

FRISCO PARK

**PROJECT MANUAL**

FRISCO PARK  
418 S. AVALON ST.  
WEST MEMPHIS, ARKANSAS 72301

DATE: 11/20//2018 – PERMIT SET

ARCHITECT'S PROJECT NO: 597



**OWNER**

WEST MEMPHIS PARTNERS II, L.P.  
THE PARK AT BARTON, LLC, GENERAL PARTNER  
124 ONE MADISON PLAZA, SUITE 1500  
MADISON, MISSISSIPPI 39110

**CONTRACTOR**

UNICORP, LLC  
124 ONE MADISON PLAZA, SUITE 1500  
MADISON, MISSISSIPPI 39110

**OWNER'S GEOTECHNICAL ENGINEER**

ANDERSON ENGINEERING CONSULTANTS, INC.  
10205 W ROCKWOOD ROAD  
LITTLE ROCK, AR 72204

**OWNER'S CIVIL ENGINEER**

MCMASTER & ASSOCIATES, INC.  
212 WATERFORD SQUARE, SUITE 300  
MADISON, MS 39110

**OWNER'S SURVEYOR**

MCMASTER & ASSOCIATES, INC.  
212 WATERFORD SQUARE, SUITE 300  
MADISON, MS 39110

**ARCHITECT**

HERRINGTON ARCHITECTS PC  
101 RICHARD ARRINGTON JR. BLVD. S.  
BIRMINGHAM, ALABAMA 35233

**STRUCTURAL ENGINEER**

STRUCTURAL DESIGN GROUP, INC.  
700 CENTURY PARK SOUTH, STE 114  
BIRMINGHAM, ALABAMA 35226

**MECHANICAL/PLUMBING ENGINEER**

ENGINEERING DESIGN TECHNOLOGIES, INC.  
215 19<sup>TH</sup> STREET NORTH, SUITE 201  
BIRMINGHAM, AL 35203

**ELECTRICAL ENGINEER**

CONSULTING CONSTRUCTION ENGINEERING INC  
2320 HIGHLAND AVENUE, SO., STE 150  
BIRMINGHAM, AL 35205

**FRISCO PARK  
TABLE OF CONTENTS**

---

**BID FORMS, DOCUMENTS, AND CONTRACT CONDITIONS**

---

- . INSTRUCTIONS TO BIDDERS AIA A701
- . SAMPLE FORMS
  - > Standard Form of Agreement Between Owner and Contractor AIA A101
  - > Proposal Request AIA G709
  - > Architect's Supplementary Instructions AIA G710
  - > Architect's Field Report AIA G711
  - > Change Order AIA G701
  - > Application and Certificate for Payment AIA G702
  - > Schedule of Values AIA G703
  - > Certificate of Substantial Completion AIA G704
- . GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AIA A201

**REFERENCE INFORMATION**

GEOTECHNICAL REPORT – THIS REPORT, DATED AUGUST 13, 2019, IS FOR REFERENCE ONLY.  
THIS REPORT IS NOT PART OF THE CONTRACT DOCUMENTS AND IS INCLUDED IN THIS PROJECT  
MANUAL FOR CONVENIENCE ONLY.

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**DIVISION 1 GENERAL REQUIREMENTS**

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01 1000	SUMMARY
01 2300	ALTERNATES
01 2500	SUBSTITUTION PROCEDURES
01 3100	PROJECT MANAGEMENT AND COORDINATION
01 3300	SUBMITTAL PROCEDURES
01 4000	QUALITY REQUIREMENTS
01 4200	REFERENCES
<b>01 7123</b>	<b>FIELD ENGINEERING (from McMaster &amp; Associates)</b>
01 7329	CUTTING AND PATCHING
<b>01 7423</b>	<b>CLEANING (from McMaster &amp; Associates)</b>
01 7700	CLOSEOUT PROCEDURES
01 7823	OPERATIONS AND MAINTENANCE DATA

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**DIVISION 2 EXISTING CONDITIONS**

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<b>02 4100</b>	<b>SELECTIVE SITE DEMOLITION (from McMaster &amp; Associates)</b>
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**DIVISION 3 CONCRETE**

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03 3000	CAST IN PLACE CONCRETE (from SDG)
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**DIVISION 4 MASONRY**

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04 2000	UNIT MASONRY
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**DIVISION 5 METALS**

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05 1200	STRUCTURAL STEEL FRAMING (from SDG)
05 3100	STEEL DECKING (from SDG)
05 5000	METAL FABRICATION
05 5100	METAL STAIRS
05 5210	PIPE AND TUBE RAILINGS

---

**DIVISION 6 WOOD**

---

06 1000	ROUGH CARPENTRY
06 1760	SHOP FABRICATED WOOD TRUSSES (from SDG)
06 2000	FINISH CARPENTRY
06 4020	ARCHITECTURAL WOODWORK

---

**DIVISION 7 THERMAL AND MOISTURE PROTECTION**

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07 2100	THERMAL INSULATION
07 2500	WEATHER RESISTANT BARRIERS

**FRISCO PARK**

07 3000	FIBERGLASS SHINGLE ROOFING
07 4200	PANELIZED STONE VENEER
07 4293	SOFFIT PANELS & LOUVERS
07 4600	FIBER CEMENT SIDING
07 6200	SHEET METAL FLASHING AND TRIM
07 7200	ROOF ACCESSORIES
07 9000	JOINT SEALERS

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**DIVISION 8 OPENINGS**

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08 1113	HOLLOW METAL DOORS AND FRAMES
08 1416	WOOD DOORS
08 3113	ACCESS DOORS AND FRAMES
08 5310	VINYL WINDOWS
08 7100	FINISH HARDWARE
08 8000	GLAZING
08 8300	MIRRORS

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**DIVISION 9 FINISHES**

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09 2900	GYPSUM BOARD
09 6500	RESILIENT FLOORING
09 9000	PAINTING

---

**DIVISION 10 SPECIALTIES**

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10 4416	FIRE EXTINGUISHERS
10 5500	POSTAL SPECIALTIES
10 6700	STORAGE SHELVING
10 8000	TOILET, BATH AND LAUNDRY ACCESSORIES

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**DIVISION 11 EQUIPMENT**

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11 3100	RESIDENTIAL APPLIANCES
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**DIVISION 12 FURNISHINGS**

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12 1000	HORIZONTAL LOUVER BLINDS
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---

**DIVISION 21 FIRE PROTECTION (from EDT)**

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21 0517	SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING
21 0518	ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING
21 0533	HEAT TRACING FOR FIRE-SUPPRESSION PIPING
21 0700	FIRE-SUPPRESSION SYSTEMS INSULATION
21 1313	WET-PIPE SPRINKLER SYSTEMS

---

**DIVISION 22 PLUMBING (from EDT)**

---

22 0518	ESCUTCHEONS FOR PLUMBING PIPING
22 0523	GENERAL-DUTY VALVES FOR PLUMBING PIPING
22 0533	HEAT TRACING FOR PLUMBING PIPING
22 0719	PLUMBING PIPING INSULATION
22 1116	DOMESTIC WATER PIPING
22 1119	DOMESTIC WATER PIPING SPECIALTIES
22 1316	SANITARY WASTE AND VENT PIPING
22 3300	ELECTRIC, DOMESTIC-WATER HEATERS
22 4100	RESIDENTIAL PLUMBING FIXTURES
22 4216.16	COMMERCIAL SINKS
22 4716	PRESSURE WATER COOLERS

---

**DIVISION 23 MECHANICAL (from EDT)**

---

23 0000	MECHANICAL GENERAL
23 0518	ESCUTCHEONS FOR HVAC PIPING

**FRISCO PARK**

23 0593	TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 0713	DUCT INSULATION
23 0719	HVAC PIPING INSULATION
23 3113	METAL DUCTS
23 3300	AIR DUCT ACCESSORIES
23 3423	HVAC POWER VENTILATORS
23 3713	DIFFUSERS, REGISTERS, AND GRILLES
23 8126	SPLIT-SYSTEM AIR-CONDITIONERS

---

**DIVISION 26 ELECTRICAL (from CCE)**

---

26 0510	ELECTRICAL - GENERAL
26 0512	ELECTRICAL SUBMITTALS
26 0515	COORDINATION
26 0519	LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 0520	METAL CLAD CABLE
26 0521	NON-METALIC SHEATHED CABLE
26 0525	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
26 0526	GROUNDING AND BONDING
26 0533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
26 2416	PANELBOARDS
26 2715	METER CENTERS
26 2726	WIRING DEVICES
26 2816	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
26 5000	LIGHTING

---

**DIVISION 27 ELECTRICAL LOW VOLTAGE (from CCE)**

---

271500	TELEPHONE SYSTEM
271501	CATV SYSTEM

---

**DIVISION 28 ELECTRICAL SAFETY AND SECURITY( from CCE)**

---

28 3100	FIRE ALARM SYSTEM
---------	-------------------

---

**DIVISION 31 EARTHWORK**

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31 1100	<b>CLEARING AND GRUBBING (from McMaster &amp; Associates)</b>
31 2000	<b>EARTHWORK (from McMaster &amp; Associates)</b>
31 2313	<b>SUBGRADE PERFORATION (from McMaster &amp; Associates)</b>
31 2333	<b>PIPELINE EXCAVATION AND BACKFILL (from McMaster &amp; Associates)</b>
31 2513	<b>SILT FENCE (from McMaster &amp; Associates)</b>
31 2514	<b>TEMPORARY EROSION CHECKS (from McMaster &amp; Associates)</b>
31 3116	TERMITE CONTROL
31 3419	<b>GEOTEXTILE FABRIC (from McMaster &amp; Associates)</b>
31 3713	<b>RIPRAP (from McMaster &amp; Associates)</b>

---

**DIVISION 32 EXTERIOR IMPROVEMENTS (from McMaster & Associates)**

---

32 1123	<b>CRUSHED LIMESTONE BASE</b>
32 1216	<b>ASPHALT PAVING</b>
32 1313	<b>CONCRETE ACCESSORIES</b>
32 1314	<b>CONCRETE PLACEMENT</b>
32 1315	<b>CONCRETE FORMWORK</b>
32 1723	<b>PAVEMENT MARKINGS</b>
32 9200	<b>SEEDING, FERTILIZING, &amp; MULCHING</b>

---

**DIVISION 33 UTILITIES**

---

33 1100	<b>WATER UTILITY DISTRIBUTION (from McMaster &amp; Associates)</b>
33 3000	<b>SANITARY SEWERAGE UTILITIES (from McMaster &amp; Associates)</b>
33 4100	<b>DRAINAGE PIPES AND CULVERTS (from McMaster &amp; Associates)</b>
33 4900	<b>STORM DRAINAGE STRUCTURES (from McMaster &amp; Associates)</b>
33 7173	SERVICE CHARACTERISTICS (from CCE)

END OF TABLE OF CONTENTS

**SECTION 017123**  
**FIELD ENGINEERING**

**PART 1 – GENERAL**

**1.1 REQUIREMENTS INCLUDED**

- A. The Contractor shall provide and pay for field engineering services for:
  - 1. Survey work required in execution of work.
  - 2. Civil, structural, or other professional engineering services specified or required to execute the Contractor's construction method.
- B. The method of field staking for the construction of the work shall be at the option of the Contractor. The Owner shall provide the engineering surveys to establish reference points which in his judgment are necessary to enable the Contractor to proceed with his work.
- C. The accuracy of any method of staking shall be the responsibility of the Contractor. All engineering for vertical and horizontal control shall be the responsibility of the Contractor.
- D. The Contractor shall be held responsible for the preservation of all stakes and marks. If any stakes or marks are carelessly or willfully disturbed by the Contractor, the Contractor shall not proceed with any work until he has reestablished such points, marks, lines and elevations as may be necessary for the prosecution of the work.
- E. The Contractor shall retain the services of a competent surveyor, registered in the State of Arkansas, to layout the work and maintain a survey during construction. The Contractor shall be solely responsible for proper location of the work.

**1.2 SURVEY REFERENCE POINTS**

Locate and protect control points prior to starting site work, and preserve all permanent reference points during construction.

- 1. Make no changes or relocations without prior written notice to the Engineer.
- 2. Report to the Engineer when any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations.

**1.3 PROJECT SURVEY REQUIREMENTS**

- A. Establish temporary bench marks as needed, referenced to data established by survey control points. Record locations, with horizontal and vertical data, on Record Drawings.
- B. Establish lines and levels, and locate and layout, by instrumentation and similar appropriate means:
  - 1. Site improvements, including utility slopes and invert elevations.
  - 2. Batter boards for structures
- C. From time to time, verify layouts by same methods.
- D. Establish all lines and grades prior to construction of site improvements.

**1.4 RECORDS**

- A. Maintain a complete, accurate log of all control and survey work as it progresses.

**1.5 SUBMITTALS**

- A. On request of the Engineer, submit documentation of verified accuracy of field engineering work.
- B. Submit Drawings showing locations and elevations of all pipes and structures constructed. This Drawing shall be included with the Record Drawings.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**

## **SECTION 017423**

### **CLEANING**

#### **PART 1-GENERAL**

##### **1.1 REQUIREMENTS INCLUDED**

Cleaning shall include daily "policing" of the work and surrounding areas to clear general debris waste paper, wood scraps, broken concrete, loose riprap, and other objectionable material along with the final cleanup of the site required for project acceptance.

##### **1.2 DISPOSAL REQUIREMENTS**

Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

#### **PART 2- PRODUCTS (NOT USED)**

#### **PART 3-EXECUTION**

##### **3.1 DURING CONSTRUCTION**

- A. Execute daily cleaning to keep the Work, the site and adjacent properties, free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations.
- B. Provide onsite containers for the collection of waste materials, debris and rubbish. All waste materials including containers, food debris and other miscellaneous materials must be disposed of daily in onsite containers.
- C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

##### **3.2 FINAL CLEANING**

- A. Employ skilled workmen for final cleaning.
- B. Remove all loose asphalt milling, asphalt spoils, excavation spoils, etc. from project limits.
- C. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
- D. Clean debris from storm drainage pipes and inlets.
- E. Prior to final completion or Owner occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas to verify that the entire Work is clean.

**END OF SECTION**

## **SECTION 024100**

### **SELECTIVE SITE DEMOLITION**

#### **PART 1 REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

##### **1.01 SCOPE**

- A. Removal of Structures and obstructions shall consist of the removal and satisfactory disposal of all buildings, fences, structures, old pavements, abandoned pipe lines, trees and vegetation, and other obstructions which are not designated or permitted to remain, except for the obstructions to be removed and disposed of as directed. It shall also include the salvaging of designated materials and backfilling the resulting trenches, holes and pits.

#### **PART 2 CONSTRUCTION REQUIREMENTS**

##### **2.01 GENERAL**

- A. The Contractor shall remove and dispose of all buildings and foundations, structures, fences, old pavement, and other obstructions, any portions of which are within the construction limits. All designated salvageable material shall remain the property of the Owner and shall be removed, without unnecessary damage, in sections or pieces which may be readily transported and shall be stacked at specified storage areas by the Contractor within the project's limits or hauled to a designated maintenance storage yard and stacked. All materials designated not to be salvaged shall be destroyed or disposed of off the project. Basements or cavities left by structure removal shall be filled to the level of the surrounding ground and, if within the prism of construction, shall be compacted to the density of the surrounding ground.

All materials specified for salvage shall be removed, without unnecessary damage, in sections or pieces which may be readily transported and shall be stacked or stored by the Contractor at such places as may be designated within the project's limits, unless other locations are specified in the Contract.

##### **2.02 REMOVAL OF BRIDGES, CULVERTS AND OTHER DRAINAGE STRUCTURES**

- A. Bridges, culverts and other drainage structures in use by traffic shall not be removed until satisfactory arrangements have been made to accommodate traffic. Unless otherwise directed, the substructures of existing structures shall be removed to the natural stream bottom and those parts outside of the stream shall be removed one foot (1') below natural ground surface. Where such portions of existing structures lie wholly or in part within the limits for a new structure, they shall be removed as necessary to accommodate the construction of the proposed structure.

As specified, steel bridges and wood bridges shall be carefully dismantled without unnecessary damage. The dismantling shall include the stripping of all hardware and the removal of all nails. Steel members shall be match marked before dismantling unless otherwise indicated. All salvaged material shall be stored or removed as specified in Section 2-01.

If permitted, blasting or other operations necessary for the removal of an existing structure or obstruction which may damage new construction shall be completed prior to placing the new work.

Removed concrete shall be disposed of by the Contractor off the project.

##### **2.03 REMOVAL OF PIPE**

- A. All culvert pipe designated to be salvaged or relaid shall be carefully removed and every reasonable precaution taken to avoid breaking or damaging. Pipes designated to be relaid shall be removed, handled, and stored when necessary so that there will be no loss or damage



before relaying. The Contractor shall replace without extra compensation all sections lost from storage or damaged by negligence or improper methods to the extent its reuse is deemed by the Engineer to be unsatisfactory. Pipes not designated to be salvaged or relaid shall be disposed of by the Contractor offsite.

#### **2.04 REMOVAL OF PAVEMENT, SIDEWALK, CURBS, ETC.**

- A. When required on the plans or in the proposal, concrete and asphalt pavement, sidewalks, curbs, gutter, etc. shall be disposed of by the Contractor without regard to size of pieces, offsite.

#### **2.05 MAINTENANCE OF TRAFFIC**

- A. The Contractor shall maintain local access to all properties fronting along the project for the duration of the work.

**END OF SECTION**

## SECTION 311100

### CLEARING AND GRUBBING

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. This item shall consist of the removal and satisfactory disposal of trees, **except those that may be designated to remain in place**, stumps, logs, snags, brush, weeds and other perishable or objectionable material within the limits of project site or along the length of the project as designated.
- B. When specified on the Bid Form as lump sum, this item shall include costs for incidental work required on other non-related items specifically detailed on the Plans but not listed separately on the Bid Form, which is subsidiary to the completion of that item of work in accordance with the Contract Documents.
- C. This work shall include stripping and stockpiling of topsoil, stump removal, felling of trees, clearing of brush and other operations as may be detailed herein or indicated on the Plans.

#### PART 2 - PRODUCTS

##### 2.01 GENERAL

- A. Materials cleared from this site, including merchantable timber, if any, shall become the property of the CONTRACTOR for his disposal unless otherwise noted elsewhere in the Specifications.
- B. The CONTRACTOR shall provide equipment of whatever nature is needed to complete the work to the satisfaction of the ENGINEER. Equipment deemed by the ENGINEER to be inadequate for the work must be removed from the site.

#### PART 3 - EXECUTION

##### 3.01 GENERAL

- A. Clearing and grubbing shall be completed a satisfactory distance in advance of earthwork for site preparation, roadways, pipe laying operations etc. and such operations shall not be started until the cleared and grubbed area has been reviewed by the ENGINEER.
- B. The CONTRACTOR shall be responsible for obtaining permits for hauling, dumping, burning, disposal and other operations, as may be required by Local, State and Federal requirements.

### 3.02 CLEARING AND GRUBBING

- A. The area within the construction limits of the project site shall be cleared of trees, stumps, roots, logs, vegetation and other objectionable matter. Roots over 1-1/2 inches in diameter shall be grubbed out to a minimum depth of 18 inches below original ground or 12 inches below the proposal finished grade excavation areas. **Where indicated on the Plans or directed by the ENGINEER, trees that are to remain in place within the project limits, shall be protected from damage by other clearing or construction operations.**
- B. Stump holes shall be backfilled and compacted to the density required for subgrades in Section 312000 "Earthwork" where applicable.
- C. When necessary to completely remove grass and small roots from areas to be covered by earth fill, such as roadways, levees, or other site construction, such areas shall be stripped to sufficient depth to remove same, to the extent directed by the ENGINEER.
- D. Felling of trees and other clearing operations shall be conducted in a manner that prevents damage to trees that are to remain and to protect existing improvements, structures, utility lines or other items.
- E. All topsoil within the construction limits shall be stripped, stockpiled in a designated area to be approved by the ENGINEER, and replaced on slopes or as directed by the ENGINEER. Upon completion of grading, the CONTRACTORS shall place a sufficient quantity of topsoil (minimum 6") to insure grass growth on the designated area. Any excess topsoil shall be removed from the project at the CONTRACTOR'S expense.

### 3.03 DISPOSAL OF MATERIALS

- A. All merchantable timber shall become property of the CONTRACTOR for his disposal unless otherwise noted.
- B. Burying of stumps, trees, logs, snags or other vegetative materials will not be permissible within the project site limits, unless otherwise approved in writing by the ENGINEER.
- C. When permitted by the OWNER, on designated projects, perishable material shall be burned within cleared areas. When on site burning is not permitted, perishable material shall be completely removed from OWNER'S property to disposal areas provided by the CONTRACTOR and approved by the ENGINEER. Piles for burning shall be placed in the center of cleared areas, and shall be limited in size so that no damage to remaining trees or other vegetation will occur. The CONTRACTOR will be responsible for obtaining all permits required and for controlling fires in compliance with all Federal, State, and Local laws and regulations for burning. Sufficient watchmen and fire extinguishers shall be provided for constant care of burning material. The CONTRACTOR shall submit to the ENGINEER for review, his proposed method of burning and appropriate precautions for protection of adjacent areas. The CONTRACTOR shall notify the local firefighter unit in advance of burning operations. The CONTRACTOR shall furnish and maintain adequate firefighting equipment and personnel at the site during burning operations.

CONTRACTOR is responsible for dwellings within adjacent areas. Burning must be permitted by local ordinance and must be conducted at least 500 yards from an occupied dwellings; this restriction may be reduced to 50 yards if ENGINEER approved forced draft air

is provided for combustion. Burning within 500 yards from commercial airport property, private airfields, or marked aircraft approach corridors except when a lesser distance is authorized by airport authority. Burning must not produce a traffic hazard. Starter and auxiliary fuels must not cause excessive visible emissions (rubber tires, etc. are prohibited).

- D. Ashes resulting from burning and incombustible materials such as green roots and debris shall be removed to designated disposal areas provided by the CONTRACTOR and approved by the ENGINEER. Ashes shall not be buried.
- E. Materials which are stripped from the project site which are not suitable for reuse shall be disposed of by the CONTRACTOR at a location provided by him and approved by the ENGINEER.
- F. The cost of hauling, stockpiling and disposal of material shall be included in the Contract Price bid for clearing and grubbing.

**END OF SECTION**

## **SECTION 312000**

### **EARTHWORK**

#### **PART 1 – GENERAL**

##### **1.01 DESCRIPTION**

- A. This work shall consist of general grading, excavating, filling, spreading, and compacting areas to be filled in accordance with these specifications and in conformity with the lines, grades, slopes, and typical cross sections depicted by the Construction Plans.
- B. This item shall also consist of satisfactory disposing of all unsuitable materials within the construction limits of the project site. The work includes grading and subgrade construction on new roadways, drainage ditches and site work.

##### **1.02 EXAMINATION OF SITE**

- A. The CONTRACTOR shall fully familiarize himself of the surrounding area and the conditions of access under which the project is to be completed.
- B. The CONTRACTOR shall visit the site and inform himself fully as to the amount of excavation, filling and grading required under the Contract.

##### **1.03 CLASSIFICATION OF EXCAVATION**

- A. All authorized excavation shall be classified as Unclassified Excavation, regardless of the nature or manner of removal, encountered in the work except for those classes of excavation for which separate pay items or designations are provided.
- B. Borrow Excavation will consist of approved material required for the construction of embankments or other portions of the work and shall be obtained from approved sources outside the project right of way. Unless otherwise provided in the contract, the CONTRACTOR shall furnish the required borrow, make arrangements for obtaining borrow, and pay all costs involved.
- C. Structure Excavation will consist of the removal of material necessary for the construction of foundation for box culverts, and box bridges when authorized by the section covering their construction. It shall also include all necessary dewatering operations such as pumping, bailing, drainage, cribbing, or sheeting, other foundation work, and the backfilling and proper disposal of all excavated material as directed.
- D. Channel Excavation will consist of the removal of material necessary for widening or realigning an existing channel or stream. It shall also include all necessary dewatering operations such as pumping, bailing, drainage, cribbing or sheeting, other foundation work, and the backfilling and proper disposal of all excavated material as directed.
- E. Stripping Excavation will consist of the removal of all objectionable rubbish, humus and vegetable matter to a sufficient depth as directed by the Engineer. After inspection

and approval by the Engineer of cleared and grubbed areas, if any, stripping operations may proceed. Stripped materials shall be stockpiled and subsequently used as topsoil

or wasted as specified herein or as directed by the Engineer. Roots and other floatable materials removed by the stripping operations in all areas shall be disposed of by burning or as specified in the Provisions of Section 311100. Stripped materials designated to be wasted shall be hauled to disposal areas furnished by the Owner or shall be disposed of off-site at a site to be furnished by the Contractor. The Plans shall specify any off-site location to be provided by the Owner or if the Contractor must furnish the off-site area.

## **PART 2 – PRODUCTS**

### **2.01 EQUIPMENT**

The CONTRACTOR may use any type of earth moving, compaction and watering equipment that he may desire or has at his disposal, provided the equipment is in satisfactory condition and is of such capacity that the construction schedule can be maintained as planned by the CONTRACTOR and approved the ENGINEER in accordance with the contract time contained in the agreement. The CONTRACTOR shall furnish, operate and maintain such equipment as is necessary to control uniform density, layers of fill and cross sections.

### **2.02 MATERIALS**

- A. Material for fills shall consist of material obtained from the excavation of on site banks; borrow pits or other approved sources. The material used shall be free from vegetable matter and other deleterious substances and shall not contain large rocks or lumps. All suitable on-site materials shall be installed in the fills or embankments behind the curb and all unsuitable material shall be disposed of as directed by the ENGINEER.
- B. Off-site material shall be classified as follows:
  - 1. Borrow Excavation material (CONTRACTOR Furnished) Material used for roadway embankment fills and backfill shall be compacted to a density of at least 98% of maximum laboratory density at moisture contents within 3 percentage points of optimum moisture contents, as determined by ASTM D-698. Borrow material shall be that required by the geotechnical report.

## **PART 3 – EXECUTION**

### **3.01 GENERAL REQUIREMENTS**

- A. All suitable materials excavated in project site construction shall be used prior of placing off-site material in the formation of fills, subgrades and shoulders as shown on the Plans.
- B. Sequence of Operations: No site construction shall be started until  
  
sufficient clearing, grubbing and stripping within construction limits has been completed and accepted to allow earthwork to proceed without interruption.
- C. Foundation Preparation:

1. When clearing and grubbing has been completed, all stump holes remaining in areas to receive fill shall be filled with suitable material and compacted to a density at least that of the surrounding ground.
  2. Prior to placing material on any areas to receive fill, the natural ground shall be proof-rolled in the presence of the Engineer.
- D. Excavation: Excavation shall be performed at all locations indicated on the Plans, to lines, grades and cross sections shown, and shall be made in such a manner that fills can be formed in accordance with the requirements herein. All suitable material encountered within the limits indicated shall be used in the formation of fills. All material not approved for use in fill shall be disposed of offsite at a site to be furnished by the contractor. During the process of excavation, the grade shall be maintained in such condition that the grade will be well drained at all times.
1. Undercutting: When soft or other objectionable or wet material remains after clearing, grubbing and stripping operations, the CONTRACTOR will be required to undercut such material to such depth and extent as directed and backfill with suitable material. Fill material shall be placed in uniform layers and compacted as specified for fills. Undercut objectionable materials will be disposed of offsite at a site to be furnished by the contractor. Undercut depth will be as determined by the ENGINEER and shall be measured from the natural ground or finished subgrade, whichever is lower.
  2. Tolerances: Excavation and grading shall be completed such that the surface of the site shall conform to the lines and grades shown on the plans. The surface shall conform to the specified grades within 0.05 feet. Any deviation shall be corrected by further grading, filling, reshaping and compacting.
  3. Backfill in undercut areas shall be tested as specified in Section 3.03 of this specification. All costs associated with testing backfill for undercut areas shall be absorbed by the CONTRACTOR.
- E. Formation of Fill:
1. Fills for project site shall be constructed to lines, grades, cross sections and dimensions shown on the Plans.
  2. Earthfills shall be formed by distributing the materials in successive uniform horizontal layers not to exceed nine (9) inches in thickness, loose depth, for full width of the cross sections. Each layer of fill shall be compacted to a density of at least 98% of maximum laboratory density, as determined by ASTM D-698, within building limits at moisture contents within 3 percentage points of optimum and 98% of maximum laboratory density for roadways & parking areas as determined by ASTM D-698.

