use and shall dispose of all surplus material without cost to the Owner, other than as reflected in the prices bid.

END OF SECTION 312000

SECTION 32 1313**CONCRETE PAVING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Driveways.
 - 2. Curbs and gutters.
 - 3. Walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.
- C. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.
- D. Other Action Submittals:
 - 1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

- E. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.
- B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- D. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- E. ACI Publications: Comply with ACI 301 unless otherwise indicated.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
 - 1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent

treatments of concrete surfaces.

2.2 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
- B. Portland Cement: ALDOT B15.02, Type II
 - a. Fly Ash: ALDOT 806
 - b. Ground Granulated Blast-Furnace Slag: ALDOT 806
- C. Aggregates: ALDOT #467 gradation, from single source, with coarse aggregate as follows:
 - 1. Maximum Coarse-Aggregate Size: 2 inch nominal.
 - 2. Do not use fine or coarse aggregates containing substances that cause spalling.
- D. Water: ALDOT 807.
- E. Air-Entraining Admixture: ALDOT 808.
- F. Water-Reducing Admixture: ALDOT 809, Type A.
- G. Retarding Admixture: ASTM C 494, Type B.
- H. High-Range, Water-Reducing Admixture: ALDOT 809, Type F.
- I. High-Range, Water-Reducing and Retarding Admixture: ALDOT 809, Type D.

2.3 CURING MATERIALS

- A. Absorptive Cover: ALDOT 830, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd.
- B. Moisture-Retaining Cover: ALDOT 830, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Wetted Earth or Sand: ALDOT 830
- E. Straw: ALDOT 830
- F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class

B, dissipating.

2.4 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber or self-expanding cork in preformed strips.

2.5 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
 - 2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 3000 psi
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.53.
 - 3. Slump Limit: 3 inches, plus or minus 1 inch.

2.6 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements of ALDOT 450.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.3 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
 - 1. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
 - 2. Extend joint fillers full width and depth of joint.
 - 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 - 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 - 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 - 6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes. Retain first subparagraph below if doweled contraction joints are required and if tolerance, coordinated with dowel length, is not indicated on Drawings. See Evaluations.
 - a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels

3.4 CONCRETE PLACEMENT

- A. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.
- B. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- C. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- D. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- F. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating joint devices.
- G. Screed paving surface with a straightedge and strike off.
- H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- I. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.
- J. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.
- K. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

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

3.5 CONCRETE WALKS

- A. Concrete walks shall generally be reconstructed to match existing walks.
- B. The walks shall be constructed of Class A-Type 2A Portland Cement Concrete conforming to ALDOT 501.
- C. Expansion joints shall be located as follows:
 1. At points where the walk changes direction.
 2. At points where the walk abuts a structures.
 3. Not farther apart than 30 feet on straight walk.
 4. At the top and bottom of steps.
- D. The expansion joint and filler shall be ½ inch thick and shall meet the requirements of ASTM D1751 for preformed, nonextruding, resilient bituminous type.
- E. The edges of the concrete at expansion joints shall be rounded with an edging tool.
- F. Contraction joints 1-1½" deep shall be cut across the walks with a grooving tool along lines not farther than (1.5x sidewalk width) apart.
- G. Forms shall be made of wood or metal and their depth shall be equal to the depth of the walks.
- H. The form shall be set to true line and grade before any concrete is poured.
- I. The sub-grade shall be damp but not wet when the concrete is placed.
- J. As soon as the concrete is placed, the following steps shall be taken:
 1. Concrete shall be vibrated or spaded to secure a dense, homogeneous mass, and struck off with a straight edge.
 2. The surface of the walks shall then be floated with a wooden float until the surface is true.
 3. Later, after the concrete has taken its initial set it shall be floated again.

