

SECTION 01410 - TESTING SERVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Selection and payment.
- B. Contractor submittals.
- C. Laboratory responsibilities.
- D. Laboratory reports.
- E. Limits on testing laboratory authority.
- F. Contractor responsibilities.
- G. Schedule of inspections and tests.

1.2 RELATED SECTIONS

- A. General Conditions of the Contract for Construction, inspection testing and approvals required by public authorities.
- B. Individual Specification Sections and Drawings.

1.3 REFERENCES

- A. ANSI/ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- B. ANSI/ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.4 SELECTION AND PAYMENT

- A. Owner will employ and pay for services of an independent testing laboratory to perform specified inspection and testing.
- B. Employment of testing laboratory shall in no way relive Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.5 QUALITY ASSURANCE

- A. Comply with requirements of ANSI/ASTM E329 and ANSI/ASTM D3740.
- B. Laboratory: Authorized to operate in state in which Project is located.
- C. Laboratory Staff: Maintain a full-time Registered Engineer on staff to review services.
- D. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards (NBS) Standards or accepted values of natural physical constants.

1.6 LABORATORY INSPECTION AND TESTING RESPONSIBILITIES.

- A. The testing agency shall perform inspections, tests and other services specified in Part 3 of this section.
 - 1. The testing agency shall provide the required qualified personnel at the project site.
 - 2. The testing agency shall cooperate fully with the Owner or Engineer in the performance of services.
- B. Reports shall be promptly submitted by the testing agency. Submittals indicating observations and results of tests and indicating compliance or non-compliance with the Contract Documents.
- C. Furnish samples of materials, design mixes, equipment, tools storage and assistance as required.
- D. Retesting due to non-conformance with the Contract Documents shall be performed by the same testing agency upon instructions from the City of West Monroe Construction Manager. Contractor shall be responsible for payment for all retesting operations.
- E. Testing agency(s) shall attend preconstruction conferences and progress meetings.

1.7 LABORATORY REPORTS

- A. After each inspection and test, promptly submit 4 (four) copies of laboratory report to the Owner's Engineer.
- B. Include:
 - 1. Date issued,
 - 2. Project title and number,
 - 3. Name of inspector,
 - 4. Date and time of sampling or inspection,
 - 5. Identification of product and Specifications Section,

6. Location in the Project,
7. Type of inspection or test,
8. Date of test,
9. Results of tests,
10. Conformance with Contract Documents.

C. When requested by Engineer or Owner, provide interpretation of test results.

1.8 LIMITS ON TESTING LABORATORY AUTHORITY

- A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Laboratory may not approve or accept any portion of the Work.
- C. Laboratory may not assume any duties of Contractor.
- D. Laboratory has no authority to stop the Work.

1.9 CONTRACTOR RESPONSIBILITIES

- A. Deliver to laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
- B. Cooperate with laboratory personnel, and provide access to the Work.
- C. Provide incidental labor and facilities to provide access to Work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples. Materials being tested shall be of identical to that being incorporated into the Work.
- D. Notify testing agency 24 hours prior to expected time for operations requiring inspection and testing services.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION

3.1 SCHEDULE OF INSPECTIONS AND TESTS

SECTION 02200 – EARTHWORK

- A. Testing laboratory will provide soils testing in accordance with requirements of Section 02200 - Earthwork.

- B. Reports:
 - 1. Testing laboratory will furnish reports as follows:
 - a. Contractor: One copy.
 - b. Engineer: One copy.