3. The upper surface of the fill shall be shaped so as to provide complete drainage of surface water at all times. The forming of ruts will not be permitted.
  4. Each layer of earthfill shall be compacted as required with appropriate equipment and in such a manner as to avoid laminating of individual lifts. Fill material which does not contain sufficient moisture shall be watered as needed before being rolled. The furnishing and application of water for construction of fills will not be paid for separately; such operations shall be considered as incidental in formation of fills.
  5. Construction operations shall be performed in such manner that the simultaneous rolling and placing of material in the same lane or section will not occur. To avoid uneven compaction, the hauling equipment shall traverse, as much as possible, the full width of the cross section. Each layer shall be compacted as required before material for the next layer is deposited. Load and speed restrictions shall comply with Section S-105.13 of MHS D State Aid Standard Specifications, latest edition.
  6. Fills constructed with on-site material will be considered as Unclassified Excavation, and shall not be measured separately for payment unless otherwise noted in the construction plans.
- F. Subgrades: All subgrades shall be graded to lines, grades and cross sections indicated. In cut sections where the earth is consolidated, the surface of the roadways shall be scarified to a depth of 9 inches before beginning compaction operations. All fill areas within building limits shall be compacted to a density at least 98% of maximum density as determined by ASTM D-698 (98% of maximum density for fill areas outside of building limits). In the area to be under paving, the top of the subgrade shall be of such smoothness that when tested with a 16 foot straightedge applied parallel and at the right angles to the centerline, the surface shall not be more than 0.04 feet from true grade. Any deviation in excess of these amounts shall be corrected by loosening, adding or removing materials, reshaping and recompacting by sprinkling and rolling.
1. Subgrades shall not be compacted until all utility lines within the roadways are in place. When utility lines are completed, the subgrades shall be regarded and compacted at no additional cost.
  2. At all times, the top of the subgrade shall be maintained in such condition that the surface will drain readily. In no case will vehicles be allowed to travel in a single track. If ruts are formed, the subgrade shall be reshaped and rolled.
- G. Ditch Excavation and Grading: Ditch excavation shall be performed in proper sequence with other construction. All satisfactory materials shall be placed in fills as needed. Unsatisfactory material shall be wasted in disposal areas. Ditches shall be graded to drain and shall not contain low spots which would hold water. Ditches and slopes shall be dressed to a tolerance of plus or minus 0.1 feet from indicated grade.
- H. Fine grading, shaping, and finishing: This work shall consist of



grading and finishing areas of the site and roadway where, in general, the elevation of the existing ground surface or roadbed is practically parallel with the proposed grade line. This work shall include backfilling, grading, shaping and finishing areas behind the curb and gutter to conform to the lines subgrades shown on the plans.

### **3.02 SEASONAL AND WEATHER LIMITS**

No fill material shall be placed, spread or rolled while the ground or fill is frozen or thawing or during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until the moisture content and density of the fill are as previously specified.

### **3.03 TESTING**

- A. CONTRACTOR shall be responsible for determining that any material utilized in fills meets project requirements and shall provide Standard Proctor density tests for on site and off site materials utilized in fills, foundations or bases. Proctors shall be run frequently as necessary to assure consistency of material and wherever changes in material are encountered.
- B. Density tests shall be performed at the following intervals:
  - 1. Subgrade Fills: For areas beneath future building locations, a minimum of one test per lift for each 2500 square feet of surface area shall be required. For areas not beneath future not beneath future building locations, a minimum of one test per lift for each 5000 square feet of surface area shall be required.
  - 2. All phases of testing shall be performed by a certified testing laboratory, which shall submit all test results to the ENGINEER for review. These phases of testing include, but are not limited to, sampling, transporting, and testing of materials. Testing shall be performed according to Section S-105-Control of Work and Section S-106-Control of Materials of the Mississippi Standard Specifications for State Aid Road and Bridge Construction, Latest Edition. Test reports must be submitted to the ENGINEER for review prior to approval of pay request. There will be no separate pay item for testing; all associated costs will be absorbed by the CONTRACTOR.

**END OF SECTION**

## SECTION 312313

### SUBGRADE PREPARATION

#### PART 1 - GENERAL

**1.01 SCOPE OF WORK:** Subgrade preparation shall consist of the preparation of natural or excavated areas prior to the placement of subbase, base or pavement materials, or prior to the construction of curb and gutter sections. Subgrade preparation shall include scarifying, windowing, spreading, watering, drying, compacting and maintaining the top surface of a roadbed upon which the pavement structure and shoulder are constructed.

#### PART 2 - MATERIALS

Part 2 is omitted from this Section.

#### PART 3 - CONSTRUCTION REQUIREMENTS

**3.01 GRADING:** Subgrade upon which pavement, sidewalk, curb and gutter, driveways or other structures are to be directly placed shall be in close conformity with the specified grade and cross-section. Subgrade upon which subbase or base material is to be place shall not vary more than one-half inch (1/2") from the specified grade and cross-section. Variations within the above specified tolerances shall be compensated so that the average grade and cross-section specified are met.

Areas where "grade only" is called for on the Plans shall be constructed to a straight grade from the finished pavement elevations shown on the Plans to the elevation of the existing ground at the extremities of the area to be graded.

**3.02 COMPACTION:** When pavement, base or subbase material or curb and gutter are to be place directly on the subgrade, the top six inches (6") of subgrade material shall be compacted to a relative compaction of ninety-eight percent (98%) as determined by the Department of Transportation's Method of Test M-T-8.

All materials that will not satisfactorily compact shall be removed and replaced with suitable material and the entire width of the subgrade shall be brought to line and grade within reasonable limits and compacted to required density. Where the subgrade is of a non-uniform compacted nature, or where required, it shall be scarified to a depth of not less than six inches (6") for its full width and the material spread and compacted to required density.

All submerged roots, stumps or other perishable matter encountered in the preparation of subgrade shall be removed to a depth of not less than two feet (2') below the subgrade elevation.

After the subgrade has been prepared as specified above, it shall be maintained in such condition as to drain. If damaged by hauling or handling materials, the subgrade shall be scarified and re-compacted to required density.

The subgrade shall be in final condition for receiving the base or surface for a distance of at least five hundred feet (500') in advance of placing subsequent courses. Subsequent courses shall not be placed until the subgrade has been approved by the Engineer.

**END OF SECTION**

## SECTION 312333

### PIPELINE EXCAVATION AND BACKFILL

#### PART 1 – GENERAL

- 1.1 **SCOPE:** This section covers the excavation, trenching, and backfilling for utilities and appurtenances.
- 1.2 **RELATED WORK SPECIFIED ELSEWHERE:** All work requiring excavation, trenching, and backfilling.
- 1.3 **APPLICABLE PUBLICATIONS:** Where reference is made to other publications, they are referred to by basic designation only and form a part of this specification to the extent indicated by reference thereto. All referenced publications shall be the latest issue, including amendments as of the date of this specification.
- 1.4 **SUBMITTALS:**
- A. **Materials Source:** Submit name of imported materials suppliers. Provide materials from same source throughout the work. Any change of source will require approval.

#### PART 2 – PRODUCTS (NOT USED)

##### 2.1 SOIL MATERIALS

- A. **Type S1 – Select Fill:** Material shall consist of select, nonorganic and debris-free silt clays (CL) or sandy clays (CL) having a plasticity index (PI) within the range of 10 to 24, a liquid limit less than 45, and a minimum of 50 percent passing the No. 200 sieve.
- B. **Type S2 – Course Aggregate: Washed Stone:** free of shale, clay, friable material, sand, debris: graded in accordance with ANSI/ASTM C33, size No. 467.
- C. **Type S3 – Pea Gravel: Natural Stone;** washed, free of clay, shale, organic matter; graded to a minimum size of 1/4 inch and a maximum size of 5/8 inch.
- D. **Type S4 – Sand:** Natural river or bank sand; washed, free of silt, clay, loam, friable or soluble materials, or organic matter; graded in accordance with ANSI/ASTM C33.
- E. **Type S5 – Crushed Stone:** Crushed Limestone, No. 610 gradation.

##### 2.2 SOURCE QUALITY CONTROL

- A. Test and analysis of soil material will be performed in accordance with ASTM D4318 or ASTM C136.
- B. If test indicate materials do not meet specified requirements, change of material and all retesting cost will be the responsibility of the Contractor.
- C. Maximum dry density of the soil materials will be determined by ASTM D698.

## **2.3 STOCKPILING OF MATERIALS**

- A. Stockpile materials on-site in sufficient quantities to meet project schedule and requirements.
- B. Separate differing materials with dividers or stockpile apart to prevent mixing.
- C. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- D. At the completion of the Work, remove stockpile, leave area in a clean and neat condition, and grade site to prevent free standing surface water.

## **PART 3 – EXECUTION**

### **3.1 EXCAVATION**

All excavation of every description and of whatever substances shall be performed to the depths indicated or as otherwise specified. All excavated materials shall be removed and disposed of off-site at the Contractor's expense. Grading shall be done as necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved methods. Sheeting and shoring shall be done as necessary for the protection of the work and for the safety of personnel. Excavation shall comprise all materials encountered, including rock and filled-in material of whatever nature is involved.

- A. The utilities shall be laid and maintained to lines and grades established by the plans and specifications with fittings at the required locations unless otherwise approved by the Engineer.
- B. Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care should be exercised by the CONTRACTOR during excavation to avoid damage to existing structures.
- C. When obstructions that are not shown on the plans are encountered during the progress of work and interfere so that an alteration of the plans is required, the ENGINEER will alter the plans or order a deviation in line and grade or arrange for removal, relocation, or reconstruction of the obstructions.
- D. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the ENGINEER, to provide clearance as required by federal, state, or local regulations or as deemed necessary by the ENGINEER to prevent future damage or contamination of either structure.

### **3.2 TRENCHING**

#### **A. GENERAL**

- 1. Trench preparation shall proceed in advance of pipe installation for only as far as stated in the specifications.
- 2. Trenches for underground pipe-work shall be open cuts to the required lines, depths, and grades, with the side walls as nearly vertical as practical. Due to utility conflicts and confined working limits, no sloping will be allowed. To adhere to all Federal safety regulations, all trenches shall be braced with interlocking sheeting or trench box/shield. Trench widths shall be as required for proper laying and jointing of pipes and the proper placing and compacting of backfill and shall be no greater than 24" wider than the outside diameter of the

pipe at and below the top of the pipe. Excavate trenches to provide uniform and continuous bearing and support of each pipe barrel on firm undisturbed earth at every point between bell holes, with the ample bell hole cut at each joint to facilitate proper jointing and to prevent bells from bearing on the trench bottom. Machine or hand-cut trenches, except that in all cases prepare the final subgrade, before laying pipe bring the trench bottom up to proper subgrade by backfilling with approved material placed in 3-inch maximum thickness loose layers, and thoroughly compact each layer as directed to provide uniform and continuous bearing and support for the pipe barrel at every point between bell holes.

3. Shore and brace trenches and excavations as directed and as required to protect personnel, adjacent structures, and adjacent property. Where required by the conditions encountered, brace trenches and excavations with suitable interlocking sheeting. Do all necessary cribbing up required for the proper operation of trenching machines.
4. Provide and maintain in proper working order all necessary dewatering equipment for the removal of water from the excavations. Where quicksand or other water bearing strata are encountered, install and connect the necessary number of well points with pumping equipment of sufficient capacity to prevent rise of water in the excavation until the work has been installed properly and will be unaffected by submersion.
5. Do not install any work until excavations are free of water, mud, and loose earth. Do not install any work on frozen ground.
6. The CONTRACTOR shall be responsible for all work associated with dewatering. Discharge from any trench dewatering pumps shall be conducted to natural drainage channels, storm sewers, or an approved reservoir in adherence with the storm water regulations for this project.
7. Excavated material shall be placed in a manner that will not obstruct sidewalks, drive-ways, or other structures and shall be done in compliance with federal, state, or local regulations.
8. Removal of pavement and road surfaces shall be a part of the trench excavation and the amount removed shall depend upon the width of trench required for the installation of structures. The dimensions of pavement removed shall not exceed the dimensions of the opening required for installation of pipe and other structures by more than 6 inches in any direction unless required or approved by the OWNER. Methods, such as sawing, drilling, or chipping, shall be used to ensure the breakage of pavement along straight lines.
9. The width of the trench at the top of the pipe shall be that of the single-pass capabilities of normally available excavating equipment and ample to permit the pipe to be laid and joined properly and allow the backfill to be placed as specified. Trench widths at the top of the trench shall be no greater than the outside diameter of the pipe plus 24 inches. Trenches shall be of such extra width, when required, to permit the placement of interlocking sheeting or trench box/shield.
10. When excavation of rock is encountered, all rock shall be removed to provide a clearance of at least 9 inches below and on each side of all pipe and fittings. When excavation is completed, a bed of sand, crushed stone or earth that is free from stones, large clods, or frozen earth, shall be placed on the bottom of the trench to the previously mentioned depths, leveled, and tamped. These clearances and bedding procedures shall also be observed for pieces of concrete or masonry and other debris or subterranean structures, such as masonry walls, piers, or foundations that may be encountered during excavation. This installation procedure shall be followed when gravel formations containing loose boulders greater than 8 inches in diameter are encountered. In all cases, the specified clearances shall be maintained between the bottom of all pipe and

appurtenances and any part, projection, or point of rock, boulder, or stones of sufficient size and placement which, in opinion of the ENGINEER, could cause a fulcrum point.

11. Should the trench pass over a sewer or other previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.
12. Trees, shrubs, fences, and all other property and surface structures shall be protected during construction unless their removal is shown in the plans and specifications or approved by the OWNER. Any cutting of tree roots and branches shall be done only as approved by the OWNER.
13. Temporary support, adequate protection, and maintenance of all underground and surface structures, drains, sewers, and other obstructions encountered in the progress of the work shall be furnished by the CONTRACTOR. All properties that have been disturbed shall be restored as nearly as practical to their original condition.
14. Appropriate traffic control devices shall be provided in accordance with federal, state, and local regulations to regulate, warn, and guide traffic at the work site.

B. Trenching – New utility line: The following procedures shall be used in areas in which new utility lines are to be constructed.

1. The trench shall be excavated to the required alignment, depth, and width and in conformance with all federal, state and local regulations for the protection of the workmen.
2. Holes for the bells shall be provided at each joint but shall be no larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. Other than noted previously, the trench bottom shall be true and even in order to provide support for the full length of the pipe barrel, except that a slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle.
3. When the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed, to a minimum of at least 12 inches, or to the depth ordered by the ENGINEER and replaced under the directions of the ENGINEER with clean, stable backfill material. The bedding shall be consolidated and leveled in order that the pipe may be installed properly.
4. When the bottom of the trench or the subgrade is found to consist of material that is unstable to such a degree that, in the judgment of the ENGINEER it cannot be removed, a foundation for the pipe and/or appurtenance shall be constructed using piling, timber, concrete, or other materials at the direction of the ENGINEER.

C. Trenching – Replacing utility lines: The following procedures shall be used in specified areas where existing sanitary sewer lines shall be replaced with new utility lines.

1. Trenching operations shall be conducted along the same line as the existing sewer lines.
2. The trench will be excavated to the depths of the existing sanitary sewer mains. The sewer mains shall be carefully uncovered and removed from the trench. Extreme care shall be taken to prevent disturbing the trench bottom from the trench. Extreme care shall be taken to prevent disturbing the trench bottom since new sewer line will be laid directly on the bottom in the exact location of the existing sewer.

3. If in the opinion of the ENGINEER the trench bottom has been disturbed to such an extent that its supporting ability has been destroyed the CONTRACTOR shall be responsible for providing adequate bedding material, subject to approval by the ENGINEER.

### **3.3 BACKFILLING:**

- A. General:
  1. Do not backfill pipe and trenches and other excavations until the underground work has been inspected and approved.
  2. The trenches shall not be backfilled until they, as installed, conform to the requirements specified. Where, in opinion of the ENGINEER, damage is likely to result from withdrawing sheeting, the sheeting shall be left in place. Except as otherwise specified for special conditions of over-depths, trenches shall be backfilled to the ground surface with material that is suitable for the compaction specified hereinafter. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as approved. The surface shall be restored to its original condition as near as practicable as hereinafter specified. Pavement, base course, and compacted subgrade disturbed by trenching operations shall be replaced in an acceptable manner with materials equal to the adjacent compacted subgrade, base course, and pavement for a minimum distance of 12 inches on each side of the trench.
  3. Backfilling covered in this Section includes all material extending from the bottom of bedding materials to existing grade or paving (as applicable).
- B. Backfilling for Utility Lines:
  1. After pipework has been approved, thoroughly tamp all backfill into bell holes, around pipework, and up to 6" above the top of all pipework, using hand or pneumatic tampers.
  2. Form 6" above top of pipe work up to finished grade (or paving subgrade, as the case may be), place and compact all backfill by approved methods that will cause the least possible settlement and provide the required density.
  3. Repair existing surfaces disturbed by construction activities to at least the condition that existed prior to construction activities.
  4. Within Construction Limits in which utilities are to be laid, the trenches shall be backfilled in six inch layers to 95 percent of maximum density as determined by ASTM D-698.

**END OF SECTION**

## SECTION 312513

### SILT FENCE

#### PART 1 GENERAL

- 1.1 **SCOPE OF WORK:** In accordance with the requirements of this Section, the Contractor shall furnish, construct and maintain a water permeable filter type fence for the purpose of removing suspended soil particles from the water passing through it in accordance with the requirements shown on the Plans and these Specifications.

#### PART 2. MATERIALS

- 2.1 **GEOTEXTILE FABRIC:** The fabric shall conform to the physical requirements of Type I or Type II as shown in Table I of Section 313419 of these Specifications. Unless a specific type is specified in the Plans or Contract Documents, the Contractor may select Type I or Type II.

Fabric for silt fence shall be manufactured in widths of not less than three feet. Sheets of fabric may be sewn or bonded together at the factory or other approved locations but deviation from the physical requirements will not be permitted.

- 2.2 **WOVEN WIRE BACKING:** Except as provided herein, silt fence shall be reinforced with a woven wire backing. The wire backing shall be at least 32 inches high and have no less than six horizontal wires. Vertical wires shall be spaced no more than 12 inches apart. The top and bottom wire shall be 10 gage or larger. All other wire shall be no smaller than 12-1/2 gage.

- 2.3 **POSTS:** Steel post shall be used. Steel tee posts shall be five feet long, approximately 1-3/8 inches wide, 1-3/8 inches deep and 1/8 inch thick with a nominal weight of 1.33 pounds per foot prior to fabrication. The posts shall have projections, notches or holes for fastening the wire backing or fabric to the posts.

- 2.4 **STAPLES:** Staples shall be made of nine gage wire with a minimum length of one inch after bending.

- 2.5 **MANUFACTURER'S CERTIFICATION:** The Contractor will furnish to the Engineer three copies of the manufacturer's certified test reports and certification that each lot in a shipment complies with the requirements of the Contract. All fabric, fence posts, woven wire and wire staples are subject to approval by the Engineer upon delivery to the Work Site and prior to incorporating in the Work.

#### PART 3. CONSTRUCTION REQUIREMENTS

- 3.1 **INSTALLATION:** Silt fences shall be constructed at the locations shown on the Plans or as directed by the Engineer.

All posts shall be installed so that no more than three feet of the post shall protrude above the ground. Extra post for bracing shall be as directed by the Engineer. The woven wire shall be securely

fastened to the wood posts with staples. When metal posts are used, the wire shall be fastened to the posts with wire or other approved means. The fabric shall be attached to the wire fence by wire or other approved means. The bottom edge of the fabric shall be buried 6 inches below ground surface to prevent undermining. When splicing of the fabric is necessary, two posts shall be installed approximately 18 inches apart and each piece of fabric shall be fastened to both posts.

The fabric will be rejected if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation storage or installation.



Type II fabric may be installed without the woven wire fence backing provided all of the following conditions are met:

- (a) Post spacing is reduced to six feet or less.
- (b) The fabric has been approved by the Engineer and the manufacturer recommends its use without the woven wire backing.
- (c) Fence posts shall be inclined toward the runoff source at an angle of 20 degrees from vertical.
- (d) Fabric shall be attached to the posts in such a manner that the purpose intended is satisfied and maintained.

**3.2 MAINTENANCE AND REMOVAL:** The Contractor shall maintain the silt fence and the fabric shall be removed and replaced when deterioration to such an extent that it reduces the effectiveness of the silt fence. Excessive accumulations against the fence shall be removed and disposed of as directed by the Engineer and the active storm water pollution prevention plan.

Unless otherwise directed, all temporary silt fences shall be removed. Upon removal, the Contractor shall remove and dispose of any excess silt accumulations, dress the area to give a pleasing appearance and vegetate all bare areas in accordance with the contract requirements. The temporary fence materials will remain the property of the Contractor and may be used at other locations provided the materials are acceptable to the Engineer.

**END OF SECTION**

## SECTION 312514

### TEMPORARY EROSION CHECKS

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

- A. This work consists of furnishing, constructing and maintaining baled hay or straw wattle erosion checks for the retention of soil along the toe of fill slopes, around inlets, swale areas, small ditches, sediment basins and other areas as directed by the Engineer in accordance with the requirements shown on the plans and these specifications. Also, the work includes removing and disposing of the erosion checks and silt accumulations as directed by the Engineer.

#### PART 2 – MATERIALS

##### 2.01 VEGETATIVE MATERIALS FOR EROSION CHECKS

- A. Type I. Approved baled straw of wheat, oat, rye grain, or rice or broomsage of Bahia grass (with seed heads) which has reached maturity prior to cutting.
- B. Type II. Approved baled hay produced from Bermuda, Bahia, Fescue, Dallis Grass, any of the Lespedezas, or combinations thereof.
- C. All of the above materials shall have been properly cured prior to baling and shall be reasonably free from Johnson Grass and other obnoxious grasses and weeds. Vegetative materials shall be reasonably bright in color, dry, and shall not be musty, moldy, or of otherwise low quality. Vegetative material that is wet or that has been baled green (nor cured properly) shall be used.
- D. Unless otherwise permitted in writing by the Engineer, Type I shall be furnished and used. The Engineer may permit the use of Type II when the Contractor has furnished satisfactory evidence in writing that Type I material is not available.

#### PART 3 – EXECUTION

##### 3.01 GENERAL

- A. The erosion checks shall be constructed at the locations and according to the requirements shown on the plans or as directed by the Engineer. Erosion checks required along the toe of fill slopes shall be constructed prior to grading operations at the site. For other locations, the erosion checks shall be constructed when directed by the Engineer.
- B. The soil shall be excavated at least three inches in depth to embed the baled material. After securing in place, a sufficient quantity of the excavated material shall be placed around the erosion check and compacted to prevent undermining.

##### 3.02 MAINTENANCE AND REMOVAL

- A. The Contractor shall maintain the erosion checks and remove and dispose of silt accumulations as directed by the Engineer.

- B. When the erosion checks are no longer needed, they shall be removed and the Contractor shall dispose of the silt accumulations and treat the disturbed areas in accordance with the contract requirements.

**END OF SECTION**

**SECTION 313419**  
**GEOTEXTILE FABRIC**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. This work consists of furnishing and installing geotextile fabric for stabilization of embankments and subgrades as shown on the plans and in conformance with these specifications.
- B. Dimensions of fabric placement shall be as indicated on the drawings.

**PART 2 - MATERIALS**

**2.01 GENERAL**

- A. Unless specified otherwise, the fabric shall be woven. The fabric shall consist only of long chain polymeric yarns of filaments such as polypropylene, poly-ethylene, polyester, polyamide or polyvinylidene-chloride and shall be formed into a stable network such that the yarns or filaments retain their relative position. The fabric shall be mildew resistant and inert to biological degradation and naturally encountered chemicals, alkalies and acids. Fabric which is not protected from sunlight after installation shall contain stabilizers and/or inhibitors to make it resistant to deterioration from direct sunlight, ultraviolet rays and heat.
- B. The edges of the fabric shall be salvaged or finished in such a manner to prevent the outer yarn or filaments from raveling. The fabric shall be free of defects or flaws which affect the required physical properties.
- C. Fabric shall be manufactured in widths of not less than six feet. Sheets of fabric may be sewn or bonded together at the factor or other approved locations but deviation from the physical requirements will not be permitted.
- D. Tests for manufacturer's certification shall be conducted with fabric as shipped by the manufacturer and acceptance testing will be conducted with fabric from the project.

**2.02 GEOTEXTILE FABRIC FOR USE UNDER RIPRAP**

- A. Unless otherwise specified the fabric shall conform to the physical requirements listed herein. The requirements for tensile, bursting, puncture and trapezoidal tear strengths may be reduced 50 percent (50%) when the fabric is cushioned from rock placement by a 6-inch minimum layer of sand.

**TABLE I**  
**GEOTEXTILE FABRICS**  
**MINIMUM AVERAGE ROLL VALUE**

Physical Properties	200	Test Method
Tensile Strength, lbs (Weaker principal direction)	200	ASTM D 4632 (CRE) (See Note 1)
Bursting Strength, psi.	300	ASTM D 3786, Diaphragm Bursting Tester

Puncture Strength, psi.	80	ASTM D 3787, Tension Testing Machine with Ring Clamp; Steel Bal replaced with a 5/16 inch hemispherical tip.
Trapezoidal Tear, lbs.	65	ASTM D 4533 (CRE) (See Note 1)
Retained Strength when wet, percent	100	ASTM D 4632 (CRE) and ASTM D 3786 and 3787, as above. (See Note 1)
Permeability, cm/sec. (See Note 2)	0.01	AASHTO M 288 (Appendix)
Flow Rate, gal./min./sq.ft (See Note 2)	30	AASHTO M 288 (Appendix)
Equivalent Opening Size (EOS) See Notes 2 & 3)		Miss. Test Method MT 60
Woven Fabric	70-100	
NonWoven Fabric	70+	

- Note 1: A test result shall be the average of the test values of five specimens.  
Note 2: Unless designated otherwise in the plans or contract documents.  
Note 3: The EOS test for nonwoven fabric may be waived by the Testing Engineer.  
Note 4: All of the above strength tests except "retained strength" are to be conducted in a dry condition.