4. At this time a light sprinkling of fine screened sand and cement mixed dry in the proportions 1 part of cement to 1-1/2 parts of sand may be used on the surface.
 5. A troweled finish is not acceptable, but the floated finish must be true to grade, and shall be lightly cross-broomed after final float finish.
- K. All concrete walks shall be constructed on firm compacted subgrade and on crushed stone base of compacted thickness not less than 4 inches.
- L. Concrete steps shall be constructed as integral portions of walk construction and shall conform to the following requirements:
1. Steps shall be reinforced monolithic concrete, as detailed.
 2. Concrete for steps shall be Class A in accordance with these Specifications.
 3. Steps shall have abrasive nonslip finish as specified in these Specifications.

3.6 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.7 CONCRETE PROTECTION AND CURING

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

3.8 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
1. Elevation: 0.1 foot.
 2. Thickness: Plus or minus 1/4 inch.
 3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed 1/8 inch.
 4. Joint Spacing: 3 inches.
 5. Contraction Joint Depth: Plus 1/4 inch, no minus.
 6. Joint Width: Plus 1/8 inch, no minus.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
 - 5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 - 6. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
- E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.

3.10 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections

from joint to joint unless otherwise approved by Engineer.

- B. Drill test cores, where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 33 4211**STORM DRAINAGE****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Related work specified elsewhere includes:
 - 1. Section 31 2000 - "Earthwork"
 - 2. Section 32 1216 - "Hot-Mixed Asphalt Paving"

1.2 SUMMARY

- A. Work described in this Section includes the construction of new storm drainage systems, piping, structures, taps, and appurtenances, as indicated on the Drawings.
 - 1. In the event of conflict between this Section and Drawings, the more stringent requirements shall be provided
- B. Each bidder shall visit the site to determine the extent of work required for completion of this contract.
- C. The extent of storm drainage system is indicated on the Drawings, in this Section 334211, and as otherwise required by authorities having jurisdiction.
- D. All fees and charges for storm sewerage permits, connections, impact fees, inspections, etc., shall be paid by the Contractor from their contract amount.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
 - 1. Product data for drainage piping and specialties.
 - 2. Shop drawings for precast concrete storm sewer manholes, including frames and covers.
 - a. Shop drawings for cast-in-place concrete or field-erected masonry storm sewer manholes, if any, including frames and covers.

1.4 QUALITY ASSURANCE

- A. Certifications: The Contractor shall submit to the Engineer copies of certificates from suppliers of pipe, gaskets, reinforcing steel, cast iron frames, covers and grates, ready-mix concrete and other

manufactured items, certifying that these products comply with the Specifications and Standards listed hereinafter.

- B. Standard Specifications: Unless otherwise noted, all specifications referred to shall be the Alabama Department of Transportation (ALDOT) "Standard Specifications for Highway Construction", Latest Edition.
- C. Testing: All laboratory and field testing as required to ensure compliance with these Specifications will be performed by an independent testing laboratory. Refer to Section "Special Conditions Section", for additional information.
- D. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to storm sewerage systems.
- E. Utility Compliance: Comply with local utility regulations and standards pertaining to storm sewerage systems.
- F. Comply with requirements of authorities having jurisdiction, when more stringent than specified or otherwise indicated.
- G. Refer to Division 01 Section "Special Conditions" for additional information and for minimum experience requirements.

1.5 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations. Verify that storm sewerage system piping is installed in compliance with original design and referenced standards.

1.6 SEQUENCING AND SCHEDULING

- A. Coordinate any connection to public storm sewer with utility company.
- B. Coordinate with interior building storm drainage piping, and exterior building storm drainage piping, to include in part, coordination of types of connections required adjacent to foundations and footings.
- C. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Plastic Pipe: Provide one of the following, unless indicated otherwise on the Drawings:
 - 1. Equivalent to ADS N-12 (unperforated) corrugated HDPE pipe with smooth interior, and all required or necessary system accessories, downspout adaptors, fittings, and components, specified in ALDOT Standard Specifications Article 853.04, unless otherwise indicated on the Drawings.
 - 2. Equivalent to Contech A2000 PVC (unperforated), ASTM F949, specified in ALDOT Standard Specifications Article 852.07 and all required or necessary system accessories,

downspout adaptors, fittings, and components, with watertight gasketed joints, unless otherwise indicated on the Drawings.