SECTION 03300 - CAST-IN-PLACE CONCRETE

- A. Required testing shall be performed in accordance with ACI 301 and testing standards listed in Section 03300.
- B. Submit proposed mix design of each type of concrete specified, to Testing Laboratory for review prior to commencement of Work. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
- C. Pay for qualification of proposed materials and establishment of mix designs in accordance with ACI 318.
- D. Notify Testing Laboratory 24 hours prior to placing concrete. Do not place concrete without Testing Laboratory present.
- E. Testing firm will:
 - 1. Review the Contractor's proposed materials and mix design.
 - 2. Conduct strength tests:
 - a. Secure composite samples (ASTM C172).
 - b. Mold, cure specimens from each sample (ASTM C31). A minimum of four concrete test cylinder shall be taken for every 100 or less cu. yds. of concrete placed each day.
 - c. Test cylinders in accordance with ASTM C39. Two specimens will be tested at 28 days for acceptance and one will be tested at 7 days for information. One specimen will be retained in reserve for later testing if required.
 - 3. Conduct slump tests: At least one slump test will be taken for each set of four test cylinders taken (ASTM C143).
 - 4. Conduct air content tests: For concrete exposed to freeze-thaw, at least one air content test will be made when slump test is taken in accordance with either ASTM C231, ASTM C 173, or ASTM C138.
 - 5. Conduct temperature tests: Determine temperature of concrete sample for each strength test.
- F. Testing laboratory will:
 - 1. Observe and report on concrete mixing of transit-mix trucks at start of each day's mixing. Prevailing conditions will be compared to criteria indicated on

appropriate design mix, including temperature, moisture, and condition of aggregates. Significant deviations will be immediately reported in writing to Engineer and designer mix laboratory, and corresponding adjustment shall be made before materials are discharged.

2. Observe and report on the addition of water to concrete at job site and length of time concrete is allowed to remain in truck during pour.
3. Certify each delivery ticket indicating type of concrete delivered or cast, amount of water added and time at which cement and aggregate were loaded into truck and time at which concrete was discharged from truck.

G. Authority and Responsibilities of Testing Laboratory:

1. Laboratory representative will immediately notify Engineer and Constructor of deviations from Specifications and accepted design mixes observed at mixing plant or job site.
2. If, in the opinion of laboratory representative, deviation observed will be probable cause for subsequent rejection of material, representative will inform Contractor and Engineer so that timely decision may be made as to whether or not to continue operations.
3. Subsequent to the on-the-spot verbal notification, laboratory will file written report of deficiencies or deviations noted, including summary of conversations and decisions made and actions taken at time. Written report shall be submitted to Contractor and the Engineer.

H. Reports:

1. Testing laboratory reports will be furnished as follows:
 - a. Concrete Supplier: One copy.
 - b. Contractor: One copy.
 - c. Engineer: One copy.
2. Reports will be made and distributed immediately after respective tests or inspections are made.
3. Where reports indicate deviations from Contract Documents, they will also include determination of probable cause of deviation and, where applicable, recommendation for corrective action.
4. Wherever testing laboratory recognizes trend of decreasing quality in concrete due to changing seasons, conditions of curing, or other cause, this will be brought to attention of the Engineer, along with recommendation for corrective action to be taken before materials fall below requirements of these Specifications.

END OF SECTION 01410

SECTION 02050 - DEMOLITION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Demolition and removal of pavements, drainage structures, utilities and curbing.
- B. Disconnecting and capping or removal of identified utilities.
- C. Filling voids in subgrade created as a result of removals or demolition.

1.2 RELATED SECTIONS

- A. Section 02100 - Site Preparation: Clearing within project area.
- B. Section 02227 - Aggregate Materials: Backfill materials.
- C. Construction drawings.

1.3 PROJECT RECORD DOCUMENTS

Accurately record actual locations of capped utilities, and subsurface obstructions.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable local code for demolition of structures, safety of adjacent structures, dust control and runoff control.
- B. Obtain required permits and licenses from authorities. Pay associated fees including disposal charges.
- C. Notify affected utility companies before starting work and comply with their requirements.
- D. Do not close or obstruct roadways, driveways or hydrants without permits.
- E. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

1.5 JOB CONDITIONS

- A. Temporary access across the work area will be provided to other contractors working on the site. Coordinate with other contractors.

- B. Owner assumes no responsibility for condition of facilities to be demolished.
- C. Conditions existing at time of inspection for bidding purposes will be maintained by Owner in so far as practicable. Variations may occur by Owner's operations prior to start of demolition work.
- D. Explosives shall not be brought to site or used.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

Aggregate materials specified in Section 02227.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide, erect, and maintain erosion control devices, temporary barriers and security devices at locations indicated.
- B. Protect existing landscaping materials, appurtenances and structures which are not to be demolished. Repair damage caused by demolition operations at no cost to Owner.
- C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.
- D. Mark location of utilities. Protect and maintain in safe and operable condition the utilities to remain. Prevent interruption of existing utility service to occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities as acceptable to governing authorities and the Owner's representative.