### 2.03 STAPLES

- A. Staples shall be made of nine gage wire with a minimum length of one inch after bending.

## PART 3 - CONSTRUCTION REQUIREMENTS

### 3.01 GENERAL

- A. A subgrade which is to receive geotextile fabric shall be shaped and compacted to a smooth finish and free of loose material and sharp objects. An embankment site shall be cleared and graded to establish a relatively smooth surface. Trees and stumps are to be cut off at ground line and sawdust or sand placed over these areas to provide a cushion for the fabric.
- B. The fabric shall be placed as smooth as possible and free from tension, stress, folds, wrinkles or creases.
- C. Where more than one layer of fabric is required, all joints of the bottom layer shall be sewn to develop the required fabric strength perpendicular to the joint. The top layer and single layer installations of fabric may be overlapped a minimum of two feet at each joint or sewn.
- D. Fabrics which weigh less than eight ounces per square yard shall be factory or field sewn with a "J" type seam. Heavier weight fabrics shall be factory sewn with two parallel bag type seams approximately one-fourth inch apart or field sewn with an additional seam zigzagged across the two parallel seams.
- E. Securing pins with washers shall be inserted along a line through the mid-point of any overlap or

sewn seam at intervals required by the Engineer to prevent movement of the fabric until covered.

- F. The subsequent course of material shall be back-dumped in such a manner as to avoid damage to the underlying fabric. No equipment will be allowed to operate over the fabric until it is covered with a layer of material of sufficient thickness to protect the fabric installation. When the underlying soil is very unstable, the two outer one-third portions of an embankment layer shall be placed approximately 25 feet in advance of the center one-third portion to prevent excessive mudwave movements and damage to the fabric installation.
- G. The Contractor shall provide equipment necessary for placing the fabric in the position and location as detailed on the plans.

**END OF SECTION**

## SECTION 313713

### RIP-RAP

#### SECTION 1 – GENERAL

##### 1.01 DESCRIPTION

- A. Scope:  
Furnish all labor, materials, equipment and incidentals necessary to place rip-rap for channel slopes and ditches at locations shown on the Construction Plans and ordered by the ENGINEER.
- B. Related Work Specified Elsewhere:
  - 1. Section 312000, Earthwork.

##### 1.02 SUBMITTALS

- A. The CONTRACTOR shall furnish representative samples of rip-rap to the ENGINEER and shall indicate the source of locations. If the source location changes during construction the CONTRACTOR shall resubmit representative samples.
- B. Shop Drawings: Submit for approval the Shop Drawings showing the areas to be covered.

#### SECTION 2- PRODUCTS

##### 2.01 MATERIALS

- A. Random Rip-Rap
  - 1. Rip-Rap shall consist of hard, durable angular filed or rough unhewn quarry stone as nearly uniform in section as possible. The stone shall be dense, resistant to the action of air, water and suitable for the purpose intended. Gradation of the rip-rap shall conform to the following:

Stone Weight, Pounds	Cumulative Percent Lighter by Weight
100	100
40	50-100
20	15-30
<20	0-5

- 2. Recommended Thickness: 12-inches
  - 3. D50: 4.7" (D50= Size of rock in rip-rap of which 50 percent by weight is finer).
  - 4. Spalls and rock dust that will pass a three inch sieve shall not represent more than five percent by weight.
  - 5. Flat or needle shapes shall not be used unless the thickness of the piece is more than one-third the length.
- B. Grouted Rubble Rip-Rap:

1. Provide portland cement mortar grouted rip-rap in locations as shown on the Drawings.
2. Stone shall meet all applicable requirements listed above for random rip-rap.
3. Consistency of the grout shall be approved by the ENGINEER.

### **PART 3 – EXECUTION**

#### **3.01 PLACING**

- A. Subgrade: The subgrade for rip-rap bedding shall be prepared to the required lines and grades. When rip-rap is below normal stream level the subgrade shall be mucked out to the grade required. All loose material shall be removed.
- B. Random Rip-Rap:
  1. The minimum total thickness of the rip-rap layer shall be 12 inches except where otherwise indicated.
  2. The stones shall be placed from the bottom of the embankment upward such that the weight of the stone is carried by the underlying material. The larger stones shall be placed in the lower courses.
  3. Open joints shall be filled with spalls.
  4. Rip-rap may be placed by equipment; however, care shall be taken in placing to obtain a good gradation of material such that the rip-rap is firm and solid. Surfaces shall be barred to the required alignment and slopes. Large voids shall be filled by hand placement of stone unless otherwise approved by the ENGINEER.
- C. Grouted Rip-Rap:
  1. Stones shall be placed as described above for random rip-rap and grouted with portland cement mortar.
  2. Unless hand mixing is specifically approved by the ENGINEER, grout shall be machine mixed for not less than 1-1/2 minutes.

**END OF SECTION**



## SECTION 321123

### CRUSHED LIMESTONE BASE

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. This item shall consist of furnishing all materials, labor, equipment and performing all work necessary for the construction of a limestone base course on a prepared subgrade in accordance with the lines and grades shown on the CONTRACT DRAWINGS and the requirements of these SPECIFICATIONS.
- B. Where directed, limestone base courses shall be installed for use as temporary access and as permanent gravel drives, roadways, roadway bases and shoulders, utility trench repairs, bases and site surfaces for wells, tanks, pumping stations and metering stations etc., with a compacted finished thickness as required by the Contract Drawings.

##### 1.02 APPLICABLE DOCUMENTS

- A. The latest edition of the following publications form a part of this Specification and where referred to by basic designation only, are applicable to the extent indicated.
- B. American Association of State Highway and Transportation Officials (AASHTO)
  - 1. T96 Resistance to Abrasion of Coarse Aggregate by Use of the Los Angeles Machine.
  - 2. AASHTO T 180 (1993) Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-in (457 mm) Drop
- C. **Arkansas Standard Specifications for Road and Bridge Construction, Latest Edition.**
- D. **AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM), LATEST EDITION**

#### PART 2 - MATERIALS

##### 2.01 GENERAL

- A. Crushed limestone shall meet the gradation of the following table.

CRUSHED STONE GRADATION LIMITS	
Sieve Size	Percent Passing
1-1/2 inch	100
1 inch	90-100
3/4 inch	70-100
1/2 inch	62-90
3/8 inch	50-80
No. 4	40-65
No. 40	12-26
No. 200	5-12

- B. The portion of the crushed stone passing the No. 40 sieve shall have a liquid limit not greater than 25 and a plasticity index of not greater than 5.

## **2.02 SOURCE AND TESTING**

- A. The limestone base material shall be obtained from a source to be furnished by the CONTRACTOR and reviewed by the Engineer. The CONTRACTOR shall designate his proposed source and shall submit certified test results to the Engineer for approval prior to starting the placement of the material on the project.
- B. Testing shall be completed as specified herein and as directed by the Engineer. Tests shall be completed by a certified laboratory approved by the Engineer and results shall be submitted in duplicate to the Engineer. Testing shall be an absorbed cost item.

## **PART 3 – CONSTRUCTION REQUIREMENTS**

### **3.01 GENERAL REQUIREMENTS**

- A. Subgrade: Prior to placing base course material, the subgrade surface shall be checked by the ENGINEER. Any ruts or soft yielding places that appear by reason of poor drainage conditions, hauling or from any other cause shall be corrected, rolled to required compaction and shaped before the base course is placed thereon.
- B. Placing and Spreading: Base course material may be spread in one or two equal lifts. The base material shall be deposited and spread in a uniform layer without appreciable segregation of the material. Addition of water or drying will be required as needed to produce a material which can be compacted to the required density.
- C. Compacting: Base course compaction may be performed with sheepsfoot, pneumatic or steel-wheeled rollers, or a combination of rollers; however, if the equipment and product selected by the CONTRACTOR proves to be unsatisfactory, the ENGINEER may order the CONTRACTOR in writing to make the necessary revisions. Compaction equipment found to be in poor condition by the ENGINEER may be ordered replaced. Final rolling shall be accomplished with a pneumatic or steel-wheeled roller.
  - 1. Each layer of base material shall be rolled and compacted to a density of 100% of standard Proctor density at moisture contents within 2 percentage points of the optimum water content..
  - 2. Irregularities or depressions that develop under rolling shall be corrected by loosening the material at such places and adding or removing materials. During the rolling operations the shape of the base course shall be maintained by blading.
- D. Surface and Thickness Requirements: the surface of the completed base shall present a uniform appearance and smooth surface without sharp breaks or depressions which will hold water. The finished grade and typical section shall be as close to that shown on the CONTRACT DRAWINGS as can be constructed with proper and expert manipulation of a motor grader to within plus or minus one half (.5) inch of true grade. The thickness of the completed base course shall not vary more than one half (0.5) inch from that shown on the DRAWINGS.

### **3.02 MAINTENANCE**

- A. The base material shall be maintained by watering, light blading and rolling, when required, in order to prevent loss of material and in order to preserve the line, grades and cross sections of the construction.
- B. Maintenance shall continue until acceptance of the project. Provide additional material as directed by the Engineer to fill low areas as needed to maintain grades.

**3.03 SUBMITTAL DATA**

- A. Submit certified gradation test results for review. Designate source of supply. Submit subgrade compaction analyses to the Engineer.

**END OF SECTION**

## SECTION 321216

### ASPHALT PAVING

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

- A. This item shall include furnishing of all labor, materials, equipment and incidentals required for paving of roads and parking areas in accordance with the Contract Drawings and these Specifications.
- B. Paving shall be performed with machinery equipped with a 40 foot ski attachment for grade control.
- C. Any required adjustments of existing utilities will be performed by Owner.
- D. Dimensions shall be as indicated on the Drawings.

#### PART 2 – PRODUCTS

##### 2.01 GENERAL

- A. All materials for asphalt paving and related work shall comply with Mississippi Standard Specifications for State Aid Road and Bridge Construction, 1989 Edition as follows:
  - 1. Plant mix pavements General Section 401
  - 2. Base course Section 301
  - 3. Tack coat Section 407
  - 4. Binder course Section 403
  - 5. Surface course Section 403
- B. As used in this specification, the following abbreviations shall apply:
  - 1. BB- Black Base
  - 2. TC- Tack Coat
  - 3. BC- Binder Course
  - 4. SC- Surface Course
- A. The term “course” used in this Section shall be understood to mean a layer of specified thickness shown on the plans and for which quantities are estimated on the plans and in the proposal as the basis for bidding. A course may, in some cases consist of a single layer, and, in other cases, may consist of two or more layers depending on the finished thickness specified.

#### PART 3 – EXECUTION

##### 3.01 BASE COURSE (BLACK BASE): Number BB-1

- A. General: Where indicated on the Drawings this work shall consist of the construction of a base course in one or more courses composed of mineral aggregates mixed in a central mixing plant with bituminous materials in the proportions specified and placed hot. The base course shall be constructed on a prepared subgrade foundation in accordance with these specifications and in close conformity with the thickness, lines, grades and sections as shown on the plans.
- B. The base course shall comply with Section 301, Plant Mix Bituminous Base Course, of the Mississippi Standard Specifications for State Aid Road and Bridge Construction, 1989 Edition. Bituminous black base shall be BB-1, Type 6.
- C. The Contractor will have the testing lab furnish to the Engineer, for approval, prior to placing any base material, a job mix formula for the project.
- D. The job mix formula shall be set within the master range as indicated below. The job mix formula shall be maintained within the job mix tolerance and shall not exceed the limits of the ranges.
  - 1. The job mix temperatures shall be between 250 degrees Fahrenheit minimum and 350k0 degrees Fahrenheit maximum unless otherwise specified.
  - 2. The job mix formula as approved shall be considered as tentative until a sufficient amount of the mixture has been processed through the plant, spread and compacted.
  - 3. Extractions shall be made on samples of each mixture, produced by a plant, before any mixture is placed on the project.
  - 4. After the job mix formula is approved, the mixture furnished to the project shall remain unchanged, within the tolerances specified for the mixture, throughout the duration of the job. No change in properties or proportions of any ingredient of the mix shall be made without written permission of the Engineer.
- E. The gradation of the mixture shall meet the following Design Master range requirements:

Sieve Size	Percentage Passing Sieve (by Weight)	Tolerances for job Mix Formula
1-1/2 inch	100	±6%
1 inch	83-100	±6%
¾ inch	-----	-----
½ inch	56-95	±6%
3/8 inch	-----	-----
No. 4	29-70	±5%
No. 8	19-54	±5%
No. 30	8-30	±4%
No. 50	4-20	±4%
No. 200	2-10	±1.5%
Min. % A.C. by wt of Mix	4	±0.4%

- F. Bituminous Materials shall be petroleum asphalt cement grade AC-30, unless otherwise specified.
- G. Mineral Filler shall meet requirements of Section 703.16 of the Mississippi State Aid Specifications. Mineral filler may be used as necessary to obtain desired properties; however, excessive use shall not be permitted in the mix.

- H. Weather Limitations: Base course shall be placed on a dry unfrozen surface and only when the air temperature meets the limitation requirements of 401.03 of the Mississippi State Aid Specifications.
- I. Density: The average lot density of all bituminous base courses shall not be less than 92.0 percent nor more than 95.0 percent of the maximum density based on AASHTO T-209. When borderline results are obtained on density tests, it shall be the Contractor's responsibility to furnish and use the appropriate number, type, and size of rollers as necessary to consistently obtain the required density. When the furnished compactive effort does not produce the required density, the Contractor shall make such approved adjustments as necessary to obtain the required density. Pavement samples obtained for determining density and/or correlation of the nuclear density gauge which have a thickness less than eight inches greater than the maximum size aggregate permitted by the job-mix formula will not be used as a representative sample.
- J. Lower layers of base course shall not exceed four inches in compacted thickness (plus the allowable tolerance). The top layer shall have a maximum compacted thickness of three inches (plus the allowable tolerance).
- K. Surface tolerance shall conform to the designated grade and cross section within the tolerances set forth in Section 301.03.2 of Mississippi State Aid Specifications.

### **3.02 TACK COAT (Required Full Width)**

- A. General: This work shall consist of preparing and treating an existing bituminous or concrete surface with bituminous material in accordance with these specifications and in close conformity with the lines shown on the plans or established by the Engineer. A tack coat shall be applied, for full width of the course to be superimposed on a previously prepared, bonded, and bituminized road surface or base or concrete surface or base. The tack coat may be omitted from a previously primed road when deemed by the Engineer to be unnecessary.
- B. Tack coat is to be applied between each lift or course of asphalt pavement unless otherwise specified by the Engineer.
- C. A tack coat shall be applied over the base course and shall consist of 0.05 to 0.10 gallons per square yard of bituminous material of the same A.C. grade as specified for the base course mix designs specified in Section 407 of Mississippi Standard Specifications for State Aid Road and Bridge Construction, 1989 Edition.
- D. Tack coat shall not be applied during wet or cold weather, after sunset or to a wet surface and only on as much pavement as can be covered with additional courses in the same day. The surface to receive tack coat shall be prepared in accordance with Section 401.03.0 of Mississippi State Aid Specifications.
- E. Separate Payment for tack coat shall not be made. The tack coat shall be an absorbed item.

### **3.03 BINDER COURSE, NUMBER BC-1**

- A. This work shall consist of the construction of a binder course, thickness indicated on the drawings, in accordance with Contract Drawings, and Mississippi Standard Specifications for State Aid Road and Bridge Construction, 1989 Edition, Section 403, Hot Bituminous Pavement.
- B. A job mix formula shall be submitted to the Engineer, for approval, prior to placing any binder course. See paragraph C of this Section.

- C. The gradation of the aggregates for the mixture shall meet the following Design MasterRange requirements.
- D. At least 20% of the total combined aggregate by weight shall be limestone or slag.
- E. The gradation of the mixture shall meet the following Design Master range requirements.

Sieve Size	Percentage Passing Sieve (by Weight)	Tolerances For Job Mix Formula
¾ inch	100	±6%
½ inch	82-100	±6%
3/8 inch	71-91	±6%
4 inch	40-73	±5%
No. 8	26-58	±5%
No. 30	9-30	±4%
No. 50	6-20	±4%
No. 200	2-10	±1.5%
Min. % A.C. by wt of Mix	4.0	±0.4%

- F. Bituminous materials shall be petroleum asphalt cement grade AC- 30, unless otherwise specified.
- G. Density: The average lot density of all bituminous base courses shall not be less than 92.0 percent nor more than 95.0 percent of the maximum density based on AASHTO T-209. When borderline results are obtained on density tests, it shall be the Contractor's responsibility to furnish and use the appropriate number, type, and size of rollers as necessary to consistency obtain the required density. When the furnished compactive effort does not produce the required density, the Contractor shall make such approved adjustments as necessary to obtain the required density. Pavement samples obtained for determining density and/or correlation of the nuclear density gauge which have a thickness less than three-eighths inch greater than the maximum size aggregate permitted by the job-mix formula will not be used as a representative sample.
- H. Mineral filler shall meet requirements of Section 703.16 of Mississippi State Aid Specifications. Mineral filler may be used as necessary to obtain desired properties; however, excessive use shall not be permitted in the mix.
- I. Tests for stability determination, if required, will be made in accordance with Section 401.02.2.1, Mississippi State Aid Specifications.
- J. Weather Limitations: Binder course shall be placed on a dry unfrozen surface and only when the air temperature meets the limitation requirements of 401.03 of the Mississippi State Aid Specifications.
- K. Surface Tolerances: Surface tolerances shall conform to the designated grades and cross-section, within the tolerances set forth in Section 403.03.2. Surface Tolerances of Mississippi State Aid Specifications.

**3.04 SURFACE COURSE, NUMBER SC-1**

- A. This work shall consist of the construction of a surface course, thickness

indicated on the drawings, in accordance with Contract Drawings, Mississippi Standard Specifications for Aid Road and bridge Construction, 1989 Edition, Section S-403, Hot Bituminous Pavement. Hot Bituminous surface course shall be SC-1, Type 8.

- B. A job formula shall be submitted to the Engineer, for approval, prior to placing any surface course. See Paragraph C of this Section
- C. The gradation of the aggregates for the mixture shall meet the following Design Master range requirements.
- D. 20 to 30% of the total combined aggregate by weight shall be limestone or slag of which 30 to 65% shall pass the No. 8 sieve.
- E. The gradation of the mixture shall meet the following Design Master range requirements.

Sieve Size 1	Percentage Passing Sieve (by Weight)	Tolerances For Job Mix Formula
½ inch	100	±6%
3/8 inch	87-100	±6%
No. 4	54-80	±5%
No. 8	32-63	±5%
No. 30	12-23	±4%
No. 50	6-20	±4%
No. 200	2-10	±1.5%
Min. % A.C. by wt of Mix	4.0	±0.4%

- F. Bituminous materials shall be petroleum asphalt cement grade AC-30, unless otherwise specified.
- G. Density: The average lot density of all bituminous base course shall not be less than 92.0 percent nor more than 95.0 percent of the maximum density based on AASHTO T-209. When borderline results are obtained on density tests, it shall be the Contractor's responsibility to furnish and use the appropriate number, type, and size of rollers as necessary to consistently obtain the required density. When the furnished compactive effort does not product the required density, the Contractor shall make such approved adjustments as necessary to obtain the required density. Pavement samples obtained for determining density and/or correlation of the nuclear density gauge which have a thickness less than three-eighths inch greater than the maximum size aggregate permitted by the job-mix formula will not be used as a representative sample.
- H. Mineral filler shall meet requirements for Section 703.16 of Mississippi State Specifications. Mineral filler may be used as necessary to obtain desired properties; however, no more than 3% of mineral filler by wt. of the total aggregate blend shall be permitted in the mix.
- I. Tests for stability determination, if required, will be made in accordance with Section 401.02.2.1, Mississippi State Aid Specifications.
- J. Weather Limitations: Surface course shall be placed on a dry unfrozen surface and only when the air temperature meets the limitation requirements of 401.03 of the Mississippi State Aid Specifications.



- K. Surface Tolerances: Surface tolerances shall conform to the designated grades and cross-section, within the tolerances set forth in Section 403.03.2, Surface Tolerances of Mississippi State Aid Specifications.

**3.05 PRE-ROLLING**

- A. Prior to application of base course, the sub-base shall be pre-rolled as may be required to determine possible presence of underlying soil failures.

**3.06 TESTING**

- A. The Contractor shall have the certified testing laboratory furnish test reports for applicable properties of each required asphalt mix. The asphalt mixture quality tests shall include an asphalt extraction to determine asphalt content and aggregate gradation, determination of maximum theoretical specific gravity (Rice Method), calculation of laboratory air voids, and determination of Marshall stability and flow properties. One set of asphalt mixture quality tests shall be conducted for each half-day of production. A minimum of five (5) field density tests (cores or nuclear gauge) shall be conducted for each day's production. The test results shall be submitted to the ENGINEER prior to approval of any pay request.
- B. Results of all testing shall be submitted to the Engineer in triplicate.
- C. Any prior use testing or certification costs shall be borne by the Contractor. Testing of the plant mix in the laboratory shall be paid for by the Contractor.

**END OF SECTION**

## SECTION 321313

### CONCRETE ACCESSORIES

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

- A. Scope:
  - 1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install concrete accessories.
  - 2. The types of concrete accessories required include the following:
    - a. Construction joints.
    - b. Expansion joints and fillers.
    - c. Control joints.
- B. General: All joints subject to hydrostatic pressure shall be provided with continuous water stop.
- C. Related Work Specified Elsewhere:
  - 1. Section 321313, Concrete Formwork.

##### 1.02 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
  - 1. ACI301, Specifications for Structural Concrete for Buildings, Chapter 6, Joints and Embedded Items.
  - 2. ASTM A 36, Structural Steel.
  - 3. ASTM D 1752, Preformed Expansion Joint Fillers for Concrete paving and Structural Construction.
  - 4. ASTM B 164, Nickel-Copper Alloy Rod and Bar.
- C. All manufactured items shall be installed in accordance with manufacture's instructions.

##### 1.03 SUBMITTALS

- A. Samples: Submit for approval the following samples:
  - 1. Cork expansion joint fillers.
  - 2. Multi-polymer plastic bearing strips.
- B. Shop Drawings: Submit for approval the following:
  - 1. Manufacturer's specifications and installation instructions for all materials required.
  - 2. Layout of all construction joint locations prior to the submittal of steel reinforcing drawings.
  - 3. Detail for joining polyvinyl chloride to steel water-stops.

## **PART 2 – PRODUCTS**

### **2.01 WATER-STOPS**

Adequate water stops of metal, rubber, or plastic shall be placed as shown on the plans. Where movement at the joint is provided for, the water stops shall be of a type permitting movement without injury. They shall be spliced, welded, or soldered to form continuous water-tight joints.

### **2.02 PERFORMED EXPANSION JOINT FILLER**

Provide performed expansion joint filler complying with ASTM D 1752, Type II, cork. Joint sealant shall be approved by the Engineer.

### **2.03 CONCRETE CONSTRUCTION JOINT ROUGHENER**

- A. Provide a water soluble non-flammable, surface-retardant roughener.
- B. Product and Manufacturer: Provide one of the following:
  - 1. Rugasol-S by Sika Chemical Corporation, for horizontal joints only.
  - 2. EAC-S by Preco Industries, Ltd., for horizontal joints only.
  - 3. Tuf-Cote (Deep Etch) by Preco Industries Ltd., for vertical joints.
  - 4. Or equal.

### **2.04 EPOXY BONDING AGENT**

- A. Provide an epoxy-resin bonding agent, two component, polyamide type.
- B. Product and Manufacturer: Provide one of the following:
  - 1. Sikadur Hi-Mod by Sika Chemical Corporation
  - 2. Epoxite Binder (Code #2390) by A.C. Horn, Inc.
  - 3. Or equal.

### **2.05 PERFORMED BEARING STRIPS**

- A. Provide a multipolymer plastic bearing strip with a coefficient of friction less than .01. Bearing strip to be 1/8 inch thick by nine inches wide.
- B. Product and Manufacturer:
  - 1. Korolath bearing strips by Koro Corporation.
  - 2. Or equal.

### **2.06 ANCHOR BOLTS**

- A. These shall conform to ASTM A675, Grade 50. Anchor bolts shall be galvanized on all exposed surfaces in accordance with ASTM A153.
- B. Set all anchor bolts by template, rigidly secure the bolts in place to prevent their displacement, and verify all bolt locations before placing concrete, so that the bolt locations in the completed foundations in the completed foundations will conform accurately to the bolt setting dimensions indicated on the foundation drawings.

## **PART 3 – EXECUTION**

### **3.01 INSPECTION**

Examine conditions under which joints are to be installed, and notify ENGINEER in writing of unsatisfactory conditions existing. Do not proceed with the Work until unsatisfactory conditions or deficiencies have been corrected in a manner acceptable to ENGINEER.

### **3.02 CONSTRUCTION JOINTS**

- A. Comply with ACI 301, Chapter 6, and as specified below.
- B. Locate and install construction joints as shown.
- C. Horizontal Joints:
  - 1. Roughen concrete at the interface of construction joints in accordance with instructions of the manufacturer of joint roughener. Immediately before placing fresh concrete, thoroughly clean the existing contact surface using a stiff brush or other tools and a stream of water under pressure. The surface shall be clean and wet, but free from pools of water at the moment the fresh concrete is placed.
  - 2. Remove laitance, waste mortar or other substance which may prevent complete adhesion.
  - 3. Place a 2-inch thick coat of mortar, of similar proportions to the mortar in the concrete, over the contact surface of the old concrete. Place fresh concrete before the mortar has attained its initial set.
- D. Vertical Joints:
  - 1. Apply roughener to the form in a thin, even film by brush, spray or roller in accordance with the manufacturer's instructions. After roughener is dry, concrete may be placed.
  - 2. When concrete has been placed and the form removed, wash loosened material off with high pressure water spray to obtain roughened surface subject to approval by ENGINEER.
- E. Place two layers of 1/8 inch thick bearing strips on concrete bearing surface prior to placing concrete slab to provide sliding bearing as shown.

### **3.03 EXPANSION JOINTS**

- A. Comply with ACI 301, Chapter 6, and as specified below.
- B. Locate and install expansion joints as shown. Install cork filler and sealant in accordance with manufacturer's instructions.

### **3.04 BONDING WITH EPOXY ADHESIVE**

- A. Use adhesive for the following:
  - 1. Bonding of fresh concrete to concrete cured at least 28 days or to existing concrete.
  - 2. Bonding of horizontal construction joints where these are required by the Drawings or approved by ENGINEER for foundation mats that are five feet thick or greater.

- B. Handle and store epoxy adhesive in compliance with the manufacturers printed instructions, including safety precautions.
- C. Mix the epoxy adhesive in complete accordance with the instructions of the manufacturer.
- D. Before placing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy grout not less than 1/16-inch thick. Place fresh concrete while the epoxy material is still tacky, without removing the in-place grout coat, and as directed by the epoxy manufacturer.

**END OF SECTION**

## SECTION 321314

### CONCRETE PLACEMENT

#### PART 1 – GENERAL

- 1.01 SCOPE:** This work consists of furnishing and placing Portland cement concrete for specified concrete structures in accordance with these specifications and in reasonable close conformity with the lines, grades, and dimensions shown on the plans or established by the ENGINEER.

The CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to provide cast-in-place concrete for concrete structures as shown and specified.