- B. Reinforced Concrete Pipe (RCP), or Equivalent Area/Volume Arch Pipe (RCAP) Where Permitted: Class 4, reinforced concrete pipe as specified in ALDOT Standard Specifications Article 850.01, unless otherwise indicated on the Drawings.
- C. Where indicated on the Drawings for “french drain”, “underdrain”, foundation drain, at planting or other areas, pipe shall be equivalent to ADS N-12 (perforated) corrugated HDPE pipe with smooth interior, complete with filter fabric “sock” and all required or necessary system accessories, fittings, and components, specified in ALDOT Standard Specification Article 853.13, or equivalent Contech A2000 PVC (perforated) with same filter sock, components and accessories.
 - 1. Where underdrain is indicated, line trench with acceptable geotextile filtration fabric, backfill with clean washed “pea gravel”, fold edges of fabric over top of gravel, and cover with acceptable and relatively impervious earth fill, up to subgrade level of grass or paving.
 - 2. Synthetic Drainage Fabric: Equivalent to fabric supplied as a component of filter fabric “sock”, but not less than 4.3 oz. per square yard per ASTM D 3776, and flow rate of 120 gpm and permittivity of 1.62 per ASTM D 4491.
- D. Concrete and reinforcing steel for headwalls, inlets, manholes, and other storm drainage structures shall comply with Alabama Department of Transportation Standard Specification Articles 501 and 502. Concrete shall be Class “A”, Type 2 (3,000 psi).
- E. Masonry materials (if any shown) and precast concrete units shall conform to Article 621.02.
- F. Castings for frames, covers and grates in drainage structures shall comply with Section 836, with particular attention directed to Article 836.04, 836.05, 836.06, and 836.07.
 - 1. All manhole covers shall be round.
- G. Identification for Underground Plastic Pipe:
 - 1. Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid yellow in color with continuously printed caption in black letters “CAUTION - STORM SEWER LINE BURIED BELOW.”
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allen Systems, Inc.; Reef Industries, Inc.
 - b. Brady (W.H.) Co.; Signmark Div.
 - c. Calpico, Inc.
 - d. Carlton Industries, Inc.
 - e. EMED Co., Inc.
 - f. Seton Name Plate Co.

PART 3 - EXECUTION

3.1 STORM DRAIN PIPE

- A. Construction requirements, including excavation of trench, placing pipe, and backfilling around pipe shall conform to the applicable portions of Article 530.03 of the ALDOT Standard Specifications.
 - 1. Additional Requirements for Plastic Pipe and Fittings: Comply with pipe manufacturer's current written instructions and recommendations, when more stringent than referenced ALDOT Standard Specifications.
- B. A minimum of 4-inches of "select fill" bedding material shall be placed under all pipes. Backfill with "select fill" unless otherwise indicated on the Drawings.
- C. Compaction requirements for backfill shall be the same as specified for type of surface constructed over the trench, paved or planted areas as described in Section 312000 - "Earthwork."
- D. Properly coordinate with elevations of finished grades, footings, and below grade work.

3.2 INSTALLATION OF IDENTIFICATION

- A. Install continuous plastic underground warning tape during back-filling of trench for underground plastic storm sewer piping. Locate 6 to 8 inches below finished grade, directly over piping.

3.3 STRUCTURES

- A. Inlets, manholes, cleanouts and other storm drainage structures shall be installed or constructed in accordance with applicable portions of the following sections of the Alabama Department of Transportation Standard Specifications, Latest Edition:
 - 1. Article 501 - Structural Portland Cement Concrete.
 - 2. Article 502 - Steel Reinforcement.
 - 3. Article 613 - Brick and Concrete Block Masonry.
 - 4. Article 620 - Minor Structure Concrete.
 - 5. Article 621 - Inlets, Junction Boxes, Manholes and Miscellaneous Drainage Structures.
 - 6. Article 622 - Resetting Gratings and Covers and for Catch Basins, Inlets, and Manholes.

END OF SECTION STORM DRAINAGE