3.2 DEMOLITION REQUIREMENTS

- A. Conduct demolition to minimize interference with adjacent structures or pavements.
- B. Cease operations immediately if adjacent structures appear to be in danger. Notify Owner. Do not resume operations until directed.
- C. Conduct operations with minimum interference to public or private access. Maintain access and egress at all times.
- D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.

- E. Sprinkle Work with water to minimize dust. Provide hoses and water connections for this purpose.
- F. Comply with governing regulations pertaining to environmental protection.
- G. Clean adjacent improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

3.3 DEMOLITION

- A. Proceed with demolition in systematic manner.
- B. Locate demolition equipment and remove materials so as to prevent excessive loading to supporting soils.
- C. Remove stumps within 2 feet of proposed roadway subgrade.

3.4 FILLING VOIDS

- A. Completely fill below grade areas and voids resulting from demolition using approved select fill materials consisting of stone, gravel, and sand free from debris, trash, frozen materials, roots, and other organic matter.
- B. Ensure that areas to be filled are free of standing water, frost, frozen, or unsuitable material, trash, and debris prior to fill placement.
- C. Place fill materials in horizontal layers not exceeding 8" in loose depth and compact each layer at optimum moisture content of fill material to proposed density, unless subsequent excavation for new work is required.
- D. Grade surface to match adjacent grades and to provide flow of surface drainage after fill placement and compaction.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from site debris, rubbish, and other materials resulting from demolition operations.
- B. No burning of any material, debris, or trash on-site or off-site will be allowed, except when allowed by the appropriate governing authority and the Owner's representative. If allowed as stated above, burning shall be performed in manner prescribed by governing authority. Attend burning materials until fires have burned out or have been extinguished.

END OF SECTION 02050

SECTION 02100 - SITE PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES:

- A. Cleaning site of debris, grass, trees and other plant life in preparation for site work, grubbing of stumps, and disposal of waste.
- B. Protection of existing structures, trees or vegetation indicated on the contract documents to remain.
- C. Stripping topsoil from areas that are to be incorporated into the limits of the project and where so indicated on the construction drawings.

1.2 RELATED SECTIONS

- A. Section 02050 - Demolition
- B. Section 02200 - Earthwork
- C. Section 02270 - Slope Protection and Erosion Control
- D. Construction Drawings

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Construct temporary erosion control systems as directed by the engineer to protect adjacent properties and water resources from erosion and sedimentation.
- B. In the event that site work on this project will disturb five (5) or more acres, the contractor shall NOT begin construction without a "National Pollution Discharge Elimination System" (NPDES) permit governing the discharge of storm water from the construction site for the entire construction period. The permit requires a "Storm Water Pollution Prevention Plan" (SWP³) to be in place during construction which includes monitoring of storm water flows during construction.

The contractor shall be totally responsible for conducting the storm water management practices in accordance with the NPDES permit and for any enforcement action taken or imposed by Federal or State agencies, including the cost of fines, construction delays and remedial actions resulting from the contractor's failure to comply with all provisions of the NPDES permit.

1.4 JOB CONDITIONS

- A. Conditions existing at time of inspection for bidding purposes will be maintained by owner in so far as practical.
- B. Variations to conditions or discrepancy in actual conditions as they apply to site preparation operations are to be brought to the attention of the owner prior to the commencement of any site work.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 PREPARATION

Verify that existing plant life and clearing limits are clearly tagged, identified and marked in such a manner as to insure their safety throughout construction operations.

3.2 PROTECTION

- A. Locate and identify existing utilities that are to remain and protect them from damage.
- B. Protect trees, plant growth and features designated to remain.
- C. Conduct operations with minimum interference to public or private accesses and facilities. Maintain access and egress at all times and clean or sweep any roadways daily or as required by the governing authority. At such times as deemed necessary by the owner, dust control shall be provided with sprinkling systems or equipment provided by the contractor.
- D. Protect bench marks, property corners and all other survey monuments from damage or displacement. If a marker needs to be removed it shall be referenced by a licensed land surveyor and replaced, as necessary, by the same.