#### PART 2 – PRODUCTS

##### 2.01 CONCRETE:

- A. Strength: Unless noted otherwise on the construction plans, concrete shall develop at least 3,000 psi (4000 psi for dumpster slabs) compressive strength in 28 days, and have a 4" maximum slump.

- A. Materials: All materials for asphalt paving and related work shall comply with Mississippi Standard Specifications for Road and Bridge Construction, 1990 Edition as follows:

Portland Cement	Section 701.01 and Section 701.02
Admixtures	Section 713.02
Fly Ash	Section 714.05
Fine Aggregate	Section 703.02
Coarse Aggregate	Section 703.03
Lightweight Aggregate and their Concrete Making Properties	Section 703.19 and 804.02.7.3
Curing Materials	Section 713.01
Joint Materials	Section 707.01, 707.02, and 707.07
Structural Steel Joints and Bearing Devices	Section 717.01
Steel Copper	Section 716.07.2
Bronze Bearing Devices	Section 716.06
Self-Lubricating Bearing Plates	Section 716.08
Bearing Pads	Section 714.10
Wire Rope or Cable for Pre-stressed Concrete	Section 700.01 and 711.03
Sprayed Finish for Concrete Surface	Section 714.12
Reinforcing Steel	Section 711.02

- B. Use, Care, and Handling: The use, care, and handling of materials shall conform to the applicable requirements of Section 501.03.10 of the Mississippi Standard Specifications for Road and Bridge Construction, 1990 Edition, and specific requirements of Sections 804.02.4 and 804.02.5. Unless otherwise authorized, only fine aggregate or coarse aggregate of one type and from the same source shall be used in the construction of any one unit of a structure.

- C. Properties of aggregates used in the mix design shall conform to Section 703 of the Mississippi Standard Specifications for Road and Bridge Construction, 1990 Edition.

- D. In general, a mixture shall be used which contains the minimum quantity of water consistent with the required workability of water consistent with the required workability and shall be such that:
1. The mortar clings to the coarse aggregate;
  2. The concrete is not sufficiently fluid to segregate when transported to the place when deposited in forms and vibrated;
  3. The concrete shall settle into place when deposited in forms and vibrated;
  4. The mortar shall show no free water when removed from the mixer; and
  5. The upper layer of the set concrete shall show a cement film on the surface but shall be free from laitance.
- E. Air Entered Concrete:
1. When air-entered concrete is specified or permitted, it shall be produced by addition at the mixer of an approved air-entering agent.
  2. Air-entered concrete shall contain at least three and not more than six percent air.
  3. Tests will be made on fresh representative samples of concrete. All tests will be subject to check test at the request of the CONTRACTOR.
  4. The quantity of air-entraining admixture shall be as recommended by the manufacturer and approved by the ENGINEER. However, no adjustment in compensation will be made when the CONTRACTOR is required to use larger or smaller quantities of the agent in order to produce the specified air content.
  5. The CONTRACTOR shall follow an approved procedure and use an approved automatic dispenser for adding the admixture to each batch. He shall maintain an adequate supply of admixture in the supply tank of the dispensing equipment and will be responsible for uniform operation of the equipment at all times during progress of the work.
- F. Admixtures and Additives
1. Admixture may be used with written permission from the ENGINEER or where provided for elsewhere in the contract. Subject to these provisions, admixtures to minimize segregation, to improve workability, to reduce the quantity of mixing water, to retard or accelerate setting time, or to accelerate development of strength may be used at the dose rate approved by the ENGINEER (Reference Section 713.02 of the Mississippi Standard Specifications for Road and Bridge Construction, 1990 Edition). Admixtures may not be used to replace cement.
  2. Admixtures containing chlorides will not be permitted unless specifically approved by the ENGINEER.
  3. Should the CONTRACTOR request and obtain permission to use admixtures for his own benefit, he shall furnish and incorporate them in the concrete mixture at his expense.
  4. Admixtures shall be dispensed in liquid form. Dispense for admixtures shall have sufficient quantity to measure at one time the full quantity required for each batch. All admixtures, except super-plasticizers, shall be dispersed uniformly into the mixing water. Unless liquid admixtures are mixed with pre-measured water for the batch, adequate provisions shall be made for discharging the admixture or additive uniformly into the flow of mixing water in such a manner as to uniformly disperse them into the water beginning to end of its flow into the mixer. As a check on the efficiency of the dispersing equipment, the ENGINEER may at his discretion make multiple air-content or other checks of any batch of concrete to

determine the uniformity of dispersion. Equipment for measure shall be designed for convenient confirmation of the accuracy of measurement.

5. When more than one liquid admixture is used, each shall be dispersed by separate equipment and not intermixed unless otherwise permitted in writing by the ENGINEER.

## **PART 3 – EXECUTION**

### **3.01 MIXING**

- A. Unless otherwise authorized, concrete shall be machine mixed.
- B. When air-entered or other admixtures are added at the mixer, the CONTRATOR shall provide separate approved scales for each admixture to be proportioned by weight, and accurate measures for each admixture to be proportioned by volume. The quantities to be introduced will be approved by the ENGINEER.
- C. All equipment necessary for construction of the applicable component of a concrete structure shall be available when required, in first class working condition, and approved by the ENGINEER before construction of the component will be permitted to start.
- D. Except when hand-mixing is specifically authorized, all concrete shall be mixed in a mechanically operated batch mixer of approved size and type.
- E. As soon as practicable after award of the contract, the CONTRACTOR shall furnish the ENGINEER the exact locations of the sources of the materials he proposes to use and sample shall be submitted as required. A design of the mix will be made and the proportions officially designated. The designated proportions shall be used so long as the materials retain the same physical characteristics, included specific gravity, and so long as they continue to meet the requirements herein specified, subject only to slight changes in the relative quantities of fine and coarse aggregates for the purpose of adjusting for free moisture.
- F. Concrete shall be mixed only in the quantity required for immediate use. Concrete which has developed initial set shall not be used. Concrete which has partially hardened shall not be retempered or remixed.
- G. The first batch of materials placed in the mixture shall contain an excess of cement, sand, and water sufficient to coat the inside of the drum without reducing the required mortar content of the mix.
- H. The entire contents of an individual drum shall be emptied before materials for a succeeding batch are placed therein. Upon cessation of mixing for an extended period, the mixer shall be thoroughly cleaned.
- I. Ready-mix concrete
  1. Ready-mix concrete shall be understood to mean concrete manufactured for delivery to the site of the work in a plastic state and delivered as herein after specified.
  2. Ready-mix concrete shall be of the same design and meet the same requirements set out for concrete mixed at the site.
  3. Mixers may either be stationary mixers or truck mixers. Agitators may be either truck mixers or truck agitators.



4. Each mixer and agitator shall be examined daily for changes in condition such as accumulation of concrete or mortar, excessive wear, etc., which may impair its capability. When such condition develops, approval of the unit will be withdrawn until the condition is corrected.
5. Each stationary mixer, truck mixer, and truck agitator shall have attached in a prominent place a metal plate showing the manufacturer's rated capacity and the speeds for mixing and for agitating.
6. The maximum size of the batch, the mixing speed, and the agitating speed shall those designed by the manufacturer for the equipment.
7. Stationary mixers: Shall be equipped with an approved device for timing each batch and shall have a timing device which will not permit the batch to be discharged until the specified mixing time has elapsed. The mixer shall have a regulator to control the mixing speed. These appliances shall be in proper working condition at all times when the mixer is in operation. Mixer drums shall be watertight, and the blades in the drum shall not be less than 85% of their designed size.
8. Truck mixers and Truck Agitators: Truck mixers and truck agitators, unless otherwise authorized in writing by the ENGINEER, shall be of the revolving drum type and shall be watertight. Truck mixers shall be so constructed that the concrete can be mixed at the prescribed rate to insure a uniform distribution of the material throughout the mass. Truck mixers and truck agitators shall be constructed so that the concrete can be agitated at the prescribed rate until delivered to the work. The mixing blades in the drum shall not be less than 85% of their designed size.

Except as subsequently provided, the truck mixer shall be equipped with a tank for carrying mixing water. Only the prescribed quantity of water shall be placed in the tank unless the tank is equipped with a device by which the quantity added can be readily verified. The prescribed quantity of water may be measured directly into the batch at the batching plant, in which case a tank will not be required on the truck. Truck mixers and truck agitators shall be equipped with approved automatic revolution counters which record either:

- a. Revolutions of the drums or blades when revolved at the mixing speed recommended by the manufacturer, or
- b. Revolutions of the drums or blades at any speed. In this case, the truck mixers shall remain at the batch plant until the required number of revolutions at mixing speed has been attained.

The counters shall be designed so as to prevent unauthorized resetting or tampering and located so as to provide safe and convenient inspection.

The capability of a truck mixer or truck agitator to produce to produce or deliver uniformly mixed concrete shall be determined at the commencement of work and repeated as deemed necessary.

9. Non-Agitator Trucks: Bodies of non-agitating hauling equipment shall be smooth, watertight containers and shall be capable of discharging the concrete at a satisfactorily controlled rate without segregation. The unit shall be constructed so as to deliver the concrete to the work in a thoroughly mixed an uniform mass and to discharge the concrete at or near the bottom of the container unless discharge is accomplished by tilting the body, in which case the surface of the load shall be retarded by a suitable baffle. Covers shall be provided when needed for protection.
10. Limits of Mixing and Agitating
  - a. Stationary Plants: The mixing time shall be that which will provide a satisfactory homogenous mixture. Unless otherwise specified in writing by the testing ENGINEER, the mixing time shall be not less than 50 seconds at the manufacturer's designated mixing speed. When deemed necessary to insure a satisfactory mix, the ENGINEER may designate in writing a

required mixing time. Four seconds shall be added to the specified mixing time if the timing starts the instant the skip reaches its maximum raised position. Mixing time will end when the discharge chute opens. Transfer time in multiple drum mixers will be included in the mixing time. The contents of an individual mixer drum shall be emptied before a succeeding batch is placed therein.

- b. Truck Mixers: Each batch shall be mixed for not less than 70 nor more than 100 revolutions at the speed designated by the manufacturer. Additional mixing, if any, shall be at the speed designated by the manufacturer as agitating speed. All materials, including mixing water, shall be in the mixer drum before actuating or documenting the revolutions of mixing. The mixing operation shall begin within 15 minutes after cement has been added to the aggregate or prior to the truck leaving the batching plant, whichever occurs first.

When the prescribed water is added at the batching plant and it is found that the slump requirements at the delivery site are not met, the ENGINEER or his representative may authorize controlled small quantities of water to be added to the batch to increase the slump to the specified requirements, provided necessary mixing is performed and all of these operations are performed within 45 minutes after the initial mixing is begun. In such case the ENGINEER may authorize or required for subsequent batches that a minimum of 75% of the mixing water be introduced at the plant and the remaining water be added at the job site to reduce loss by evaporation and that additional mixing be performed to insure thorough incorporation of the added water into the mix. The additional mixing shall be approved by the ENGINEER.

- c. Partial Mixing at the Central Plant: When a truck mixer is used for transportation, the mixing time at the stationary mixer may be reduced to 30 seconds provided the mixing is completed in the truck mixer. The mixing in the truck mixer shall be 50 to 80 revolutions at mixing speed.
- d. Truck Agitators: When a stationary mixer is used for complete mixing and truck agitators are used to transport the fully mixed concrete, the truck agitator shall be operated at the rate of rotation designed by the manufacturer from the time the mixed concrete is deposited into the agitator and until discharge at the site of the work.
- e. Time of Hauling and Placing Mixed Concrete: Concrete transported in a truck mixer or truck agitator shall be placed in its final position in the forms within 1 ½ hours after introduction of the mixing water to the cement and aggregate, whichever occurs first; except that in abnormal weather or under other conditions contributing the quick stiffening or unusually slow stiffening of the concrete, the ENGINEER may make a determination of a lesser or greater time for placement considering all factors affecting initial set of the concrete. When mixed concrete is transported in approved non-agitating trucks, the concrete shall be discharged at the work site within 30 minutes after the introduction of the mixing water to the cement and aggregate.

The maximum volume of mixed concrete transported in any transportation device shall not exceed the manufacturer's maximum operating capacity for the device.

- 11. Hand Mixing: When hand-mixing is authorized, it shall be done on a watertight platform and in such a manner as to insure a uniform distribution of the materials throughout the mass. Mixing shall be continued until a homogenous mixture of the required consistency is obtained.

12. Conveying Concrete: Ample and satisfactory equipment or means of conveying concrete from the mixer to the forms shall be provided.
13. Delivery: The plant supplying concrete shall have sufficient capacity and transporting apparatus to insure continuous delivery at the rate required. The rate of delivery shall be such as to provide for the proper continuity in handling, placing, and furnishing of the concrete. The rate shall be such that the interval between batches shall not exceed 20 minutes. The methods of delivering and handling the concrete shall be that which will facilitate placing with minimum rehandling and without damage to the structure or the concrete.

### **3.02 HANDLING AND PLACING CONCRETE**

- A. Prior to placing concrete, all reinforcement shall have been accurately placed in the position shown on the plans and fastened as set out in Section 805, MS Standard Specifications for Road and Bridge Construction, 1990 Edition. All sawdust, chips, and other construction debris and extraneous matter shall have been removed from the interior of the forms. Temporary struts, braces, and stays holding the forms in correct shape and alignment shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. These temporary members shall be entirely removed from the forms and shall not be buried in the concrete.
- B. All concrete shall be placed and finished during daylight hours unless otherwise specifically authorized by the ENGINEER. No concrete shall be placed until the forms and reinforcement have been inspected and approved.
- A. Except as provided for truck mixers and truck agitators, concrete shall be placed in the forms within 30 minutes after the time that the cement is first added to the mix.
- B. Concrete shall be placed so as to avoid segregation of materials and displacement of reinforcement. The use of troughs, chutes, and pipes over 25 feet in length for gravity conveyance of concrete to the forms, will not be permitted except when authorized by the ENGINEER and subject to the production of quality concrete.
- C. Only approved mechanical conveyors will be permitted.
- D. Open troughs and chutes shall be metal or metal lined. The use of aluminum pipes, chutes or other devices made of aluminum that come into direct contact with the concrete shall not be used. Where steep slopes are required, the chutes shall be equipped with baffles or be in short sections that change the direction of movement.
- E. All chutes, troughs, and pipes shall be kept clean and free from coatings and hardened concrete by thoroughly flushing with water after each run. Water used for flushing shall be discharged clear of the structure.
- F. When placing operations involve dropping the concrete more than five feet, it shall be deposited through sheet metal or other approved pipes to prevent segregation and unnecessary splashing. The pipes shall be made in sections to permit discharging and rising as the placement progresses. A non-jointed pipe may be used if sufficient openings of the proper size are provided to allow for the flow of the concrete into the shaft. As far as practicable, the pipes shall be kept full of concrete during placing, and their ends shall be kept buried in the newly placed concrete.

G. Except as hereinafter provided, concrete shall be placed in horizontal layers not more than 12 inches thick. When, with the ENGINEER'S approval, less than the complete length of a layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and compacted before the preceding layer has taken its initial set and shall be compacted so as to avoid the formation of a construction joint with the preceding layer.

H. Consolidation

Concrete, during and immediately after depositing, shall be thoroughly consolidated by the use of approved mechanical vibrators and suitable spading tools. Hand spading alone will be permitted on small structural members such as railing and small culvert headwalls. Mechanical vibration of concrete shall be subject to the following:

a. The vibration shall be internal unless special authorization of other methods is given by the ENGINEER or as provided.

b. In general, vibrators shall be a type and design approved by the ENGINEER. They shall be capable of vibration frequencies of at least 4500 impulses per minute.

For lightweight concrete, the vibrator shall be an internal type operated at 10,000 rpm, unless otherwise approved by the ENGINEER. Excessive vibration will not be permitted.

c. The intensity of vibration shall be such as to visibly affect a mass of concrete of one inch slump over a radius of at least 18 inches.

d. The CONTRACTOR shall provide sufficient vibrators to properly compact each batch immediately after it is placed in the forms.

e. Vibrators shall be manipulated so as to thoroughly work the concrete around the reinforcement and embedded fixtures and into the corners and angles of the forms.

Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete. The vibrators shall be inserted into and withdrawn out of the concrete slowly. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but shall not be continued so as to cause segregation. Vibration shall be continued at any one point to the extent that localized areas of grout are formed.

f. Vibration shall not be applied directly or through the reinforcement to sections of layers of concrete which have taken initial set. It shall not be used to make concrete flow in the forms over distances so great as to cause segregation, and vibrators shall not be used to transport concrete in the forms.

g. Vibration shall be supplemented by spading as necessary to insure smooth surfaces, in corners, and in locations impossible to reach with vibrators.

h. These provisions shall apply to the filler concrete for steel grid floors except that the vibrator shall be applied to the steel.

- i. These provisions shall apply to precast piling, concrete cribbing, and other precast members except that, if approved by the ENGINEER, the manufacturer's methods of vibrations may be used.

When hand spading is used for consolidation, a sufficient number of workmen with spading tools shall be provided. They will be required to flush a thin layer of mortar to all surfaces and thoroughly and satisfactorily consolidate the concrete.

The entire operation of depositing and consolidating the concrete shall be conducted so that the concrete shall be smooth and dense and free from honeycomb or pockets of segregated aggregate.

I. Discontinuance of Placing

- a. When placing is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete. To avoid visible joints insofar as possible upon exposed faces, the top surface of the concrete adjacent to the forms shall be smoothed with a trowel. Where a "feather edge" might be produced at a construction joint, such as in the sloped top surface of a wing wall, an inset form work shall be used in the preceding layer. Work shall not be discontinued within 18 inches thick. In the case and if permitted by the ENGINEER, the construction joint may be made at the under side of the coping.

- b. Immediately following the discontinuance of placing concrete, all accumulations of mortar splashed on the reinforcement and the surface of the forms shall be removed. Dried mortar chips and dust shall not be puddle into the unset concrete. If the accumulations are not removed prior to the concrete becoming set, care shall be exercised not to break or injure the concrete-steel bond at and near the surface of the concrete while cleaning the reinforcement. After initial set the forms shall not be jarred, and no strain shall be placed on the ends of projecting reinforcement until the concrete has sufficiently set to insure against any damage by such jarring or strain.

- J. Place concrete by methods which will completely fill entire form and encase reinforcing and other embedded items without honeycombing and air pockets. Deposit concrete as near as practicable to its final position, in layers at such a rate that at all times during placing, concrete will be plastic; no pouring planes will occur; and no thin sheets of concrete will adhere and harden on reinforcing and other embedded items before they are embedded in final concrete body. Spade and vibrate concrete so that it will flow together and completely fill all void spaces.

- K. DO NOT cast any large stones, brick, or pieces of previously hardened concrete into concrete work; place any concrete on frozen ground, mud, topsoil, or other unsuitable materials.

- L. Top surface of each pier shall be level plane, and finished pier top elevations shall not vary more than 1/4" from those specified.

M. Cold Weather Placing:

- a. No Portland cement concrete, mortar, or grout shall be placed when the atmospheric temperature is below 35°F without written permission from the ENGINEER. When the CONTRACTOR proposes to place concrete during seasons when there is a probability of temperatures lower than 40°F, he shall have available on the project the approved facilities necessary to enclose

uncured concrete and to keep the temperature of the air inside the enclosure within the ranges and for the minimum periods specified herein.

- b. When there are indications of temperatures of less than 40°F during the first four days after placement of concrete, the ENGINEER may not permit placement or he may stipulate conditions under which the concrete maybe placed and protected. Concrete required to be protected from cold temperatures will be required to be maintained between 50°F and 100°F for at least three additional days.
- c. When directed by the ENGINEER, the CONTRACTOR shall use heating equipment such as stoves, salamanders, or steam equipment as deemed necessary to protect the concrete. When dry heat is used, means of maintaining atmospheric moisture shall be provided. When directed by the ENGINEER, one or more of the aggregates and/or missing water shall be heated to a temperature of at least 70°F but more than 150°F at the time of mixing. The aggregates may be heated by steam or dry heat or by placing in the mixing water which has been heated to a temperature of not more than 175°F provided the resulting temperature of the aggregates and mixing water is at least 70°F and not more than 150°F. Frozen aggregates shall not be placed in the mixing water. The temperature of the concrete shall be at least 60°F and not more than 80°F at the time of placing. In case of extremely cold temperatures, the ENGINEER may raise the minimum temperatures for water, aggregates, and mixed concrete. When either aggregates of water are heated above 100°F, the aggregates and water shall be combined first in the mixer before the cement is added to avoid flash set.
- d. The use of salt or other chemical admixtures in lieu of heating will not be permitted.
- e. Before placing concrete, all ice or frost shall be removed from the forms and reinforcement.
- f. In the case of concrete placed directly on or in the ground, such as far footings or bottom slabs, protection and curing during cold weather may be provided as set for concrete pavement under 501.03.20.3 of the MS Standard Specifications for Road and Bridge Construction, 1990 Edition.
- g. CONTRACTOR shall assume all risk and added cost connected with the placing and protecting of concrete during cold weather. Permission given by the ENGINEER to place during such time will no way relieve the CONTRACTOR of responsibility for satisfactory results. Should it be determined at anytime that the concrete placed under such conditions is unsatisfactory; it shall be removed and replaced with satisfactory concrete by the CONTRACTOR with out extra compensation.

N. Hot Weather Placing

- a. The manufacture, placement, and protection of concrete during hot weather requires special attention to insure that uniform slump ranges and satisfactory placement qualities are maintained, that surface cracking is held to a minimum, and that design strengths are produced.
- b. When the atmospheric temperature is 95°F or above, the CONTRACTOR shall use such controls as are deemed by the ENGINEER to be necessary to produce and place concrete in as cool and uniform condition as practicable to safeguard

against improper placement characteristics or temporary or permanent damage. The ENGINEER may require any or all, but not limited to, the following precautions depending upon his determination as to the severity of the hot or arid conditions with respect to the work being performed.

1. Provide or require an adequate sprinkling system and sprinkle coarse aggregate stockpiles as necessary to keep the aggregates in a saturated condition in order to minimize variation of absorption of mixing water and to cool the aggregates by evaporation.
  2. Protect mixing water lines from the sun by adequate covering.
  3. Paint transporting containers with light colored, heat-reflective paints, or cool the surfaces of these containers by water spraying, fogging, or other effective methods.
  4. Provide for proper spacing of trucks delivering fresh concrete to the project site so that the concrete will be placed in the work after on the minimum necessary elapsed time.
  5. Fog spray with water the forms and foundations to receive the green concrete in order to reduce absorption and to cool by evaporation.
  6. Fog spray with water or otherwise protect from excessive temperatures reinforcing steel and structural steel against which fresh concrete is to be placed.
  7. Apply water spray to membrane curing surfaces after the curing compound has set in order to maintain lower daytime temperatures in the concrete.
- c. In order to minimize the number and extent of precautions required for hot weather concreting, the CONTRACTOR may use approved chemical admixtures for set retarding purposes. However, the use of set-retarding admixtures will not relieve the CONTRACTOR of the necessity of taking other precautions deemed necessary to protect the green concrete.
- d. Unless otherwise specified, additives or admixtures shall be used only with the authority of the Testing ENGINEER and subject to the conditions set forth on such authority.
- e. Unless otherwise provided in the contract, the furnishing and use of additives or admixtures and the other precautions necessary to provide satisfactory concrete shall be considered subsidiary to the furnishing and placement of the concrete, and all additional costs related thereto and risks resulting there from shall be borne by the CONTRACTOR.

### **3.03 CURING**

- A. Concrete surfaces shall be protected from premature drying by covering as soon as possible with a satisfactory curing material. When wetted burlap is used, it shall not be less than two thicknesses of Class 3 burlap or its equivalent, and the burlap shall be kept continuously and thoroughly wet. Careful attention shall be given to the proper curing and protection of concrete, and curing by the wetting methods shall continue for a period of at least seven days after placing the concrete. If high-early strength cement is used, this period may be reduced to four days.

- B. Surfaces to have Class 2 rubbed and sprayed finish and bridge deck surfaces when the atmospheric temperature is 90°F or above shall be cured only by the wetting method. The curing of concrete bridges with membrane curing will be permitted only under the conditions specified herein.
- A. Surfaces on which curing is to be by liquid membrane shall be given the required surface finish prior to the application of curing compound. During the finishing period the concrete shall be protected by the water method of curing. Concrete surfaces cured by the liquid membrane method shall receive two applications of curing compound. The first application shall be applied immediately after the finishing is completed and accepted. Prior to applying the first application, the concrete shall be thoroughly wetted with water and the liquid membrane applied just as the surface film of water disappears. The second application shall be applied immediately after the first application is set. The rate of the application of curing compound will be as prescribed by the ENGINEER with a minimum spreading rate per application of one gallon per 200 square feet of concrete surface. The coating shall be protected against marring for at least 10 days after the application of the curing compound. The coating on bridge decks shall receive attention and may require additional protection as required by the ENGINEER. All membrane marred or otherwise disturbed shall be given an additional coating. Should the surface coating be subjected repeatedly to injury, the ENGINEER may require that the water curing method be applied at once.
- B. When using curing compound, the compound should be thoroughly mixed within an hour before use. If the use of curing compound results in a streaked or blotched appearance, the method shall be stopped and water curing applied until the cause of defective appearance is corrected.
- C. Other precautions to insure the development to insure the development of strength shall be taken as directed.
- D. Adequate tarpaulins of ample size shall be on the project and used as necessary to protect the work in case of rain or other emergencies.
- E. Conditions governing the placement of concrete and the requirements for the placement, protection and curing of concrete during cold or hot weather shall conform to the limitations, conditions, and requirements stipulated in 804-03-16, of the MS Standard Specifications for Road and Bridge Construction, 1990 edition, as applicable.

**3.04 PATCHING:** As soon as practicable after form removal, first remove loose materials from honeycombs, void spaces, other defects, and holes left by removal of form tie devices, and then fill and patch these areas with cement-sand grout. Force grout in place, and finish it flush with and to match adjacent concrete surfaces.

**3.05 FINISHING:**

A. Surface finishes of exposed concrete surfaces shall be classified as follows:

- Class 1 Ordinary Surface Finish
- Class 2 Rubbed or Spray Finish
- Class 3 Tooled Finish
- Class 4 Sand-Blast Finish
- Class 5 Wirebrush or Scrubbed Finish
- Class 6 Floated Surface Finish

B. Class 1, Ordinary Finish



1. Immediately following the removal of forms, all fins and irregular projections shall be removed from all surfaces except from those which are not to be exposed or not to be waterproofed. On all surfaces, the cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges, and other defects shall be thoroughly cleaned, and after having been kept saturated with water for at least three hours shall be carefully pointed and trued with a mortar of cement and fine aggregate mixed in the proportions used in the class of the concrete being finished. Mortar used in pointing shall be not more than one hour old. The mortar patches shall be cured as specified in Section 08100-3.02. All construction and expansion joints shall be left carefully tooled and free of mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges.
2. The resulting surfaces shall be true and uniform. All surfaces which cannot be repaired to the satisfaction of the ENGINEER shall be given a Class 2 Rubbed Finish.

C. Class 2, Rubbed or Spray Finish

1. Rubbed Finish

- a. After removal of forms, the Class 1 finish shall be completed and the rubbing of concrete shall be started as soon as its condition will permit. Immediately before starting this work, the concrete shall be kept thoroughly saturated with water for at least three hours. Surfaces shall be rubbed with a medium course Carborundum stone using a small amount of mortar on its face. The mortar shall be composed of cement and sand mixed in proportions used in the concrete being finished. Rubbing shall be continued until all form marks, projections, and irregularities have been removed, all voids are filled, and a uniform surface has been obtained. The paste produced by this rubbing shall be left in place at this time.
- b. After all concrete above the surface being treated has been cast; the final finish shall be obtained by rubbing with a fine carborundum stone and water. This rubbing shall continue until the entire surface is of a smooth texture and uniform color.
- c. After the final rubbing is complete and the surface has dried, it shall be rubbed with burlap to remove loose powder and objectionable marks.

2. Spray Finish

- a. Prior to the spray finish, the concrete shall be given a Class 1 finish in accordance with Section 08100-3.05-B, supplement if necessary with a grout meeting the requirements of 714.11, of the MS Standard Specifications for Road and Bridge Construction, 1990 edition, with fine aggregate modified to require 100 percent passing the No. 16 Sieve.
- b. Grout shall be applied with burlap pads or float sponges, and as soon as the grout has dried the surface shall be brushed to remove all loose grout and the surface left smooth and free of air holes. Surfaces to be sprayed shall be free of efflorescence, flaking coatings dirt, oil, and other foreign substances. Prior to application of the spray finish, the surfaces shall be free of mixture, as determined by sight and touch, and in a condition consistent with the manufacturer's published recommendations.

- c. The spray finish shall be applied with heavy duty spray equipment capable of maintaining a constant pressure as necessary for proper application. The material shall be applied as recommended by the manufacturer except the rate of application shall not be less than one gallon per 50 square feet of surface area without prior written approval of the ENGINEER.
- d. The completed finish shall be tightly bonded to the structure and present a uniform appearance and texture equal to or better than a rubbed finish. If necessary, additional coats shall be sprayed to produce the desired surface texture and uniformity. Upon failure to adhere positively to the structure without chipping or cracking or to attain the desired surface appearance, the coatings shall be completely removed and the surface given a rubbed finish in accordance with Section 08100-3.05-C, or other approved methods shall be used to obtain the desired surface finish to the satisfaction of the ENGINEER without additional cost to the OWNER.

D. Class 3, 4, and Finishes

If required, specifications for these finishes will be contained in the special provisions.

E. Class 6, Floated Surface Finish

After the concrete has been deposited in place, it shall be consolidated and the surface shall be struck off by means of a strike board and floated with a wooden or cork float. An edging tool shall be used on edges and expansion joints. The surface shall not vary more than 1/8 inch under a 10-foot straightedge. The surface shall have a granular or matte texture which will not be slick when wet.

F. Required Finishes for Various Surfaces

Unless otherwise specified, the top surface of sidewalks, the top horizontal surfaces of footings, and top slabs of box bridges, box culverts, or other structures shall be given a Class 6 finish. All formed concrete surfaces shall be given a Class 1 finish, except on surfaces which are completely enclosed, such as the inside surfaces of cells of box girders, the removal of fins and form marks and the rubbing of mortared surfaces to a uniform color will not be required. In reference to finishing, exposed surfaces are surfaces or faces which may be seen after the backfill has been placed. Exposed surfaces requiring Class 2 finish shall be finished at least one foot below the ground line or the low water elevation, whichever is higher.

The Class 2 finish shall be made upon a Class 1 finish. After the removal of forms the Class 1 finish shall be completed and the rubbing of concrete shall be started as soon as the condition of the concrete will permit.

### 3.06 FIELD QUALITY CONTROL DURING CONSTRUCTION

A. Quality Control Testing During Construction:

- 1. Perform sampling and testing for field quality control during the placement of concrete, as directed by the ENGINEER. Sampling & testing shall be performed by a certified technician and laboratory. At a minimum, testing shall consist of:
  - a. Sampling Fresh Concrete: ASTM C 172
  - b. Slump: ASTM C 143; one test for each set of compressive strength test specimens (minimum of one per day). Maximum Slump = 4"
  - c. Air Content: ASTM C 231; one test for each set of compressive strength test specimens (minimum of one per day).

- d. Compressive Strength Tests: ASTM C 39; one set of compression cylinders (four per set) for each 30 cubic yards or fraction thereof and for each additional 100 cubic yards thereafter, of each mix design placed in any one day; one specimen tested at three days, one specimen tested at seven days, one specimen tested at 28 days, and one backup specimen.
    - 1) Adjust mix if test results are unsatisfactory and resubmit for ENGINEER'S approval.
    - 2) Concrete which does not meet the strength requirements is subject to rejection and removal from the Work, or to other such corrective measures as directed by the ENGINEER, at the expense of the CONTRACTOR.
  - e. Compression Test Specimens: ASTM C 31; make one set of four standard cylinders for each compressive strength test, unless otherwise directed. Cast, store and cure specimens as specified in ASTM C 31.
  - f. Concrete Temperature: Test hourly when air temperature is 40°F and below, and when 80°F and above; and each time a set of compression test specimens is made.
2. The testing laboratory shall submit certified copies of test results directly to the ENGINEER and the CONTRACTOR within 24 hours after tests are made. Test results must be submitted to the ENGINEER for review prior to approval of any pay request.

**END OF SECTION**

## SECTION 321315

### CONCRETE FORMWORK

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

- A. Scope: CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install the concrete formwork. The Work also includes providing openings in formwork to accommodate the Work under this and other Sections and building into framework all items such as sleeves, anchor bolts, inserts and all other items to be embedded in concrete for which placement is not specifically provided under other Sections.
- B. Coordination:
  - 1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the formwork.
  - 2. Notify other CONTRACTORS in advance of the construction of the framework to provide the other CONTRACTORS with sufficient time for the installation of items included in their contracts that must be installed with the formwork.

##### 1.02 QUALITY ASSURANCE

- A. CONTRACTOR shall examine the substratum and the conditions under which concrete formwork is to be performed, and notify the ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
  - a. ACI 347, Recommended Practice for Concrete Formwork.
- C. Allowable Tolerances: Construct formwork to provide completed concrete surfaces complying with tolerances specified in ACI 347, Chapter 3.3, except as otherwise specified.
- D. All items for permanent or temporary facilities shall be used in accordance with manufacturer's instructions.

##### 1.03 SUBMITTALS

Shop Drawings: Submit for information purposes copies of manufacturer's data and installation instructions for proprietary materials, including form coatings, manufactured form systems, ties and accessories.

##### 1.04 PRODUCTIVITY DELIVERY, STORAGE, AND HANDLING

- A. On delivery to job site, place materials in area protected from weather.
- B. Store materials above ground on framework or blocking. Cover wood for forms with protective waterproof covering. Provide for adequate air circulation or ventilation.
- C. Handle materials to prevent damage.

#### PART 2 – PRODUCTS

## 2.01 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal-framed plywood-faced or other panel type materials accepted to ENGINEER, to provide continuous, straight, smooth as-cast surfaces. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown or specified. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- B. Forms for Unexposed Finish Concrete: Form concrete surfaces that will be unexposed in the finished structure with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least two edges and one side.
- C. Form Ties:
  - 1. Provide factory-fabricated, removable or snap off metal form ties, designed to prevent form deflection, and to prevent spalling of concrete surfaces upon removal. Materials used for tying forms, will be subject to approval of the ENGINEER.
  - 2. Unless otherwise shown, provide ties so that portion remaining within concrete after removal of exterior parts is at least one-inch from the outer concrete surface. Unless otherwise shown, provide form ties that will leave a hole no larger than one-inch diameter in the concrete surface.
  - 3. Ties for exterior walls and walls subject to hydrostatic pressure shall have water stops.
  - 4. Provide wood or plastic cones for ties, where concrete is exposed in the finish structure and in the interior of tanks.
  - 5. Provide stainless steel form ties for planned exposed tie hole locations, where shown on the Drawings. When used, tie break back point shall be at least one inch from outer concrete surface.
  - 6. Wire ties are not acceptable.
- D. Forms Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting surfaces to be cured with water or curing compounds. For concrete surfaces which will be in contact with potable water, the form coating shall be a mineral oil base coating.

## 2.02 DESIGN OF FORMWORK

- A. Design, erect, support, brace and minimum formwork so that it shall safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system or in-place construction that has attained adequate strength for this purpose. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.
- B. Design forms and falsework to include values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
- C. Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.
- D. Support form facing materials by structural members spaced sufficiently close to prevent significant deflection. For forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances. For long span members

without intermediate supports, provide camber in formwork as required for anticipated deflections resulting from weight and pressure of fresh concrete and construction loads.

- E. Design formwork to be readily removable without impact, shock or damage to concrete surfaces and adjacent materials.
- F. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

## **PART 3 – EXECUTION**

### **3.01 INSPECTION**

Examine conditions under which formwork is to be installed, and notify ENGINEER in writing of unsatisfactory conditions existing. Do not proceed with the Work until unsatisfactory conditions or deficiencies have been corrected in a manner acceptable to ENGINEER.

### **3.02 FORM CONSTRUCTION**

- A. All forms shall be built mortar-tight and sufficiently rigid to prevent distortion due to pressure of the concrete and other loads incident to the construction operations. Forms shall be constructed and maintained so as to prevent warping and the opening of joints due to shrinkage. The forms shall be substantial and unyielding and shall be so designed that the finished concrete will conform to the proper dimensions and contours. The design of the forms shall take into account the effect of vibration of concrete as it is placed.
- B. Forms shall have sufficient strength to carry safely the load of concrete with a construction live load of at least 50 pounds per square foot; be stiff enough to prevent any appreciable bulging, sagging or moving out of position; be tight enough to prevent any appreciable loss of mortar; and be arranged so that they can be safely and easily removed without damaging concrete. Construct and erect forms with the fewest practicable number of joints, and to insure straight, plumb, level, and smooth concrete surfaces with all angles sharp and true to line. Use form oil and wetting as required to accomplish these results
- C. Construct forms complying with ACI 347; to the exact sizes, shapes, lines and dimensions shown as required to obtain accurate alignment, location and grades; to tolerances specifies; and to obtain level and plumb work in finish structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes. Finish shall be as determined by approved mock-up or sample panel, if specified.
- D. Fabricate forms for easy removal without damaging concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
- E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms in locations as inconspicuous as possible, consistent with requirements of the Work. Form

intersecting planes of openings to provide true, clean-out corners, with edge grain of plywood not exposed as form for concrete.

- F. Minimum requirements for slab overhang forms shall be 3/4- inch plywood supported on 2"x 6" S4S wood timbers placed flat-wise on 16-inch centers. Adjustable brackets for support of slab overhang forms shall be spaced at a minimum distance of 3'0" center to center unless specifically approved otherwise. Grade points for forms shall coincide with the location of the adjustable form brackets.
- G. Metal ties or anchorages within the forms shall be so constructed as to permit their removal, without injury to the concrete, to a depth of at least the reinforcing steel clearance shown on the plans. Nippers shall be used for green concrete. All fittings for metal ties shall be designed so that upon their removal the cavities which are left will be the smallest practicable size. The cavities shall be filled with cement mortar and the surface left sound, smooth, even, and uniform in color.
- H. Forms shall be set and maintained to the lines designated until the concrete is sufficiently cured for form removal. Forms shall remain in place for periods which shall be determined as hereinafter specified. If forms are deemed to be unsatisfactory in any way, either before or during the placing of concrete, the ENGINEER will order the work stopped until the defects have been corrected.
- I. Access to the lower portions of forms for narrow walls and columns shall be provided for cleaning our extraneous material immediately before placing the concrete.
- J. All forms shall be treated with approved oil saturated with water immediately before placing the concrete. For rail members or other members with exposed faces, the forms shall be treated only with an approved oil to prevent the adherence of concrete. Any material which will adhere to or discolor the concrete shall not be used.
- K. When metal forms are used they shall be kept free from rust, grease, or other foreign matter which will discolor the concrete. They shall be of sufficient thickness and so connected that they will remain true to shape and line, and shall conform in all respects as herein prescribed for mortar tightness, filleted corners, beveled projections, etc. They shall be constructed so as to insure easy removal without injury to concrete. All inside bolt and rivet heads shall be countersunk.
- L. All chamfer strips shall be dressed, straight, and of uniform width and shall be maintained as such at all times.
- M. Falsework:
  - 1. The CONTRACTOR shall submit to the ENGINEER four copies of structural design analysis and detail drawings which show the method of falsework or centering. These designs and detail plans shall be prepared and bear the seal of a Registered Professional Engineer with experience in falsework design.
  - 2. Falsework plans shall include falsework elevations together with all other dimensions and details which is considered necessary for construction. Other pertinent data needed is size and spacing of all falsework members and minimum bearing requirements for false piles.
  - 3. Erect falsework and support, brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct falsework so that adjustments can be made for take-up and settlement. Upon completion of falsework erection, the Registered Professional Engineer shall certify that the erected falsework is capable of supporting the load for construction.
  - 4. Falsework piling shall be spaced and driven so that the bearing value of each pile is sufficient to support the load that will be imposed upon it. The bearing value of the piles should be calculated according to the appropriate formula given in Section 803

of the Mississippi Standard Specifications for Road and Bridge Construction, 1990 Edition.

5. For designing falsework and centering, a weight of 150 pounds per cubic foot shall be assumed for green concrete. All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads without appreciable settlement or deformation. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce finished Work of required dimensions. The CONTRACTOR may be required to employ screw jackets or hardwood wedges to take up slight settlement in the falsework either before or during the placing of concrete. An allowance shall be made for anticipated compressibility of falsework and for the placement of shims, wedges, or jacks to produce the permanent structural camber shown on the plans. If during construction, any weakness develops and the falsework shows any undue settlement or distortion, the work shall be stopped, the part of the structure affected removed, and the falsework strengthened before work is resumed. Falsework which cannot be founded on a satisfactory footing shall be supported on piling, which shall be spaced, driven, and removed (reference Section 804.03.15 of the Mississippi Standard Specifications for Road and Bridge Construction, 1990 Edition) in manner approved by the ENGINEER.
6. All structures built across a public street or highway on which maintenance of traffic is required, shall have falsework so arranged that a vertical clearance of at least 13'-6", and unless otherwise specified, a horizontal clearance of at least the width of the traveled way shall be provided at all times. If the vertical clearance is less than 13'-6" or the horizontal clearance is less than the full crown width of the roadways, the CONTRACTOR shall install and maintain appropriate safety devices, clearance signs, and warning lights, and shall notify the ENGINEER sufficiently in advance of restricting the clearance for him to advise both the Traffic Control and Safety and the Maintenance Divisions.

N. Forms for Exposed Concrete:

1. Shall be of uniform thickness with a smooth inside surface of an approved type.
2. Joints shall be closely fitted to eliminate fins, stone pockets, or other variations in the surface of the concrete which would mar a smooth and uniform texture.
3. Do not use metal cover plates for patching holes or defects in forms.
4. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
5. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material that will produce bow.
6. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
7. Form molding shapes, recesses and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

O. Corner Treatment:

1. Form exposed corners of beams, walls, foundations, bases and columns to produce smooth, solid, unbroken lines, except as otherwise shown. Except as specified below for reentrant or internal corners, exposed corners shall be chamfered.
2. Form chamfers with 3/4-inch by 3/4-inch strips, unless otherwise shown, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Extend terminal edges to required limit and mitter chamfer strips at changes in direction.



3. Reentrant or internal corners and unexposed, buried corners may be formed either square or chamfered.
- P. Openings and Built-In Work:
1. Provide openings in concrete formwork shown or required by other Sections or other contracts. Refer to paragraph 1.01B herein for the requirements of coordination.
  2. Accurately place and securely support items to be built into forms.
- Q. Cleaning and Tightening: Thoroughly clean and forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

### **3.03 FORM COATINGS**

- A. Coat form contact surfaces with a non-staining form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.
- B. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

### **3.04 INSTALLATION OF EMBEDDED ITEMS**

- A. General: Set and build into the formwork, anchorage devices and other embedded items, shown, specified or required by other Sections and other contracts. Refer to paragraph 1.01B herein for the requirements of coordination. Use necessary setting, drawings, diagrams, instructions and directions.
- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support screeds.

### **3.05 FIELD QUALITY CONTROL**

- A. Before concrete placement, CONTRACTOR shall check the formwork, including lines, ties, tie cones, and form coatings. He shall make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
- B. During concrete placement CONTRACTOR shall check formwork and related supports to ensure that forms are not displaced and that completed Work shall be within specified tolerances.
- C. If CONTRACTOR finds that forms are unsatisfactory in any way, either before or during placing of concrete shall be postponed or stopped until the defects have been corrected, and reviewed by the ENGINEER.

### **3.06 REMOVAL OF FORMS**

- A. Conform to the requirements of ACI 301, Chapter 4 and ACI 347, Chapter 3.6.2.3, except as specified below.
- B. Form facing material shall remain in place a minimum of five days after concrete placement unless otherwise approved by ENGINEER.

- C. Do not remove supporting forms or shoring until the members have acquired sufficient strength to safely support their weight and the load upon them. Results of suitable control tests may be used as evidence that the concrete has attained sufficient strength.
- D. The time for removal of all forms will be subject to the ENGINEER'S approval.
- E. In the determination of the time for the removal of falsework, forms, and housing and the discontinuous of heating, consideration shall be given to the location and character of the structure, the weather and other conditions influencing the setting of the concrete, and the materials used in the mix. No forms or supports shall be removed prior and approval by the Engineer. During cold weather, removal of housing and the discontinuous of heating shall be in accordance with Section 804.03.16.1 of the Mississippi Standard Specifications for Road and Bridge Construction, 1990 Edition.
- F. At the CONTRACTOR'S option and with approval of the ENGINEER, the time for removal of forms may be determined by cylinder tests, in which case the CONTRACTOR shall furnish facilities for testing the cylinders. The facilities shall include an approved concrete testing machine of sufficient capacity and calibrated by an acceptable commercial laboratory. Tests shall be conducted in the presence of the ENGINEER'S representative to witness and record strengths obtained on each break or performed by a certified testing laboratory.
- G. Methods of form removal likely to cause overstressing of the concrete shall not be used. Forms and supports shall be removed in a manner that will permit the concrete to uniformly and gradually take the stresses due to its own weight. Centers shall be gradually and uniformly lowered in a manner that will avoid injurious stresses in any part of the structure.
- H. As soon as concrete for railings, ornamental work, parapets, and vertical faces which required a rubbed finish has attained a safe strength, the forms shall be carefully removed without marring the surfaces and corners, the required finishing performed, and the required curing continued.
- I. Prior to final acceptance of the work, the CONTRACTOR shall remove all falsework, forms, excavated material, or other material placed in the stream channel during construction. Falsework piles may be cut or broken off at least one foot below the mud-line or ground line unless the plans specifically indicate that they are to be pulled and completely removed from the channel.

### **3.07 PERMANENT SHORES**

- A. Provide permanent shores as defined in ACI 347 Chapter 3.7.
- B. Reshores will not be permitted.

### **3.08 RE-USE OF FORMS**

- A. Clean and repair surfaces of forms to be re-used in the Work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces. Form surfaces shall be subject to the ENGINEER'S approval.

The shape, strength, and rigidity, water-tightness, and surface smoothness of reused forms shall be maintained at all times. Warped or bulged lumber shall be resized before being reused. Forms which are unsatisfactory in any respect shall not be reused

**END OF SECTION**

## SECTION 321723

### PAVEMENT MARKINGS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. This Section consists of requirements necessary when furnishing Traffic Markings as required by the project Drawings and detailed in these Specifications and MDOT Specifications.
- B. Dimensions shall be as indicated on the Drawings.
- C. Where reference is made to Mississippi Department of Transportation Specifications (MDOT), it is intended to be in accordance with **Mississippi Standard Specifications for Road and Bridge Construction, Mississippi Department of Transportation , Current Edition.**

#### PART 2 - MATERIALS

##### 2.01 DESCRIPTION

- A. All materials for Traffic Markings and related work shall comply with Mississippi Standard Specifications for Road and Bridge Construction, MDOT, Current Edition as follows:

##### 2.02 THERMOPLASTIC TRAFFIC MARKINGS

- A. All thermoplastic traffic markings shall conform to the requirements of the **Current Edition of the Mississippi Standard Specifications for Road and Bridge Construction, Thermoplastic Traffic Markings**, except as amended herein.

- 1.
  - a. 4" or 6" Continuous White Per LF
  - b. 4" or 6" Continuous Yellow Per LF
  - c. 4" or 6" Skip White Per LF
  - d. Stop Bar (White) Per LF
  - e. Traffic Legend Per SF
  - f. Traffic Detail Per LF

##### 2.03 PAINTED TRAFFIC MARKINGS

- A. All painted traffic markings shall conform to the requirements of the **Current Edition of the Mississippi Standard Specifications for Road and Bridge Construction, Section 625, Painted Traffic Markings**, except as amended herein.

- 1.
  - a. 4" or 6" Continuous White Per LF
  - b. 4" or 6" Continuous Yellow Per LF
  - c. 4" or 6" Skip Yellow Per LF
  - d. Stop Bar (White) Per LF
  - e. Traffic Legend Per SF
  - f. Handicap Symbol Per Each

END OF SECTION

## SECTION 329200

### SEEDING, FERTILIZING, AND MULCHING

#### PART 1 – GENERAL

This section consists of furnishing all labor, supervision, materials, tools, incidentals and equipment, and performing all top soiling tilling, fertilizer, seeding, watering, and otherwise establishing, protecting, and maintaining seeded areas as required by the Construction Plans and these Specifications.

#### PART 2 – PRODUCTS

##### 2.01 TOPSOIL

- A. Topsoil shall be well-graded soil of good uniform quality, without detrimental admixture of subsoil, refuse and foreign material, and reasonably free of hard clods, stones, cement, brick, slag, concrete, sticks or other undesirable material harmful to plant life.
- B. Topsoil shall have a pH value of not less than 4.5 nor more than 8.0, and shall meet the following gradation requirements:

Sieve Size	
Percent Passing No. 10 Sieve, by weight	95-100
Percent Passing No. 270 Sieve, by weight	40-85
Silt (.05-.005mm)	20-65
Clay (passing .005mm)	10-35

##### 2.02 LIME

Lime shall be ground limestone containing not less than 85% of total carbonates and shall be ground to such fineness that 95% will pass through a No. 8 mesh sieve and 50% will pass through a No. 100 mesh sieve.

##### 2.03 FERTILIZER

Fertilizer shall be water soluble commercial fertilizer 13-13-13. Containers shall be kept dry until use.

##### 2.04 TEMPORARY SEED

Seeds with a minimum pure live seed content of 90 percent shall be used. They shall be of the best grade and of known vitality, purity, and germination and shall be delivered in containers bearing seed tags as required by law showing percentages of germination content and purity of seed as well as percentages of weed seed content.

All seeds shall be free of wild onion, Canadian thistle, Johnson grass, crab grass or other seeds of noxious weeds. Seed which has become wet, moldy or otherwise damaged in transit or storage will not be acceptable.

**Purity, Germination and Planting Schedule**

<u>Name</u>	<u>Percent Purity</u>	<u>Percent Germination</u>	<u>Mix (Dry Wt. Lbs. Per Acre)</u>
Spring and Summer Seeding (March to September 1)			
Hulled Bermuda	95	90	20
Tall Fescue	95	95	<u>20</u>
Total			40
Fall and Winter Seeding (September 1 to March 1)			
Unhulled Bermuda	95	90	20
Rye	95	85	15
Tall Fescue	95	90	<u>15</u>
Total			50

**2.05 LEGUMINOUS INNOCULANTS**

Inoculation media containing live nitrogen-fixing bacteria shall be supplied with all legume seed. The inoculants shall be standard, pure culture of nitrogen-fixing bacteria. Each kind of legume will require a cultural bacterium that is adapted to that particular kind of seed. The bacteria shall be supplied in convenient containers of a proper size to treat the amount of seed to be planted. The legume seeds shall be treated according to the directions, and before the expiration data for use of the media as shown on the container.

**2.06 MULCH**

Mulch shall be Class I vegetative material consisting of approved baled straw from cereal grain or common native hay crops in accordance with Section 215 and 715 of the MDOT Standard Specifications. The mulch shall have been cured properly prior to baling and shall be reasonably free of foreign grasses and weeds. All straw material shall be approved by the ENGINEER prior to use.

**2.07 WATER**

Water shall be free from oil, acid, alkali, salt and other substances harmful to growth of grass, and shall be from a source approved prior to use.

**PART 3 – EXECUTION**

**3.01 GENERAL**

All areas disturbed during construction shall be seeded and mulched. Suitable equipment for proper preparation and treatment of the ground surface and for handling and placing all required materials shall be on hand and in good condition and shall be approved by the ENGINEER before the operations are started. The types and amounts of seed to be used will depend on the planting dates and shall be in accordance with the planting schedule.

### **3.02 ORDER OF WORK**

The order of work operations shall be as follows:

- 1) Ground preparation;
- 2) Applying commercial fertilizer and Lime;
- 3) Sowing seed;
- 4) Cleaning up; and
- 5) Mulching.

### **3.03 PROTECTION**

The CONTRACTOR shall be responsible for maintaining and protecting seeded, sodded and mulch areas until final acceptance of the project. He shall take every precaution to prevent necessary foot and vehicular traffic and shall repair and restore damaged areas immediately without extra compensation.

### **3.04 GOUND PREPARATION**

Topsoil can be obtained from on-site or off-site locations. The topsoil used by the CONTRACTOR shall meet all specifications required and shall be approved by the ENGINEER. The topsoil shall be evenly spread on tilled areas to a uniform depth of at least four inches (4") (maximum depth six inches (6") after compaction. Spreading shall be performed so that turfing can proceed with a minimum of soil preparation or tilling. After preplanting fertilization is completed, the topsoil shall be compacted by rolling with a cultipacker or by other approved means. Previously established grades shall be maintained on the areas to be treated in a true and even condition; necessary repairs shall be made to previously graded areas by means of graders or other approved equipment. After the areas required to be treated have been brought to the grades shown, the soil shall be tilled to a depth of at least four inches (4") by plowing, disking, harrowing, or other approved operations until the condition of the soil is acceptable. The work shall be performed only during periods when, in the opinion of the ENGINEER, beneficial results are likely to be obtained. When drought, excessive moisture, or other unsatisfactorily conditions prevail, the work shall be stopped when directed. Undulations or irregularities in the surface shall be leveled before the next specified operation.

### **3.05 APPLICATION OF FERILIZER AND LIMESTONE**

#### **1. Fertilizer**

Fertilizer shall be distributed uniformly at a rate of 1,000 pounds per acre over areas to be seeded and shall be incorporated into the soil to a depth of at least four inches (4").

#### **2. Lime**

Immediately following or simultaneously with the incorporation of fertilizer, limestone shall be distributed uniformly at a rate of 2,000 pounds per acre, and shall be incorporated into soil to depth of at least four inches (4").

### **3.06 SOWING SEED**

All seeds shall be as indicated in the planting schedule. No seeding shall be done during windy weather or when the ground is frozen, excessively wet or otherwise in a non-tillable condition. Full use shall be taken of time and weather conditions best suited for seeding and such time of seeding shall be subject to the approval of the ENGINEER. The seed shall be sown uniformly in the specified amounts preferably by approved mechanical seeders and immediately rolled with a culti-packer or other satisfactory equipment; or covered lightly with soil by the use of a garden rake or other approved methods. All seeds shall be planted using strip markers or similar means to insure that succeeding seeded strips shall slightly overlap.

### **3.07 FINISHING AND CLEANING UP**

After seeding operations and prior to mulching, the surface shall be cleared of all stones or other objects larger than two inches (2") in diameter and of all wire, roots, brush or other objects that may interfere with subsequent mowing operations.

### **3.08 MULCHING**

- A. The rate of application of mulching material shall be two (2) tons per acre. Mulching may be performed by hand or mechanical methods. Mulching shall be placed uniformly on designate areas within twenty-four (24) hours after completion of seeding operations. Placement shall begin on the windward side areas and from tops of slopes. The mulch shall be loose enough in its final positions to allow air to circulate but the mulch shall be compact enough in its final position to partially shade the ground and reduce erosion. The mulch shall be anchored by a mulch stabilizer or other approved means. Mulch shall be punched into a minimum depth of one inch. Anchoring shall be performed along the contour of the ground surface.
- B. The use of wet vegetative materials will not be permitted and baled material shall be loose and broken thoroughly before it is placed.

### **3.09 MAINTENANANCE**

Seeding areas shall be maintained until all work or designate portions thereof have been completed and accepted. Tall grass and weeds that tend to smother the desired grass species shall be mowed, and any damage resulting from these operations shall be repaired. The CONTRACTOR at his own expense shall reseed, mulch and fertilize as necessary to establish vegetative cover. He shall maintain care of seeded areas for sixty (60) days after completion of treatment of the entire project.

**END OF SECTION**



## **SECTION 331100**

### **WATER UTILITY DISTRIBUTION**

#### **SECTION 1 – GENERAL**

##### **1.01 DESCRIPTION**

- A. The Contractor shall furnish all tools, material, labor, and equipment and perform all operations necessary to construct a complete underground water distribution system as shown on the Plans, as hereinafter specified and as directed by the Engineer.
- B. The work shall include the furnishing and installation of water mains, water services, fittings, valves, fire hydrants, and all other related appurtenances, ready for operations, including connections to all new and existing service lines and to the existing water supply. The pipe and accessories shall be installed in accordance with the requirements of these Specifications at the locations and depths indicated on the Plans.
- C. Water main shall be of Polyvinyl Chloride (PVC) or Ductile Iron (DI) as specified below.
- D. All connections to existing water mains shall be performed in the presence of a representative from the water association.
- E. The specifications of the Arkansas Department of Health shall govern all construction procedures of the water distribution system.
- F. The Contractor shall be responsible for obtaining all information, permits, meters, deposits, etc. required for connection to a water main of a public utility company.

##### **1.02 CONTRACTOR'S EQUIPMENT**

The contractor shall provide and maintain the principle equipment necessary to execute the work in an orderly and safe manner. The equipment shall consist of approved units designed or selected to perform and expedite all of the work and incidental items of construction.

##### **1.03 CONFLICTS WITH OTHER UTILITIES**

- A. Where the location of the water line is not clearly defined by dimensions on the Plans or unless otherwise directed by the Engineer, water mains shall be laid at least ten (10) feet horizontally and eighteen (18) inches vertically from any sanitary sewer or manhole (water over sewer).
- B. At locations where the water and sewer line must cross each other, the above requirements may be waived if pipe segments are centered to provide maximum spacing of the joints of both water and sewer lines and a vertical separation of at least eighteen (18) inches (water over sewer) is maintained. Where gravity-flow sewers cross above water lines, the sewer pipe, for a distance of ten (10) feet each side of the crossing, shall be either ductile iron pressure pipe without any joint closer horizontally than eight (8) feet to the crossing or shall be fully encased in concrete.

## 1.04 PROTECTION OF PROPERTY

- A. GENERAL: Existing power lines, telephone lines, trees, shrubbery, fences, water mains, gas mains, sewers, cables, conduits, ditches, embankments and other structures in the vicinity of the work, not authorized to be removed, shall be supported and protected from injury by the Contractor during the construction and until completion of the work affecting them. The Contractor shall be liable for damages done to such existing facilities and structures, as herein provided, and shall hold the Owner harmless from liability or expense for injuries, damages or repairs to such facilities. No additional compensation will be allowed for any operations of the Contractor in completing the work near, over, under or around existing utilities unless otherwise specified.
- B. UNDERGROUND UTILITIES: The type, size, location and number of known underground utilities have been shown on the Plans; however, no guarantee is made as to the true type, size, location or number of such utilities. It shall be the responsibility of the Contractor to verify the existence and location of underground utilities along the route of the work. The omission from, or the inclusion of utility locations on the Plans is not to be considered as **the nonexistence of** or a **definite location of** existing underground utilities. The Contract unit prices bid shall provide full and complete compensation for operations necessary to complete the work in accordance with the Plans and Specifications in working near, over, under or around existing utilities unless specified otherwise.
- C. RELOCATION OF EXISTING UTILITIES
1. The Contractor shall notify the Owner or Owners of the existing utilities, whether above the ground or underground, prior to proceeding with trench excavation whenever such trenching operations are within ten (10) feet of any existing utility.
  2. In the event that during construction it is determined that underground utilities, including sanitary sewers, water mains, gas mains, telephone cables, storm sewers, etc., and above ground utility facilities require relocation, the Contractor shall notify the utility Owner well in advance of his approach to such utility so that arrangements for such relocation by the Owner or the Owners of the affected utilities can be completed without delay to the Contractor's work.
  3. Should a utility be damaged from trenching operations, the Contractor shall immediately notify the Owner of the utility, necessary Emergency Operations Agency, local Law Enforcement Agency, and the project Owner and Engineer. **The Contractor shall not attempt to make repairs unless so authorized, in writing, by the affected utility owner. Duplicate copies of written authorization given to the Contractor to make repairs shall be filed with the Engineer and shall be so worded as to hold harmless The Owner and Engineer of responsibility relative to the sufficiency of the repairs.**
- D. LANDSCAPE VEGETATION: Reasonable care shall be taken during construction to avoid damage to landscape 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.

## 1.05 RAILROAD AND HIGHWAY CROSSING

Work incidental to the construction of sewer lines under streets, railroads, highways, driveways or parking areas shall be done in strict compliance with the regulations prescribed by the Owners of these properties and shall be done with extreme care to safeguard life and property. After the necessary permits and agreements for these crossings have been approved and executed, the Contractor shall confer with the representatives of the Railroad Company, the State Highway Department, the City or County, or the Owner of these properties and arrange schedules and the manner for constructing the work in accordance therewith. In general, the sewer pipe will be installed in steel casing or steel lined tunnels at all railroad, street and highway crossings unless otherwise specified.

## **1.06 MAINTENANCE**

The Contractor shall be responsible for, without any extra compensation, the maintenance of all water mains and appurtenances to the lines and grades established for the construction, for the stabilities of all backfills and the finished grades above the water mains and appurtenances, and for the repair and replacement of all the items which were damaged or removed during the construction.

## **1.07 WARRANTY**

The Contractor shall warrant all materials of construction and repair and all workmanship for a period of one (1) year from the date of final acceptance of the work. Should defects or failures occur during the period of warranty, the Contractor shall promptly take whatever steps are necessary to return the work to first class condition.

## **SECTION 2 – MATERIALS**

### **2.01 GENERAL**

All pipe and other materials shall be new and of first quality with certified tests for pipe and pipe fittings made at the manufacturers plant to assure conformance with these technical specifications. Two certified copies of each test result shall be furnished to the Engineer. The types and classes of materials incorporated into the work shall be designated by the Engineer. The Contractor shall not construe or interpret the several kinds of materials described herein as being equal in their application for the project.

### **2.02 WATER FOR CONSTRUCTION AND TESTING**

The Contractor shall be responsible for all water needed in constructing the work, flushing the completed system, testing, and other incidental needs. All water used shall be from an approved source free of pollution and shall be of a satisfactory bacteriological quality.

### **2.03 WATER PIPE AND FITTINGS**

- A. **DUCTILE IRON PIPE AND FITTINGS:** Ductile iron pipe shall be cement-mortar lined, Class 50 and shall conform to ANSI Specifications A 21.51 (AWWA C151). The working pressure shall be rated at 200 PSI plus surge allowance of 100 PSI. Wall thickness shall be at least that specified by ANSI A21.50 and AWWA C150 for the specified laying conditions.
  - 1. Joints for ductile iron pipe shall be “slip-on” type, compression type with molded rubber gasket, unless otherwise specified conforming to ANSI A21.11 and AWWA C111. Rubber gaskets and lubricants shall meet applicable requirements of ANSI A21.11 and AWWA A21.11. Joints for fittings, valves, and specials shall be mechanical joints and shall conform to AWWA C111. Material requirements

for pipe ends, glands, bolts and nuts, and gaskets for mechanical joints, where required or indicated, shall conform to AWWA C111 and ANSI A21.11.

2. Fittings shall be ductile iron and shall conform to ANSI A21.10, AWWA C110 and ANSI A21.11, AWWA C111. All fittings shall have a working pressure of 250 PSI. The minimum wall thickness of the fittings shall be determined consistent with trench conditions 'B' and not less than five (5) feet of cover.

B. PVC PLASTIC PIPE AND FITTINGS: PVC water pipe four (4) inches to twelve (12) inches shall conform to ASTM 2241 and AWWA C-900 and shall be gasket bell end, C-900, Class 150. PVC pipe shall conform with the outside diameter dimensions of ductile iron pipe to facilitate mechanical joint, ductile iron fittings conforming to AWWA C-110 and shall have cement-mortar lining conforming to AWWA C104/A21.4. PVC water pipe three (3) inches and smaller in diameter shall conform to the latest edition of ASTM D-2241 and shall be made from Type 1120 material. Joints shall be solvent weld in accordance with the latest edition

1. Joints shall be push-on joints as specified in ASTM D 3139 and shall be made in accordance with the manufacturers recommendations.
2. Rubber gaskets for push-on joints shall meet the requirements of ASTM F 477. All lubricants shall be non-toxic and not allow the growth of bacteria nor contribute to the taste or odor of water systems flushed in accordance of AWWA Standard B601.

\*NOTE: All PVC pipe shall bear the National Sanitation Foundation seal for potable water.

C. VALVES:

1. Gate Valves: **AWWA C-509 NRS Resilient Seat – Mueller, M&H or approved equal.** Gate valves shall comply with the latest edition of AWWA C-500, non-rising, iron body, and shall open counter-clockwise, and shall have a 250 psig maximum working pressure and tested to a static pressure of 500 psig. Gate valves shall be equipped with mechanical joint connections unless otherwise specified.
2. Check Valves: **AWWA C-508 Swing Type Spring and Lever – Mueller, M&H or approved equal.** Check valves shall comply with the latest edition of AWWA C-500, iron body, bronze mounted, swing type, spring and lever loaded with bronze disc facing, and shall have a 175 psig maximum working pressure and tested to a pressure of 350 psig. Check valves shall be equipped with mechanical joint connections unless otherwise specified.
3. Tapping Valves: **AWWA C-509 T-2360 Resilient Wedge Tapping Valves – Mueller, M&H or approved equal.**

D. FIRE HYDRANTS: **Mueller Super Centurion 250 (A423)(3'-0") (Bury 6" MJ Shoe) or approved equal.** Fire hydrants must be meet all the applicable parts of AWWA C-502, shall have 5-1/4" main valve opening three way (two hose nozzles and one pumper nozzle), and have a 250 psig maximum working pressure and tested to a static pressure of 500 psig.

- E. VALVE BOXES: **Vulcan V-8462 Cast Iron.** Contractor shall supply boxes with the correct base for valves and in correct length for field conditions. The word water shall be cast into the valve box cover. Each valve box will be surrounded by a 24 inch precast conical concrete pad w/7 inch throat by **Russell Foundry or approved equal.**
- F. BLOW OFF ASSEMBLY: A blow-off Assembly shall be required at the end of all water mains and as shown on the Plans. Where a blow-off assembly is required, the water main shall be capped with a **Ductile Iron Mechanical Joint Tapped Cap (w/megalug)** and reduced to two (2) inches. The typical blow-off assembly will include one (1) **2" Mueller Locking Ball Valve**, four (4) **2" Galvanized Threaded Bends**, **2" Galvanized Threaded Pipe**, and one (1) **Oversized Black Plastic Meter Box.**
- G. STEEL AND PVC CASING: Steel casing shall meet the specifications of ASTM A-252, Grade 2 or better. Minimum wall thickness for steel casing shall be as follows (casing size (outside diameter), minimum wall thickness): 12" or less, no minimum wall thickness; 12" to 18", 0.188"; 18" or greater, 0.250". Minimum wall thickness of casing used in railroad crossings shall be 0.25". The minimum yield point shall be 35,000 psi.

<u>Pipe Size</u>	<u>Inside Diameter Of Casing</u>	<u>Maximum Skid Support Spacing</u>
14"	20"-20"	11'
12"	18"-20"	13.7'
10"	16"-18"	12.2'
8"	14"-16"	10.5'
6"	10"-12"	8.8'
4"	8"-10"	6.8'
3"	6"-8"	4'
2"	4"-6"	3'
3/4"	2"-4"	2'

\*The maximum skid support spacing shall be used for PVC pipes.

- H. WATER SERVICE ASSEMBLY:
1. Service Clamp: **Bronze Series Service Saddles-Double Strap – Mueller, Smith-Blair or approved equal.** Service Clamps shall meet all the applicable parts of AWWA C-800, brass body, and have a 250 psig maximum working pressure.

2. Service Line: **Polyethylene CL-200**. All service line shall meet all the latest editions of ANSI\AWWA. All service lines shall be encased in PVC pipe under roadway in sizes specified on the plans.
  3. Transition Fitting: **Mueller 110 Compression Connection or approved equal**.
  4. Curb Stop: **Mueller 300 Ball Straight Service Valve or approved equal**. Curb Stops shall be quarter turn check-lock wing.
  5. Meter Couplings: **Mueller Straight Meter Coupling or approved equal**.
  6. Water Meter: **Sensus SR (To Be Approved by the Water Association)**
  7. Standard Black Plastic Meter Box w/ Reader Lid: **NDS 12" Standard Box w/ 2 Holes (Touch Read)**.
  8. Corporation Stop: **Mueller Ground Key Corporation Valve or approved equal**. Corporation Stops shall be made of bronze conforming to ASTM B 61 or ASTM B 62 and shall be suitable for the working pressure of the system. Threaded ends for the inlet and outlet end of the corporation stop shall conform to AWWA C800. Corporation Stops shall include two (2)  $\frac{3}{4}$  inch inserts.
  9. Touch Read Device: **Sensus (To Be Approved by the Water Association)**.
- I. TRACER WIRE: Tracer Wire shall be used with all water mains with a test cap located a maximum of 500 feet apart. Tracer wire shall be **#12 insulated solid copper type THHN or THWN VW-1 600V** gasoline and oil resistant wire and test caps shall be Blue for water.

### SECTION 3 – EXECUTION

#### 3.01 PIPE LAYING

- A. Water pipe shall not be laid in the same trench with other utilities.
- B. PVC pipe shall be installed in accordance with the latest edition of ASTM D-2321 assuming the use Class IV native material or better. Ductile iron pipe shall be installed in accordance with the latest edition of AWWA C-151 using a sand-clay bedding material with a maximum liquid limit (LL) of 30 and a plasticity index (PI) of less than 10 and native material as backfill. Select bedding and backfill for PVC or ductile iron pipe shall be called for by the Engineer and specified as to location on the Plans
- C. Water pipe, fittings, and appurtenances shall be laid to the line and grade as shown on the Plans. Extra depth shall not be measured unless noted on the Plans.
- D. The inside of the bells and the outside of the spigots shall be thoroughly cleaned before they are placed. The inside of the pipe shall be swabbed to ensure that the pipe is clean and free of obstructions and foreign matter until the work is completed. Blocking and wedging between bell and spigots shall not be permitted. The pipe shall be laid in a manner so that the full length of each pipe and all fittings are fully supported and solidly rest on the pipe bedding.
- E. Where pipe laying ceases at the end of the day or for any cause during the day, the end of the pipe shall be securely closed in order to prevent the entrance of water, mud, or other objectionable matter.

- F. Pipe shall not be laid in a trench where water is present.
- G. The minimum depth of cover over water mains shall be 36 inches.

### **3.02 INSTALLATION OF FITTINGS, VALVES, HYDRANTS, AND SPECIALS**

- A. Fittings, valves, valve boxes, hydrants, and other appurtenances shall be set at the location indicated on the Plans. Omission of these items shall be corrected by the Contractor without extra cost to the Owner. The addition of these items not shown on the Plans or requested by the Owner, which are installed for the convenience of the Contractor and without the expressed consent and agreement of the Owner, shall not be allowed for payment but shall be considered as absorbed items to the Contractor.
- B. All valves shall be provided with a valve box and a precast concrete valve pad as specified above in Section 2-03 E. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut with the cover flush with the finished ground surface.
- C. Hydrants shall be located as shown on the Plans and in a manner that will provide complete accessibility and will prevent damage from vehicles. Hydrants shall stand plumb and shall have their pumper connections at right angles to the curb line. The center of hose nozzles shall be eighteen (18) inches above the top of the ground surface or top of curb. If necessary, hydrant extensions shall be furnished at no additional cost to the Owner unless otherwise noted in the Plans.
  - 1. Each fire hydrant shall be set truly vertical and securely braced with concrete or stone blocks until it is self-standing. It shall be set on well-compacted soil surrounded by 2'0" x 2'0" x 8" of crushed stone or clean gravel to permit free draining of the hydrant.
  - 2. All fire hydrants shall connect to the main with a flanged fitting connected to a non-rising stem flanged by a six (6) inch mechanical joint end gate valve to the specifications listed above in Section 2-03-C-1, and with the associated valve box and the precast concrete valve pad. Ductile iron shall be used from valve to fire hydrant with retainer glands.

### **3.03 CONNECTION TO EXISTING MAINS**

- A. Connections to existing water mains shall be made by installing tapping sleeves and valves unless otherwise indicated on the Plans. If so directed, cut-ins shall be made by the Contractor in order to connect the new main with existing water mains. The Contractor shall furnish labor, materials and service required for excavating, cutting the existing mains, removal and relocation of sections of old pipe, de-watering the trench, connecting to the new main with the existing and setting of the necessary fittings, specials, and valves as shown on the Plans.

- B. Contractor shall provide temporary blocking and bracing, properly placed, to prevent movement and blowing off of pipe, valves or fittings due to water pressure in the main. Connections shall be made in a manner to cause the least inconvenience to water customers and traffic.
- C. When the interruption of water service in the existing system is necessary, the contractor shall notify the City of West Memphis at least forty-eight (48) hours in advance. Interruptions of water service shall not exceed over night or through the weekend unless approved by the City of West Memphis.

### **3.04 THRUST BLOCKING**

- A. Thrust blocks shall be provided for all dead-ends (plugs & caps), tees, and bends, either vertically or horizontally, on water lines four (4) inches in diameter or larger.
- B. Concrete shall be used to form the thrust block and shall meet Class 3000 PSI concrete.
- C. Blocking shall be placed so that the fitting joints will be accessible for repair.

### **3.05 BORING AND JACKING FOR CASING AT RAILROAD AND STREET CROSSINGS**

- A. Pipe in steel or PVC casing (see Plans for material required) shall be used where bored and jacked encased water line street or railroad crossings area called for in the Plans. All work incidental to the construction of railroad and street crossings shall be done in strict compliance with the requirements prescribed by the Owner(s) of the impacted properties upon which the work is to be performed and shall be done with extreme care to safeguard life and property. After the necessary permits and agreements have been approved and executed, the Contractor shall contact the representatives of the Owners of the railroad or roadway properties and arrange schedules for constructing the work in accordance with the Plans and these Specifications.
- B. **DRY BORING:** The casing or carrier pipe is to be installed by drilling a hole if a size not larger than one (1) inch around the outside circumference of the casing or carrier pipe.
  - 1. Water bearing sands and mucky soils will be well pointed as necessary prior to commencing the bore.
  - 2. All bores will be accomplished with the auger inside the casing or carrier pipe with the cutting edges positioned just ahead of the pipe.
  - 3. Care should be exercised at all times to keep the auger properly positioned within the encasement of carrier pipe and to maintain sufficient forward pressure upon the encasement or carrier pipe to quickly run through any pockets of loose soil.
  - 4. All boring will be carefully observed for comparison between the amount of cuttings removed from the hole and the diameter of the bore together with the distance the auger has traveled in the bore. An excessive amount of cuttings removed from the bore indicates caving or spalling of the bore wall and the bore will be stopped until a method for completing the bore is found acceptable to the owners of the railroad and/or street properties has been agreed upon.
  - 5. An acceptable fluid may be introduced by gravity flow approximately three (3) feet back of the forward end of the casing or carrier pipe to lubricate the cuttings



in order to facilitate the removal thereof; however, the intemperate use of such fluid causing undue flow back and erosion of the bore shall not be allowed.

C. BORING WITH DRILLING FLUID: The use of either a gel-forming colloidal drilling fluid or the use of polymer surfactant mixture is permitted only if acceptable by the owner of the property and with prior approval from the Engineer. The drilling fluid shall be used to lubricate the cutters or reamers, as a binder to bind the cuttings into plugs of appropriated length and to form a filter cake around the circumference of the bore in order to prevent cave-ins or spalling, to maintain the arch and also to lubricate the bore for easy removal of masses or plugs of cuttings from the bore by using compressed air. Liquids other than the drilling fluids described in Methods A and B shall not be permitted. All bores accomplished with the use of a drilling fluid will be made as follows:

1. METHOD "A": The casing or carrier pipe shall be installed by drilling a hole of a size not larger than 1" around the outside circumference of the casing or carrier pipe with an open type bit that leaves the cuttings in place. A gel-forming colloidal drilling fluid consisting of at least 10% by weight of an accepted type of gel-forming substance, when boring is sandy subsoils, fine sands, water bearing sand or any soils which easily spall or cave consisting of at least 5% by weight of an accepted type of gel-forming substance, when boring in dense consolidated soils will be used to consolidate the cuttings, seal the wall of the bore and furnish lubrication for subsequent removal of the cuttings and installation of the casing immediately thereafter. The percentage of the gel-forming agent will be increased as required by soil conditions. When boring sandy subsoils, fine sands, water bearing sands or any soil, which easily spalls or caves the bore entrance will be plugged or dammed in order to retain the drilling fluid and the cuttings within the bore until immediately before the casing or carrier pipe is installed. Water bearing sands and mucky soils will be well pointed as necessary prior to commencing the bore. When drilling through dense consolidated soils the cuttings may be partially removed from the hole in approximately three (3) foot plugs by use of compressed air or by retraction of the cutter or reamer. No cutter or reamer shall have holes therein larger than 5/16" in diameter through which drilling fluid is forced during boring.
2. METHOD "B": The casing or carrier pipe shall be installed by drilling a hole a size not larger than 1" around the outside circumference of the casing or carrier pipe with an open type bit leaves that leaves the cuttings in place. Drilling fluid composed of water and a polysurfactant of approximately 61% diesel fuel, 15% sodium carboxyl methyl cellulose of same quality as Drispace, 21.5% water and 2.5% anionic surfactant will be used to consolidate the cuttings, seal the wall of the bore and furnish lubrication for subsequent removal of the cuttings and installation of the casing or carrier pipe immediately thereafter. When boring sandy subsoils, fine sands, water bearing sands or any soil, which easily spalls or caves the bore entrance will be plugged or dammed in order to retain the drilling fluid and the cuttings within the bore until immediately before the casing or carrier pipe is installed. Water bearing sands and mucky soils will be well pointed as necessary prior to commencing the bore. When drilling through dense consolidated soils the cuttings may be partially removed from the hole in approximately three (3) foot plugs by use of compressed air. The polymer-surfactant mixture or drilling fluid when used in dense consolidated soils will consist of not less than 2% of polymer-surfactant by volume and when used in sandy subsoils, fine sands or any other soil which easily caves will consist of at

least 4% of polymer-surfacent by volume. The percentage of polymer-surfacent will be increased as required by soil conditions.

### 3.06 HYDROSTATIC TESTING

After backfilling, subject all pipe work to pressure and leakage tests. Piping may be tested in sections between valves as the work progresses. Admit water slowly into the section to be tested, and expel all air through openings at all high points in the piping, as required. After all air has been expelled apply a hydrostatic pressure of 150 PSI measured at the lowest point in the piping section involved. Maintain the test pressure at least two hours. No pipe installation will be accepted unless and until the leakage, evaluated on a basis of 150 PSI, meets the AWWA Standard C600-93, Section 4, Hydrostatic Testing, for leakage. The duration of the leakage test shall be a minimum of 4 hours. Furnish approved testing equipment, consisting of a suitable pump to apply and maintain test pressure, accurate pressure gauges, suitable equipment to measure volume of water pumped, and other necessary equipment, and conduct all tests in the Engineer's presence, as approved. Determine leakage by measuring the volume of water pumped to maintain the required test pressure for the duration of the leakage test. If the measured leakage exceeds the maximum specified allowable leakage, locate and repair the leaks, and repeat the tests on sections of pipe involved until all tests have been approved. The following formula will be used to determine the allowable leakage:

$$L = \frac{S \times D \times \text{SQRT}(P)}{133,200}$$

L=allowable leakage (gph)

S= length of pipe tested (ft)

D= nominal diameter of pipe (in)

P= average test pressure during leakage test (psig)

### 3.07 DISINFECTION

- A. Before acceptance of potable water operation, each unit of completed water distribution line and water service line shall be disinfected meeting ANSI/AWWA C651. After pressure tests have been made, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material.
- B. The chlorinating material shall be either liquid chlorine, calcium hypochlorite, or sodium hypochlorite, as specified in this section and the chlorinating material shall provide a dosage of not less than 50 parts per million and shall be introduced into the water lined in an approved manner.
- C. The treated water shall be retained in the pipe long enough to destroy all non-spore-forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 10 ppm of chlorine throughout the line at the end of the retention period.
- D. Valves on the lines being disinfected shall be opened and closed several times during the contact period, and then the line shall be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm.
- E. After completion of the construction and disinfection of water distribution mains, the Contractor shall arrange for at least one sample to be collected by the county sanitarian, consulting Engineer or waterworks superintendent from every dead end line and every major looped line for bacteriological examination. Water being collected for testing shall not have chlorine residual higher than is normally maintained in other parts of the distribution system. No chlorine shall be present, which is a result of line disinfection. No coliform bacteria and no confluent growth indication shall constitute a satisfactory sample when analyzed by the

Arkansas Department of Public Health Laboratory or a laboratory certified by the Arkansas State Department of Health. Tests must indicate the absence of pollution for at least (2) full days.

- F. Water for testing, disinfection, and flushing will be furnished by the Owner from existing water facilities, without cost to the Contractor, the Contractor shall furnish all piping and equipment to convey the water to the new pipe lines.
- G. Corporation stops shall match those of the customer service connections. Provide these as required for testing and disinfection, and after that use leave them in place with their outlets plugged. Customer service corporation stops may also be used for testing and sterilizing.

### **3.08 FINAL CLEAN-UP**

- A. In areas where the water main trenches have been backfilled, the Contractor shall dress the disturbed area to the approval of the Owner, and shall dispose of waste materials and debris resulting from his operations. The Contractor shall fill and smooth holes and ruts and shall repair miscellaneous and unclassified ground damage done by him and shall restore the ground to such a stable and suitable condition as may be reasonably required, consistent with the condition of the ground prior to construction. All clean-up work shall be completed by the Contractor at no additional cost.
- B. In the presence of the representative for the City of West Memphis, the Engineer, and the representative for the Contractor, a final "walk-thru" inspection shall be made to ensure all work set out in the Plans and Specifications has been completed. Application for final payment shall not be processed until this has been completed.

**END OF SECTION**

## SECTION 333000

### SANITARY SEWERAGE UTILITIES

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

- A. The Contractor shall furnish all tools, material, labor, and equipment and perform all operations necessary to construct a complete sanitary sewer system as shown on the drawings, as hereinafter specified and as directed by the Engineer.
- B. The work shall include excavation, trenching and backfilling; furnishing and installing trench sheeting and bracing; furnishing and installing pipe, specials, services, manholes and related appurtenances; storage and protection of materials; testing, clean-up and other operations necessary to complete the work in accordance with the Plans and Specifications.
- C. Inspection is defined as the visual observation of materials, equipment, or construction work, on an intermittent basis, to determine that the work is in conformance with the Plans and Specifications. Such inspection does not constitute acceptance of the work, nor shall it be construed to relieve the Contractor in any way from his responsibility for the means and methods of construction or for safety on the construction site.

##### 1.02 CONTRACTOR'S EQUIPMENT

The contractor shall provide and maintain the principle equipment necessary to execute the work in an orderly and safe manner. The equipment shall consist of approved units designed or selected to perform and expedite all of the work and incidental items of construction.

##### 1.03 CONFLICTS WITH OTHER UTILITIES

- A. Where the location of the water line is not clearly defined by dimensions on the drawings or unless otherwise directed by the Engineer, water mains shall be laid at least ten (10) feet horizontally and eighteen (18) inches vertically from any sanitary sewer or manhole (water over sewer).
- B. At locations where the water and sewer line must cross each other, the above requirements may be waived if pipe segments are centered to provide maximum spacing of the joints of both water and sewer lines and a vertical separation of at least eighteen (18) inches (water over sewer) is maintained. Where gravity-flow sewers cross above water lines, the sewer pipe, for a distance of ten (10) feet each side of the crossing, shall be either ductile iron pressure pipe without any joint closer horizontally than eight (8) feet to the crossing or shall be encased in steel casing.
- C. Where sewer construction conflicts with underground utilities, which are indicated to remain in place, the Contractor shall be fully responsible for protecting these facilities and for restoring the portions of these lines, which are damaged or severed as a result of his operations. Where existing lines in conflict are indicated to be removed by others, the Contractor shall cooperate with the Owner of these utilities to the end that these conflicts may be removed prior to excavation for the sewers.

#### 1.04 PROTECTION OF PROPERTY

- A. GENERAL: Existing power lines, telephone lines, trees, shrubbery, fences, water mains, gas mains, sewers, cables, conduits, ditches, embankments and other structures in the vicinity of the work, not authorized to be removed, shall be supported and protected from injury by the Contractor during the construction and until completion of the work affecting them. The Contractor shall be liable for damages done to such existing facilities and structures, as herein provided, and shall hold the Owner harmless from liability or expense for injuries, damages or repairs to such facilities. No additional compensation will be allowed for any operations of the Contractor in completing the work near, over, under or around existing utilities unless otherwise specified.
- B. UNDERGROUND UTILITIES: The type, size, location and number of known underground utilities have been shown on the Drawings; however, no guarantee is made as to the true type, size, location or number of such utilities. It shall be the responsibility of the Contractor to verify the existence and location of underground utilities along the route of the work. The omission from, or the inclusion of utility locations on the Drawings is not to be considered as the nonexistence of or a definite location of existing underground utilities. The Contract unit prices bid shall provide full and complete compensation for operations necessary to complete the work in accordance with the Drawings and Specifications in working near, over, under or around existing utilities unless specified otherwise.
- C. RELOCATION OF EXISTING UTILITIES
1. The Contractor shall notify the Owner or Owners of the existing utilities, whether above the ground or underground, prior to proceeding with trench excavation whenever such trenching operations are within ten (10) feet of any existing utility.
  2. In the event that during construction it is determined that underground utilities, including sanitary sewers, water mains, gas mains, telephone cables, storm sewers, etc., and above ground utility facilities require relocation, the Contractor shall notify the utility Owner well in advance of his approach to such utility so that arrangements for such relocation by the Owner or the Owners of the affected utilities can be completed without delay to the Contractor's work.
  3. Should a utility be damaged from trenching operations, the Contractor shall immediately notify the Owner of the utility, necessary Emergency Operations Agency, local Law Enforcement Agency, and the project Owner and Engineer.
- The Contractor shall not attempt to make repairs unless so authorized, in writing, by the affected utility owner. Duplicate copies of written authorization given to the Contractor to make repairs shall be filed with the Engineer and shall be so worded as to hold harmless The Owner and Engineer of responsibility relative to the sufficiency of the repairs.**
- D. LANDSCAPE VEGETATION: Reasonable care shall be taken during construction to avoid damage to landscape 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.

## **1.05 RAILROAD AND HIGHWAY CROSSING**

Work incidental to the construction of sewer lines under streets, railroads, highways, driveways or parking areas shall be done in strict compliance with the regulations prescribed by the Owners of these properties and shall be done with extreme care to safeguard life and property. After the necessary permits and agreements for these crossings have been approved and executed, the Contractor shall confer with the representatives of the Railroad Company, the State Highway Department, the City or County, or the Owner of these properties and arrange schedules and the manner for constructing the work in accordance therewith. In general, the sewer pipe will be installed in steel casing or steel lined tunnels at all railroad, street and highway crossings unless otherwise specified.

## **1.06 MAINTENANCE**

The Contractor shall be responsible for, without any extra compensation, the maintenance of all sewers and structures to the lines and grades established for the construction, for the stabilities of all backfills and the finished grades above the sewers and around the structures, and for the repair and replacement of all the items which were damaged or removed during the construction.

## **1.07 WARRANTY**

The Contractor shall warrant all materials of construction and repair and all workmanship for a period of one (1) year from the date of final acceptance of the work. Should defects or failures occur during the period of warranty, the Contractor shall promptly take whatever steps are necessary to return the work to first class condition.

## **PART 2 – MATERIALS**

### **2.01 GENERAL**

All pipe and other materials shall be new and of first quality with certified tests for pipe and pipe fittings made at the manufacturers plant to assure conformance with these technical specifications. Two certified copies of each test result shall be furnished to the Engineer. The types and classes of materials incorporated into the work shall be designated by the Engineer. The Contractor shall not construe or interpret the several kinds of materials described herein as being equal in their application for the project.

### **2.02 WATER FOR CONSTRUCTION AND TESTING**

The Contractor shall be responsible for all water needed in constructing the work, flushing the completed system, testing, and other incidental needs. All water used shall be from an approved source relatively free of pollution and shall be of a satisfactory bacteriological quality.

### **2.03 SEWER PIPES AND FITTINGS**

- A. **DUCTILE IRON PIPE AND FITTINGS:** Ductile iron pipe shall be Class 50 and shall conform to ANSI Specifications A 21.15(AWWA C150) and A 21.51 (AWWA C151). Ductile iron pipe and fittings shall be coated outside with a standard bituminous coating. Pipe shall be lined inside with a factory-applied polyethylene lining twenty (20) mils in thickness or with field applied coal-tar epoxy lining twenty-four (24) mils in thickness. Rubber gasket joints for slip

joint ductile iron pipe shall conform to the requirements of AWWA C-111. Fittings shall conform to AWWA C-110. Jointing shall be completed in accordance with the manufacturer's specifications. Minimum thicknesses for ductile iron pipe are as follows:

<u>Diameter</u>	<u>Minimum Wall Thickness</u>
12"	0.31"
10"	0.29"
8"	0.27"
6"	0.25"

- B. PVC PLASTIC PIPE AND FITTINGS: PVC sewer pipe and fittings shall be solid wall in accordance with ASTM D-3034 with SDR 26 minimum wall thickness and 13 foot laying lengths. Joints between pipes and fittings shall be integral bell push-on type with elastomeric gaskets conforming to ASTM D3212. Elastomeric seals shall conform to ASTM Standard Specification F477. SOLVENT WELD SHALL NOT BE PERMITTED. Depth of bury for SDR 26 or heavier pressure pipe shall not exceed limits acceptable to the Engineer. Jointing shall be completed in accordance with manufacturer's specifications. Sewer Services shall have SDR 26 wall thickness.

\*NOTE: Each pipe and fitting shall have plainly and permanently marked thereon: pipe class, date of manufacturer, and manufacturer's name or trademark. The marking shall be stamped or painted with waterproof paint.

## 2.04 MANHOLES

- A. Precast concrete manholes shall consist of reinforced riser sections, an eccentric cone section being thirty-six (36) inches high and tapering uniformly to twenty-eight (28) inches inside diameter at the top, and a base section conforming with details as shown on the STANDARD SANITARY SEWER DETAILS SHEET included in the plans. Precast flat top sections will be required for manholes where the rim elevation is more than three (3) feet above the finished ground elevation and shall be installed with no additional payment.
- B. Precast reinforced concrete sections shall meet the requirements of the latest edition of ASTM C-478, and shall not have more than two (2) holes for the purpose of handling.
- C. Joints for precast sections shall be concrete pipe type and shall be sealed with preformed joint compound. Preformed joint compound shall be "Butyl-Tite" as manufactured by Blue Ridge Rubber Company, Fletcher, North Carolina; "Kent, Ohio; or equal and shall meet Federal Specification SS-S00210(210-A) SS-S-00219 and AASHTO Specification M-198.
- D. Manhole frames and covers shall meet the requirements of ASTM Designation A-48 for "Gray Iron Castings, Class 25". They shall be of the size and style shown on the plans.
- E. Manhole steps shall be ten (10) inch plastic encased steel aligned vertically along the inside wall of the manhole.
- F. Flexible manhole pipe connectors shall be Kor-N-Seal as manufactured by NPC Systems, Inc. or approved equal and shall meet ASTM C-923.
- G. Precast manholes shall be lined with three (3) coats of coal tar epoxy to a dry film thickness of 24 mils. The lining shall comply with the following specification.

## 2.05 LINING FOR CONCRETE PIPE AND MANHOLES

- A. GENERAL: All interior barrel and joint surface areas, which will be exposed to sewer liquids and gases, shall be prepared, coated, and cured as necessary to complete the installation of a coal tar epoxy lining in each concrete pipe section and manhole section, at the concrete pipe manufacturer's plant. Before coating work has begun, the Contractor shall submit to the Engineer the proposed coating supplier's complete materials, data sheets, and application specifications specifically prepared for the particular application.
- B. MATERIALS: Materials used in the application of the coating shall comply with the requirements specified herein and are subject to the review of the Engineer. Protective coatings shall be either Porter Coatings' Tasset C-200, Tnemec 46H-413, Koppers Bituminastic Number 300-M, or approved equal, used with the manufacturer's recommended epoxy structural paste adhesives, primers and thinners.
- C. PREPARATION: Specifically, surface preparation shall consist of sandblasting and cleaning the barrel of the pipe and the joint surface areas on which coatings will be applied. Under no circumstances shall the lining be applied on "green" concrete. All surfaces to be coated shall be essentially free of voids, cracks, inclusions or other structural defects. Any such defects shall be corrected by bagging or brushing the wet formed concrete and/or cement grouting the cured section. All grouting must be allowed to thoroughly cure before any coating is applied. The surfaces to be prepared and coated shall be smooth or lightly profiled. These surfaces shall not be extremely rough or deeply textured nor shall they bear exposed aggregate. All mortar fins, concrete splatter and other protrusions shall be removed by appropriate means. Prior to applying specified coatings, the concrete surface shall be clean and properly prepared as specified herein and shall be dry to the extent that the surfaces to be coated are visibly dry and the concrete contains no greater than ten (10) percent moisture as determined by measurement with a suitable moisture meter. Surfaces to be coated shall be clean and dry. All grease, oil, salts and other foreign matter shall be removed by steam or detergent cleaning. Any such areas shall be allowed to thoroughly dry before any further surface preparation is performed. All surfaces to be coated shall be uniformly brush-sandblasted to the extent that all loose or unsound concrete and laitance are removed. All necessary precautions shall be employed to avoid excessive sandblasting so that a uniformly blasted concrete surface is produced that is clean and lightly etched. All blasted concrete surfaces shall be patched with an epoxy structural paste adhesive, if required, and have the prime coat applied within eight (8) hours and before surface contamination or moisture absorption can occur. In order to avoid damaging previously applied coatings, work shall be scheduled such that complete concrete units are sandblasted and coated. The pipe surface areas to be lined shall be blown off with air to remove all sand, dust and other loose materials immediately prior to application of the lining compound. The lining compound shall not be applied when the ambient temperature is below forty (40) degrees Fahrenheit. The compound shall not be applied under adverse atmospheric conditions that will cause detrimental blistering, pinholing, or porosity of the film.
- D. APPLICATION: The coating shall be applied by the airless spray method, in three (3) coats, consisting of a primer, four (4) mils minimum dry film thickness, followed by two (2) coats each with a minimum dry film thickness of ten (10) mils, for a total minimum dry film thickness of twenty-four (24) mils.



- E. The complete coating system shall be free of excessive runs, sags, drips, cracks, crazing, alligatoring, blisters, inclusions, excessive or deficient film thickness, voids, pinholes or other damaged area defects. Any such deficiencies shall be corrected by removal and recoating. Depending upon air circulation and relative humidity conditions, the coating system should be cured sufficiently hard so that the pipe can be handled with minimal damage. Surface temperature shall be determined with an appropriate dial thermometer. Pipe moisture content shall be determined by an appropriate moisture meter to assure proper condition of the surface before applying coatings. The primer and finish coats shall be inspected for continuity, pinholes, bore areas and holidays, with a non-destructive field-calibrated sparking holiday detector. Dry film thickness shall be determined with a non-destructive dry film gauge. All instruments shall be as recommended by the coating supplier. Excessive runs, sags, dips, cracks, crazing, alligatoring, blisters and inclusions shall be completely removed by suitable scraping, chipping, or grinding. Loose or poorly bonded coating and improperly cured coating shall be completely removed to a sound substrate by grinding or sandblasting. Excessive film thickness shall be reduced to below 24.0 mils by grinding or sandblasting. All deficient areas shall be wiped free of all surface contamination using clean rags soaked in specified thinner and the cleaned areas shall be allowed to dry. The deficient area shall then be thoroughly abraded and the abrasion shall be "feathered" out slightly beyond the perimeter of the affected area. Small areas may be abraded by hand or power tool sanding using medium grit garnet or sandpaper. Extensive areas may be abraded by uniform brush sandblasting. All necessary precautions shall be employed, including temporary shielding where required to protect adjacent coatings from damage during sandblasting operations. All abraded areas shall be thoroughly swept clean and the specified coating applied the same day and before contamination can occur. The prepared areas shall then be primed and finish coated as specified, except that all coating may be applied unthinned and by brush. All coating shall be "feathered" out to the edge of the abraded area. The pipe shall be visually inspected at the job site before installation.

## **2.06 BEDDING AND BACKFILL**

- A. Type A - Pipe Bedding, Haunching, and Backfill Material:
1. Bedding and Haunching material shall consist of Type S2 Material as specified in section 312333 of the Specifications.
  2. Initial Backfill shall consist of Type S1 Material as specified in Section 312333 of the Specifications.
- B. Type B - Pipe Bedding, Haunching, and Backfill Material:
1. Bedding and Haunching material shall consist of Type 5 Material as specified in section 312333 of the Specifications.
  2. Initial Backfill shall consist of S1 Material as specified in section 312333 of the Specifications.

## **901-S-501.03 – CONSTRUCTION REQUIREMENTS**

### **3.01 REMOVAL OF PAVEMENT, SIDEWALKS, DRIVEWAYS, AND CURBS**

- A. Whenever the wastewater improvements are to be located along or across an improved surface, the width of the trench shall be as nearly as possible to the maximum width as specified in Section 3-01 of these Specifications. Where brick, asphalt, or concrete

pavement, sidewalk, driveway, or curbing is cut, the width of the cut shall exceed the actual width of the top of the trench by twelve inches on each side or a total of twenty-four (24) inches. Exposed surfaces of Portland cement or asphaltic concrete shall be cut with a pavement saw before breaking. Care shall be taken in cutting to insure that straight joint is sawed. The Contractor shall repair any damage that occurs outside the specified limits as shown on the Plans at no additional expense. The Contractor shall maintain all crossings until completion. All areas that are to be replaced shall be restored to the original state before construction began. Special care shall be given to returning these specified areas to their original compaction, gradation, and structure thickness. The Contractor shall be responsible for written approvals from all public works departments impacted before construction begins and before final payment is made.

### **3.02 EXCAVATION AND TRENCHING**

- A. Excavation of every description and of whatever substances encountered shall be performed to the depths indicated on the Plans or as otherwise specified. Excavation shall be by open cut method unless tunneling or boring is specified as per the Plans or with approval of the Engineer and/or Owner.
- B. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Excavated materials not required or not suitable for backfill shall be removed and/or wasted as directed by the Engineer and/or Owner at no additional expense. Grading shall be performed to prevent surface runoff from entering the excavated trench. Any accumulated water shall be removed by pumping or by methods approved by the Engineer and/or Owner.
- C. Materials suitable for bedding/backfill encountered during excavation shall be stockpiled separately. Sandy material shall be stockpiled in a manner to prevent mixing with clay material for use in backfilling.
- D. Excavation for manholes shall be done in a manner to facilitate the construction as per the Plans.
- E. The minimum net trench width for sewer pipe at and below the top of the pipe shall be the pipe outside diameter plus twelve (12) inches and in no case shall the net trench width be more than the pipe outside diameter plus twenty-four (24) inches. The width of the trench above this level may be as wide as necessary for sheeting, bracing, and shoring or for ensuring safe working conditions.
- F. The bottom of the trench shall be carefully graded and aligned as per the Plans and shall be conformed to the shape of the sewer pipe to ensure the pipe has continuous support for the entire length.
- G. No more than four hundred (400) feet of trench shall be opened in advance of the completed sewer and no more than one hundred (100) feet of unfilled trench shall be left open without the authority from the Engineer and/or Owner.
- H. Tunneling or Boring shall be permitted where indicated on the Plans.

### **3.03 SHEETING, SHORING, AND BRACING**

- A. Sheeting, shoring, and bracing shall be furnished, placed and maintained by the Contractor as may be required to support the sides of the excavation. The Contractor shall be fully responsible for the sufficiency of such supports to prevent movement, which can injure

personnel, delay work, or cause damage to adjacent pavements, buildings, or other structures.

- B. Sheeting, shoring, and bracing which are not ordered by the Engineer to be left in place shall be removed in such a manner as not to endanger the constructed sewer or other structures, utilities or property. Voids left or caused by the withdrawal of sheeting shall be immediately refilled with sand by ramming with tools specifically adapted to the purpose, by watering, or otherwise as may be directed.

### **3.04 DEWATERING**

- A. The Contractor shall provide and maintain dewatering equipment for the removal of surface and ground water that enters excavated trenches. Excavated trenches shall be kept dry until the pipe placement has reached sufficient completion as to prevent damage from hydrostatic pressure or flotation. Excavation for trenches or other concrete sewer structures that extend below static ground water shall be dewatered by lowering and maintaining the ground water level a minimum of eighteen (18) inches below the bottom of the excavation.
- B. The Contractor will be held responsible for the carrying capacity of pipe, which may be used for drainage purposes and shall be kept free and clean of sediment and restrictions.
- C. Dewatering shall be performed by the Contractor at his own expense.

### **3.05 STEEL SHEET PILING**

- A. Steel sheet piling shall be driven at locations shown on the Plans. Piling shall be in such a condition that it can be interlocked and driven in an appropriate manner
- B. The Contractor shall be responsible for adequately bracing the units against lateral forces. Piling shall be driven before final adjacent excavations are made.
- C. Pile driving equipment used shall be maintained in first class condition and shall operate efficiently in the space provided. Equipment shall be subject to the review of the Engineer.
- D. No separate payment will be made for this item.

### **3.06 PIPE BEDDING AND HAUNCHING INSTALLATION**

- A. The specified granular bedding material shall be placed on the trench bottom to full trench width and shall extend six (6) inches minimum below the pipe bottom.
- B. Haunching material shall consist of the specified granular bedding material and shall extend up the sides of the pipe to a height equal to fifty (50) percent of the pipe diameter, also being the springline of the pipe. Haunching materials should be worked in around the pipe by hand

to provide uniform support adjacent to the pipe and shall be installed on 6" thick loose lifts and compacted to ninety (90) percent of the maximum dry density as determined by ASTM D-698, or fifty (50) percent relative density as determined by ASTM D-4259 and ASTM D-4254. Compaction equipment should not contact and damage the pipe. The compaction equipment and procedures should be acceptable with the select granular materials used.

- C. This item shall be paid for per linear foot of sewer pipe as an absorbed item for the designated depths specified in the Summary of Quantities.

### **3.07 SEWER PIPE PLACEMENT**

- A. Sewer lines shall be accurately laid to the alignment, grade and elevations as per the approved Plans. The contractor shall provide suitable equipment for the safe handling, transporting, and installation of piping materials in a manner that will prevent damage. Each joint of pipe and all fittings shall be inspected for defects prior to installation and removed if any are found. Under no circumstances shall sewer pipe be laid in frozen ground.
- B. The Contractor shall begin laying pipe at the lowest points and continue laying up-grade with no breaks between manholes with the pipe spigots facing down-grade. The pipe shall be laid using the bedding method required to accommodate the trench conditions encountered. The entire length of pipe shall be fully supported without groove or bell ends bearing on the trench bottom, with water-tight joints. Whenever work ceases, the unfinished end of the pipe line shall be securely closed with a tight-fitted plug or cover.
- C. The Contractor shall adhere to the pipe and gasket manufactures instructions when jointing the pipe. All surfaces of each joint and jointing material shall be dry and free of sediment prior to any pipe jointing. Immediately after jointing, secure the laid pipe with tamped backfilled on either side.
- D. If dissimilar pipes are encountered, approved adaptor couplings shall be used for jointing. The completed joint shall be encased with a three (3) inch thick concrete collar and shall extend six (6) inches each side of the joint. No separate payment for adaptor couplings or concrete collars shall be made.

### **3.08 INITIAL BACKFILL MATERIAL AND PLACEMENT**

- A. Initial backfill shall be considered as the material beginning at the springline of the pipe (top of haunching material hereinbefore specified) and extending no less than twelve (12) inches above the top of the pipe. The material shall be placed in six (6) inch lifts and compacted to ninety-five (95) percent of maximum dry density as determined by ASTM D-698, or fifty (50) percent relative density as determined by ASTM D-4259 and ASTM D-4254, before any other backfill is placed. Compaction equipment should not contact and damage the pipe.
- B. Select backfill material shall be considered as material hauled in from off-site. Testing costs incurred for tests required by the Engineer, associated with verifying that onsite or offsite material meets this specification shall be paid by the Contractor.
- C. Tamping: The backfill shall be placed in equal thickness lifts, each lift being thoroughly compacted to the density required. Each lift of the backfill material shall have proper moisture content to permit compaction to this density.

In areas where street paving, sidewalks, driveways and other restoration work is required, the backfill above the twelve (12) inch cover (initial backfill) level shall be compacted to the subgrade level or as directed and maintained to eliminate voids and future settlement. The backfill shall be placed in six (6) inch lifts and compacted to ninety-eight (98) percent of maximum dry density in these locations and other locations as shown on the Plans.

1. In open fields or undeveloped areas, the backfill above the twelve (12) inch cover (initial backfill) level may be placed in twelve (12) inch lifts and compacted to a density not less than the surrounding earth. The top of the completed filled trench shall be mounded slightly above natural ground to allow for settlement.
2. Cultivable areas shall be restored by the replacement of the stockpiled topsoil stripping to a depth of at least twelve (12) inches

### **3.09 ALIGNMENT**

- A. The Contractor shall utilize a commercial grade laser beam specifically manufactured to aid in maintaining grade and alignment of pipelines during installation. The primary unit shall be mounted on a heavy-duty base and firmly anchored in the downstream manhole of the reach under construction. The maximum distance shall not exceed four hundred (400) feet per set-up unless otherwise approved by the Engineer.
- B. Each joint of pipe shall be installed using the methods and procedures in accordance with the manufacturer's recommendations and instructions. Care shall be exercised in order to prevent misalignment of the projected beam.

### **3.10 MANHOLE CONSTRUCTION**

- A. All manholes shall be made up of precast concrete sections conforming to the latest edition of ASTM C-478, unless otherwise specified in the Plans. Precast manholes shall be built to the correct dimensions and installed at the correct elevations as per the Plans. All joints between precast sections shall be sealed with the hereinbefore-specified material. All lift holes and pipe entrances shall be sealed with non-shrink mortar to provide a watertight construction. Mortar shall not be used to seal precast section joints. The Contractor shall provide twenty-eight (28) inches inside diameter brick, precast concrete, or cast-in-place concrete spacer rings between the manhole rim and the precast eccentric cone section in order to set the rim to the correct elevation. Grout spacers and rim shall be secured to the manhole using masonry mortar. The above specified manhole steps shall be permanently installed on twelve (12) inch (minimum) to sixteen (16) inch (maximum) vertical centers.
- B. Pipe sections connecting manholes shall be no longer than four (4) feet to insure that a joint is provided in each line within four (4) feet of the inside face of each manhole. The above specified flexible manhole connector shall be installed and inspected to ensure a watertight connection and to allow differential settlement of the pipe and manhole wall to take place.
- C. The Contractor shall provide an invert in each manhole bottom to allow flow from incoming pipes to outgoing pipes, constructed of brick and mortar, with full pipe channels smoothly shaped and finished to prevent splashing and turbulent flow. Generally, the manhole floor outside the flowline shall be smooth and shall gently slope toward the outgoing invert at one (1) inch per foot minimum.
- D. Drop manhole connections shall be installed in locations indicated on the Plans and any other locations where the vertical difference in elevation between the inflow invert(s) and the outflow invert is equal or greater than twenty-four (24) inches.
- E. After installation, manholes shall be inspected for water-tightness at section joint locations, pipe locations, and any other areas of possible leaks, prior to placing in service. Any leaks are to be repaired at the Contractor's expense.

### **3.11 SERVICE LINE AND CONNECTIONS**

- A. Sewer services shall be installed at points indicated on the Plans and at other locations as the Engineer and/or Owner may designate during construction. All service lines and connections shall be in accordance with the hereinbefore-specified materials and on the Sanitary Sewer Details sheet.
- B. Sewer services shall be laid on a minimum grade of one-eighth (1/8) inches per foot from the main to the proper location at each lot as per the Sanitary Sewer Details sheet. The minimum depth of cover over the service line at the property or easement line shall be three (3) feet unless otherwise directed by the Engineer or specified in the Plans. The ends of the sewer service shall be permanently marked with a six (6) foot metal fence post protruding three (3) feet above the existing ground with the top six (6) inches painted green. Before the final payment is issued, the Engineer and/or Owner shall inspect all service locations to verify that all have been adequately marked.
- C. Service lines and fittings shall be six (6) inch diameter of the hereinbefore-specified material unless otherwise directed by the Engineer or specified in the Plans.

### 3.12 SEWER TESTING

- A. GENERAL: Prior to putting the sewer system in service, all sewer lines shall be tested. If a test is required in accordance with an ASTM Specification or other publication, a copy of the publication shall be kept on site in good condition for the Contractors and Engineer's use during testing. If leaks are discovered, the Contractor is responsible for the repair and retesting of the line until satisfactory test results are obtained. The materials specified on the Plans shall govern what types of test are required and are as follows:
  - 1. PVC PLASTIC PIPE: Satisfactory results from a Deflection test and an Air Test are required. An Exfiltration test may be required if the Engineer deems necessary. An infiltration test will be required where the crown of the entire reach of sewer being tested lies three (3) feet or more under the existing water table.
  - 2. DUCTILE IRON PIPE: A satisfactory Air Test is required. An Exfiltration test may be required if the Engineer deems necessary. An infiltration test will be required where the crown of the entire reach of sewer being tested lies three (3) feet or more under the existing water table.
- B. Air Test: Air Test shall be conducted in accordance with one of the following standards.
  - 1. ASTM F1417: "Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air."
  - 2. UNI-B-6: "Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe." Published by the Uni-Bell PVC Pipe Association.
- C. Deflection Test: All PVC sewer main shall be tested with a five (5) percent mandrel and deficient sections shall be uncovered, re-bed, re-backfilled, and re-tested until satisfactory

test results are obtained. The mandrel test shall not be performed until the PVC sewer main has been installed in place for a minimum of thirty (30) days.

- D. Exfiltration Test: Exfiltration Test shall be conducted by blocking off manhole openings except those connecting with the reach being tested, filling the line and measuring the water required to maintain a constant level in the manholes. A reach shall be considered as the distance between two (2) manholes. Manholes shall be considered sections of equivalent diameter pipe. The pipe shall be filled with enough water to maintain at least four (4) feet of hydrostatic head above the top of pipe on the high end of the section being tested and at least four (4) feet of standing head at the lower end thereof with a maximum hydrostatic head of fifteen (15) feet allowed. The total allowable exfiltration shall not exceed two-hundred (200) gallons per inch of nominal diameter per mile of pipe per twenty-four (24) hours for each reach tested. For purposes of determining maximum allowable leakage, exfiltration tests shall be maintained on each for a minimum of two (2) hours and as much longer as necessary, in the opinion of the Engineer and/or Owner to locate all leaks. Any leaks found that exceeds the maximum allowable shall be repaired and retested by the Contractor at no additional cost. The Contractor shall provide, at his own expense, necessary piping between the reach to be tested and the source of water supply together with equipment, materials, and labor required for the test. The methods used and the time conducting exfiltration tests shall be acceptable to the Engineer and/or Owner.
  
- E. Infiltration Test: The total allowable infiltration shall not exceed two-hundred (200) gallons per inch of nominal diameter per mile of pipe per twenty-four (24) hours for each reach tested. A reach shall be considered as the distance between two (2) manholes. Manholes shall be considered sections of equivalent diameter pipe. Any leaks found that exceeds the maximum allowable shall be repaired and retested by the Contractor at no additional cost. The Contractor shall provide, at his own expense, necessary piping between the reach to be tested and the source of water supply together with equipment, materials, and labor required for the test.

### **3.13 FLUSHING**

- A. The completed gravity flow system shall be free of mud, siltation, and other foreign material deposited during construction. Flushing shall commence at the upstream end of the completed system and continue downstream manhole to manhole. Only water from an approved source shall be permitted.
  
- B. Water used in flushing shall not be permitted to enter into the existing system but shall be disposed of in a manner acceptable to the Owner. Flushing shall not be required in those sections of installed pipe and manholes where an exfiltration test was required and as adequately cleaned the mains.

### **3.14 CLEAN-UP**

- A. After backfill is completed, the Contractor shall dispose of surplus material, dirt, and rubbish from the site. Surplus dirt shall be disposed of in Contractor furnished and approved disposal areas or in on site areas as directed by the Engineer and/or Owner.
  
- B. After work is completed, the Contractor shall remove all tools and equipment used and shall leave the entire site in a clear and clean condition.

**END OF SECTION**



## SECTION 334100

### DRAINAGE PIPES AND CULVERTS

#### SECTION 1 – GENERAL

##### 1.01 DESCRIPTION

This item shall consist of furnishing all materials, labor, tools, equipment, and incidentals and performing all work necessary for the installation of pipe culverts, curb inlets, catch basins, and concrete headwalls and other specials in accordance with the Contract Documents. The work shall include all excavation, grading, backfill and other incidentals necessary for the installation of drainage structures as specified herein.

##### 1.02 APPLICABLE DOCUMENTS

A. The following publications form a part of this Specification and where referred to by basic designation only, are applicable to the extent indicated. Reference is to the later edition of each unless specified otherwise.

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

- a. C-76 Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
- b. C443 Joints for Circular Concrete Sewer and Culvert Pipe.
- c. C478 Precast Reinforced Concrete Manhole Sections.
- d. F667 Standard Specifications for Large Diameter Corrugated Polyethylene Pipe and Fittings.

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

- a. M190 Bituminous Coated Corrugated Metal Culvert Pipe & Pipe Arches.
- b. M36 Corrugated Metal Culvert Pipe, Aluminum Coated.
- c. M294 Standard Specification for Corrugated Polyethylene Pipe, 12" to 24" diameter.

3. American Concrete Institute (ACI):

- a. ACI 301 Specifications for Structural Concrete for Buildings.
- b. ACI 318 Building Code Requirements for Reinforced Concrete.

B. Local Building Codes: Any City, County and State Codes applying to the work.

C. Standard Specifications for State Aid Road and Bridge Construction, Latest Edition, as referenced herein.

##### 1.03 SUBMITTALS

A. Certified Test Reports: Before delivery of materials and equipment, certified copies of the reports of all tests specified herein or elsewhere shall be submitted to the ENGINEER for review. The testing shall have been performed in a laboratory meeting the ENGINEERS approval. Test reports shall be accompanied by notarized certificates from the manufacturer certifying that the tested material and equipment is of the same type, quality, manufacture and made as that proposed to be supplied.

- B. Concrete Pipe: Certified copies of test reports shall include strength tests of concrete pipe. Strength tests for concrete piping shall be the three edge bearing tests. Test reports shall be furnished prior to installation of piping.
- C. Shop Drawings: CONTRACTOR shall supply shop drawings as specified herein or as directed by the ENGINEER. Review of shop drawings by the ENGINEER shall be required prior to incorporation of the subject item into the work.

## SECTION 2 – PRODUCTS

- 2.01 REINFORCED CONCRETE PIPE:** Shall conform to ASTM C76, Class III, Wall B minimum, unless otherwise specified. Joints shall be rubber gasket or bituminous plastic. Jointing shall be in conformance with the manufacturer's recommendations, applicable ASTM Standards, and MSHD Standards.
- 2.02 CORRUGATED METAL PIPE:** Pipe shall be bituminous coated on inside and outside. Manufacture of pipe and galvanizing shall conform to AASHTO M190, Type A. Joints shall be fully bituminous coated coupling bands and conform to AASHTO M36. Bands shall not be less than 7 inches wide for pipe diameters from 8 inches to 30 inches, inclusive; and 12 inches wide for pipe with diameters from 36 inches to 60 inches, inclusive. Jointing shall be completed in accordance with the manufacturer's recommendations and applicable ASTM/AASHTO Standards. Corrugated metal pipe shall have 14 gauge wall thickness, unless otherwise specified.
- 2.03 ALUMINIZED STEEL PIPE:** Pipe shall be aluminized, Type II, and have smooth interior wall (Manning "n" roughness value = 0.012) shall be aluminized on inside and outside. Manufacture of pipe and galvanizing shall conform to AASHTO specifications. Joints shall be aluminized, Type II, coupling bands and conform to AASHTO specifications. Bands shall not be less than 7 inches wide for pipe diameters from 8 inches to 30 inches, inclusive; and 12 inches wide for pipe with diameters from 36 inches to 60 inches, inclusive. Jointing shall be completed in accordance with the manufacturer's recommendations and applicable ASTM/AASHTO Standards. Aluminized steel pipe shall have 14 gauge thicknesses, unless otherwise specified. Bedding material shall be required for all HDPE pipes, to the dimensions detailed on the construction plans.
- 2.04 CORRUGATED POLYETHYLENE PIPE:** High Density Polyethylene Pipe (HDPE), shall have a full circular cross-section, and shall be corrugated on the exterior and smooth lined on the interior and shall be manufactured in accordance with requirements of AASHTO M 294 and AASHTO MP7, latest editions. Pipe and fittings shall be manufactured from virgin PE compounds which conform to the requirements of cell class 335400C as defined and described in ASTM D 3350. All HDPE delivered and used shall be certified through the Plastics Pipe Institute (PPI) Third Party Certification Program, and shall bear the Third Part Administered PPI seal. Bedding material shall be required for all HDPE pipe, to the dimensions detailed on the construction plans.
- 2.05 CONCRETE:**
  - A. Cement, reinforcement, forms, jointing and other incidentals shall be as specified in the Section S-600 of the Standard Specifications for State Aid Road and Bridge Construction of the State of Mississippi, latest edition
  - B. All concrete work shall be in accordance with the provisions of "Building Code Requirements for Reinforced Concrete," ACI 318 and ACI 301. Any questions

regarding acceptable concrete practice shall be decided by reference to ACI 301 and to ACI Standards listed in Chapter 4 of ACI 318.

## **2.06 CONTRACTOR'S RESPONSIBILITY**

- A. The CONTRACTOR shall be responsible for the condition of all excavations made by him. All slides and cave-ins shall be removed without extra compensation, at whatever time and under whatever circumstances they may occur.

## **2.07 INCIDENTAL MATERIALS**

- A. Masonry brick shall conform to the standard specifications for sewer brick, made from clay or shale, ASTM C-32, Grade MS.
- B. Mortar: Portland Cement Mortar shall consist of one (1) part Portland Cement complying with ASTM C- 150, Type 1, and three (3) parts mortar sand and sufficient water mix mortar to proper consistency.
- C. Gray iron casting shall conform to the standard specifications for gray iron castings ASTM A-48, Class 25.
- D. Manhole Steps: Steps for manholes shall be cast aluminum alloy meeting the requirements of the Aluminum Association (Alloy AA-514) and Federal Specifications G4A.
- E. Foundations: Shall be either poured in place reinforced concrete as detailed, or precast sections set on undisturbed earth or select bedding, where ordered by the ENGINEER or detailed on the drawings. Concrete shall be Class "B" as specified in Section Section S-600 of the Standard Specifications for State Aid Road and Bridge Construction of the State of Mississippi, latest edition
- F. Flared End Section: Shall be of the same class and type of pipe installed where specified.
- G. Bedding Material: Bedding Material for storm drainage pipe shall be Type S1 Material unless otherwise specified.

## **SECTION 3 – EXCAVATION**

### **3.01 EXCAVATION**

- A. General: The CONTRACTOR shall perform all excavation of every description and of whatever substances encountered, to the depths indicated or as otherwise specified.
- B. During excavation, material suitable for backfilling in the opinion of the ENGINEER shall be stock piled in an orderly manner a sufficient distance from the banks of trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or not suitable for backfill shall be removed and wasted as approved by the ENGINEER. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved method.

### 3.02 TRENCHES

- A. The trenches shall be if the necessary width for the proper laying of the pipe. The bottom of the trenches shall be accurately graded and shaped to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for the portion of the pipe where it is necessary to excavate for pipe bells or joints.
- B. Depressions for joints shall be dug after the trench bottom has been graded in order that the pipe rest upon the prepared bottom for as nearly its full length as practicable. Depressions shall only be of such length, depth and width as required for properly making the particular type of joint.
- C. Care shall be exercised not to excavate below the depth indicated. Over excavated depths shall be backfilled with loose, granular, moist earth, and thoroughly tamped.
- D. The width of the trench at and below the top of the pipe and the trench wall shall not exceed the pipe O.D. plus 24 inches.
- E. The bottom of the trench shall be rounded so that at least the bottom quadrant of the pipe shall rest firmly on undisturbed soil for as nearly the full length of the barrel as proper jointing operations will permit. This part of the excavation shall be done manually only a few feet in advance of the pipe lying by men skilled in this type of work. The pipe bed shall be prepared to the ENGINEER'S complete satisfaction.
- F. Whenever unstable soil that is incapable of properly supporting the pipe is encountered in the bottom of the trench, such soil shall be removed for the full width of the trench and to the depth required. The trench shall be backfilled to the proper grade with an aggregate composed of coarse sand, fine gravel or other suitable material approved by the ENGINEER. The backfill shall be thoroughly compacted and shaped to form a bed for the pipe.

**3.03 DEWATERING/SHORING:** The CONTRACTOR shall perform all pumping, well pointing, or shoring necessary to perform the excavation and to maintain excavation in dry state during the work. This shall be an absorbed cost and shall not be measured for separate payment.

### 3.04 BACKFILLING

- A. General: The trenches shall not be backfilled until the system as installed conforms to the requirements specified. The trenches shall be carefully backfilled with the excavated materials, approved for backfilling. CONTRACTOR shall ensure that proper backfill and compaction is achieved beneath and around pipe haunches.
- B. Backfill material shall be Type S1 material. Backfill shall be carefully rammed and compacted in places.

- C. Trenches within roadways shall be backfilled to the top of the subgrade or the ground surface in 6 inch loose layers, and each layer shall be compacted to a density at least 98% of maximum density as determined by AASHTO Method T-99. The surface shall be graded to conform to the surrounding ground surface.
- D. Trenches in open areas shall be backfilled to a point one (1) foot above the top of the pipe in 6 inch loose layers. Each layer shall be compacted to a density of at least 98% of the maximum density as determined by AASHTO T-99. The remainder of the backfill above 1 foot level shall be properly and carefully compacted to the density of the adjacent earth, and the surface shall be mounded over the trench and left in a uniform and neat condition satisfactory to the ENGINEER.
- E. Trenches improperly backfilled in the opinion of the ENGINEER shall be reopened to the depth required for proper inspection, then refilled and recompacted as specified. There shall be no extra compensation for such corrective work.

### **3.05 PIPE LAYING**

- A. Pipe laying shall proceed upgrade with the spigot ends of bell and spigot pipe and tongue ends of tongue and groove pointing in the direction of flow in the case of concrete pipe. Corrugated metal pipe shall be laid with outside laps of circumferential joints pointing upstream and with longitudinal laps on the side. Corrugated polyethylene pipe shall be installed in accordance with ASTM recommended practice D-2321 and in accordance with manufacturer's recommendations.
- B. Each pipe shall be laid true to line and grade in such a manner as to form a close concentric joint with the adjoining pipe and to avoid sudden off sets of the flow line. As the work progresses, the interior of the pipe shall be cleared of all dirt and superfluous materials of every description.
- C. Trenches shall be kept free of water and pipe shall be laid when the condition of the trench or the weather is unsuitable for such work.
- D. Pipe shall be plugged or sealed at the end of work day to inhibit the entrance of foreign objects into the line.

### **3.06 JOINTS**

- A. Concrete Pipe: Joints shall be rubber gasket complying with ASTM C-443 or bituminous plastic sealer in accordance with MSHD Standard Section 707.04 as specified herein.
  - 1. All rubber gaskets shall be extruded or molded and cured in such a manner that any cross section will be dense, homogeneous, and free of porosity, blisters, pitting, and other imperfections. The gaskets shall be extruded or molded to the specified size within a tolerance of  $\pm 6\%$  on any dimension, measured at any cross section. The rubber gasket shall be fabricated from a high grade rubber compound. The basic polymer shall be natural rubber, synthetic rubber or a blend of both acceptable to the purchaser.

2. Bituminous plastic sealer shall be composed of a steam refined petroleum asphalt or of a refined coal tar, dissolved in a suitable solvent and stiffened with a mineral filler consisting essentially of short fiber asbestos. The sealer shall be smooth uniform mixture, not thickened or livered; it shall show no separation which cannot be easily overcome by stirring. The material shall be of such consistency and properties that it can readily applied with a towel, a putty knife, or a caulking gun without pulling or drawing. The material, when applied to pipe surfaces, shall exhibit good adhesive and cohesive properties and shall have only slight shrinkage after curing. The material shall be capable of being exposed to below freezing temperatures without incurring damage.
- B. Aluminized Steel Pipe: Joints shall be made with coupling bands. Bands shall be aluminized on inside and outside and shall be seated and made up tightly in accordance with the recommendations of the pipe manufacturer. The exterior surface of all bands and any other defects shall receive a field coat of bituminous paint.
  - C. Corrugated Polyethylene Pipe: Joints shall be made with split couplings corrugated to engage the pipe corrugations, and shall engage a minimum of 4 corrugations, 2 on each side of joint. A neoprene gasket shall be utilized with the couplings to provide a soil tight joint.

### **3.07 CONSTRUCTION OF CONCRETE HEADWALLS**

- A. General: Construction of concrete headwalls shall be of reinforced concrete and conform to dimensions, grades and details shown of the Drawings. Forms of exposed surfaces of headwalls shall be provided with liners and chamfers strips. Chamfers shall be 3/4".
- B. Exposed surfaces of parapets and wing walls shall be given a rubbed finish with a medium coarse carborundum stone.
- C. The structures shall be cured for a minimum of 7 days. The structures shall be kept wet by the use of wetted burlap or may be cured with membrane curing compound.
- D. The headwalls shall be carefully backfilled to a density at least that of the surrounding ground. All costs involved in excavation and backfilling shall be in the Contract Unit Price for headwalls.

### **3.08 CONSTRUCTION OF CATCH BASINS, CURB INLETS AND STORM MANHOLES**

- A. Brick masonry and concrete work for catch basins and inlets shall be constructed in conformity with the details shown on the Construction Plans.
- B. Where irons or other fittings enter the brick work, they shall be placed as the work is laid up, thoroughly bonded, accurately spaced and lined. Upon completion of the masonry and settings of castings and fittings, the inside and outside surfaces of the brick masonry shall be neatly plastered

with mortar to the thickness of one half (1/2) inch. Plastering shall be finished to a uniform, smooth surface and neatly pointed to all fittings.

- C. The concrete or brick and mortar shall be carefully constructed around the inlet and outlet pipes so as to prevent leakage and form a neat connection.
- D. Basins, inlets and manholes may be constructed partially or totally of precast reinforced concrete manhole sections and specials. All precast units shall comply with ASTM C-478 and joints shall be preformed plastic joints. Preformed plastic joint compound shall be "Butyl-Tite" as manufactured by Blue Ridge Rubber Company, Fletcher, North Carolina; "Kent -Seal" as manufactured by Hamilton Kent Manufacturing Company of Kent, Ohio; or equal. Preformed plastic joint compound shall meet Federal Specifications SS-S-SS-00219 and AASHTO M-198.

### **3.09 CLEAN\_UP**

After backfill of pipe and structures is completed, the area shall be graded to conform with the surrounding ground or to grade indicated, as applicable. The CONTRACTOR shall dispose of all surplus material, dirt and rubbish. Surplus material shall be deposited at locations and in a manner approved by the ENGINEER.

### **3.10 INSPECTION**

- A. Prior to final approval of the system, the CONTRACTOR and ENGINEER shall conduct a thorough inspection of the entire installation. Any indications of defects on material or workmanship or any obstruction to the flow in the pipe system shall be corrected.
- B. All defects shall be corrected by the CONTRACTOR without additional compensation and in a manner acceptable to the ENGINEER.

- 3.11 MAINTENANCE:** The **CONTRACTOR** shall be responsible, until final acceptance and without extra compensation, for the maintenance of all sewers and structures to the lines and grades established for the construction, for the stability of all backfills and the finished grades above the sewers and around the structures, and for the repair and replacement of all items which were damaged or removed during the construction. Restoration of pavement, base courses, driveways, curb and gutter, sidewalks and other items shall conform to the requirements specified in other sections of the Specifications.

**END OF SECTION**

## SECTION 334900

### STORM DRAINAGE STRUCTURES

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

This item shall consist of furnishing all materials, labor, tools, equipment, and incidentals and performing all work necessary for the installation of precast inlets, precast manholes, precast junction boxes, and other specials in accordance with the Construction Plans. The work shall include all excavation, grading, backfill and other incidentals necessary for the installation of drainage structures as specified herein.

##### 1.2 APPLICABLE DOCUMENTS

- A. The following publications form a part of this Specification and where referred to by basic designation only, are applicable to the extent indicated. Reference is to the later edition of each unless specified otherwise.
1. American Society for Testing and Materials (ASTM):
    - a. C-76 Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
    - b. C443 Joints for Circular Concrete Sewer and Culvert Pipe.
    - c. C478 Precast Reinforced Concrete Manhole Sections.
    - d. F667 Standard Specifications for Large Diameter Corrugated Polyethylene Pipe and Fittings.
  2. American Association of State Highway and Transportation Officials (AASHTO):
    - a. M190 Bituminous Coated Corrugated Metal Culvert Pipe & Pipe Arches.
    - b. M36 Corrugated Metal Culvert Pipe, Aluminum Coated.
    - c. M294 Standard Specification for Corrugated Polyethylene Pipe, 12" to 24" diameter.
  3. American Concrete Institute (ACI):
    - a. ACI 301 Specifications for Structural Concrete for Buildings.
    - b. ACI 318 Building Code Requirements for Reinforced Concrete.
- B. Local Building Codes: Any City, County and State Codes applying to the work.
- C. Standard Specifications for State Aid Road and Bridge Construction, Latest Edition, as referenced herein.

##### 1.3 SUBMITTALS

- A. Certified Test Reports: Before delivery of materials and equipment, certified copies of the reports of all tests specified herein or elsewhere shall be submitted to the ENGINEER for review. The testing shall have been performed in a laboratory meeting the ENGINEERS approval. Test reports shall be accompanied by notarized certificates from the manufacturer certifying that the tested material and equipment is of the same type, quality, manufacture and made as that proposed to be supplied.
- B. Shop Drawings: CONTRACTOR shall supply shop drawings as specified herein or as directed by the ENGINEER. Review of shop drawings by the ENGINEER shall be required prior to incorporation of the subject item into the work.



## **PART 2 PRODUCTS**

### **2.1 CONCRETE:**

- A. Cement, reinforcement, forms, jointing and other incidentals shall be as specified in Section S-600 of the Standard Specifications for State Aid Road and Bridge Construction of the State of Mississippi, latest edition
- B. All concrete work shall be in accordance with the provisions of "Building Code Requirements for Reinforced Concrete," ACI 318 and ACI 301. Any questions regarding acceptable concrete practice shall be decided by reference to ACI 301 and to ACI Standards listed in Chapter 4 of ACI 318.

### **2.2 CONTRACTOR'S RESPONSIBILITY**

- A. The CONTRACTOR shall be responsible for the condition of all excavations made by him. All slides and cave-ins shall be removed without extra compensation, at whatever time and under whatever circumstances they may occur.

### **2.3 INCIDENTAL MATERIALS**

- A. Masonry brick shall conform to the standard specifications for sewer brick, made from clay or shale, ASTM C-32, Grade MS.
- B. Mortar: Portland Cement Mortar shall consist of one (1) part Portland Cement complying with ASTM C-150, Type 1, and three (3) parts mortar sand and sufficient water mix mortar to proper consistency.
- C. Gray iron casting shall conform to the standard specifications for gray iron castings ASTM A-48, Class 25. Grate tops for all grate inlets shall be "Bee Hive" type by East Jordan Iron Works, Inc. or equal.
- D. Manhole Steps: Steps for manholes shall be cast aluminum alloy meeting the requirements of the Aluminum Association (Alloy AA-514) and Federal Specifications G4A.
- E. Foundations: Shall be either poured in place reinforced concrete as detailed, or precast sections set on undisturbed earth or select bedding, where ordered by the ENGINEER or detailed on the drawings. Concrete shall be Class "B" as specified in Section S-600 of the Standard Specifications for State Aid Road and Bridge Construction of the State of Mississippi, latest edition
- F. Flared End Section: Shall be of the same class and type of pipe installed where specified.
- G. Bedding Material: Bedding Material for storm drainage structures shall be Type S5 Material in accordance with 312333 and the Drawings. The thickness of bedding material beneath the structure shall be at least six inches.

## **PART 3 EXECUTION**

### **3.1 EXCAVATION AND BACKFILL**

- A. General: The CONTRACTOR shall perform all excavation of every description and of whatever substances encountered, to the depths indicated or as otherwise specified.
- B. All excavated materials shall be removed and disposed off of-site at the Contractor's expense. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved method.
- C. Backfill shall consist of Type S1 material placed in six inch lifts to 95% of maximum density as determined by ASTM D-698.

### **3.2 CONSTRUCTION OF GRATE INLETS, CURB INLETS AND STORM MANHOLES**

- A. Brick masonry and concrete work for inlets shall be constructed in conformity with the details shown on the Construction Plans.
- B. Where irons or other fittings enter the brick work, they shall be placed as the work is laid up, thoroughly bonded, accurately spaced and lined. Upon completion of the masonry and settings of castings and fittings, the inside and outside surfaces of the brick masonry shall be neatly plastered with mortar to the thickness of one half (1/2) inch. Plastering shall be finished to a uniform, smooth surface and neatly pointed to all fittings.
- C. The concrete or brick and mortar shall be carefully constructed around the inlet and outlet pipes so as to prevent leakage, form a neat connection and allow for positive drainage across the inlet.
- D. Basins, inlets and manholes shall be constructed totally of precast reinforced concrete manhole sections and specials. All precast units shall comply with ASTM C-478 and joints shall be preformed plastic joints. Preformed plastic joint compound shall be "Butyl-Tite" as manufactured by Blue Ridge Rubber Company, Fletcher , North Carolina; "Kent -Seal" as manufactured by Hamilton Kent Manufacturing Company of Kent, Ohio; or equal. Preformed plastic joint compound shall meet Federal Specifications SS-S-SS-00219 and AASHTO M-198.

### **3.3 CLEAN-UP**

After backfill of pipe and structures is completed, the area shall be graded to conform with the surrounding ground or to grade indicated, as applicable. The CONTRACTOR shall dispose of all surplus material, dirt and rubbish off of the site.

### **3.4 INSPECTION**

- A. Prior to final approval of the system, the CONTRACTOR and ENGINEER shall conduct a thorough inspection of the entire installation. Any indications of defects on material or workmanship or any obstruction to the flow in the pipe system shall be corrected.
- B. All defects shall be corrected by the CONTRACTOR without additional compensation and in a manner acceptable to the ENGINEER.

### **3.5 MAINTENANCE**

The CONTRACTOR shall be responsible, until final acceptance and without extra compensation, for the maintenance of all sewers and structures to the lines and grades established for the construction, for the stability of all backfills and the finished grades above the sewers and around the structures, and for the repair and replacement of all items which were damaged or removed during the construction.

### **3.6 WARRANTY**

The Contractor shall warrant all materials of construction and repair and all workmanship for a period of one (1) year from the date of final acceptance of the work. Should defects or failures occur during the period of warranty, the Contractor shall promptly take whatever steps are necessary to return the work to first class condition.

**END OF SECTION**