3.3 CLEARING

- A. Clear areas required for access to site and execution of work.
- B. Unless otherwise indicated on the drawings, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out stumps and roots. Depressions caused by clearing and grubbing operations are to be filled to subgrade elevation to avoid water ponding. Satisfactory fill material shall be placed in horizontal layers not exceeding 8" loose depth, and thoroughly compacted per fill requirements of this section and Section 02200.
- C. Remove grass, trees, plant life, stumps and all other construction debris from the site to a dump site that is suitable for handling such material according to state laws and regulations.

3.4 TOPSOIL EXCAVATION

- A. Strip topsoil from areas that are to be filled, excavated or re-graded to such a depth that it prevents intermingling with underlying subsoil or questionable material.
- B. Cut heavy growths of grass from areas before stripping and remove with the rest of the cleared vegetative material.
- C. Topsoil shall consist of organic surficial soil found in depth of not less than 4". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over 2" in diameter, weeds, roots, and other objectionable material.
- D. Stockpile topsoil in storage piles in areas where directed. Construct storage piles to freely drain surface water. Dispose of unsuitable topsoil as specified for waste material, unless otherwise specified by owner.

END OF SECTION 02100

SECTION 02200 - EARTHWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Protection, modification and/or installation of utilities as sitework progresses paying particular attention to grade changes and any necessary staging of work.
- B. Cutting, filling and grading to required lines, dimensions, contours and proposed elevations for proposed improvements.
- C. Scarifying, compaction, drying and removal of unsuitable material to ensure proper preparation of areas for fills or proposed improvements.

1.2 RELATED SECTIONS

- A. Section 02050 - Demolition
- B. Section 02100 - Site Preparation
- C. Section 02222 - Excavation, Backfill and Compaction for Utilities
- D. Section 02223 - Excavation, Backfill and Compaction for Pavement
- E. Section 02227 - Aggregate Materials
- F. Construction Drawings

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM) latest edition.
 - D 422 Method for Particle Size Analysis of Soils
 - D 698 Test for Moisture-Density Relations of Soils Using 5.5 lb. (2.5 kg) Rammer and 12-inch (304.8 mm) Drop (Standard Proctor)
 - D 1556 Test for Density of soil in Place by the Sand Cone Method
 - D 1557 Test for Moisture-Density Relations of Soils Using 10-lb (4.5 Kg) Rammer and 18-inch (457 mm) Drop (Modified Proctor)
 - D 1559 Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
 - D 2167 Test for Density of Soil in Place by the Rubber Balloon Method
 - D 2216 Laboratory Determination of Moisture content of Soil
 - D 2487 Classification of Soils for Engineering Purposes
 - D 2922 Tests for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth)

- D 3017 Test for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 - D 4318 Test for Plastic Limit, Liquid Limit, and Plasticity Index of Soils
 - C 25 Chemical Analysis of Limestone, Quicklime and Hydrate Lime
 - C 110 Physical Testing for Quicklime and Hydrated Lime, Wet Sieve Method
 - C 618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
 - C 977 Quicklime and Hydrated Lime for Soil Stabilization
- B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
- T 88 Mechanical Analysis of Soils

1.4 QUALITY ASSURANCE

- A. Independent Testing Laboratory selected and paid by owner, shall be retained to perform construction testing on site. Frequency of tests will be as follows:
1. In cut areas: Not less than one compaction test for every 5,000 square feet.
 2. In fill areas: Same rate of testing for each 8" lift (measured loose).
- B. If compaction requirements are not complied with at any time during construction process, remove and recompact deficient areas until proper compaction is obtained at no additional expense to owner.
- C. The following tests shall be performed on each type of on-site or imported soil material used as compacted fill as part of construction testing requirements.
1. Moisture and Density Relationship: ASTM D 698 or ASTM D1557.
 2. Mechanical Analysis: AASHTO T-88
 3. Plasticity Index: ASTM D 4318
- D. Field density tests for in-place materials shall be performed according to one of the following standards as part of construction testing requirements.
1. Sand-Cone Method: ASTM D 1556
 2. Balloon Method: ASTM D 2167
 3. Nuclear Method: ASTM D 2922 (Method B-Direct Transmission)
- E. Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results. Owner, architect, and contractor shall be provided with copies of reports within 96 hours of time test was performed. In event that any test performed fails to meet these Specifications, owner and contractor shall be notified immediately by independent testing laboratory.
- F. All costs related to retesting due to failures shall be paid for by the contractor at no additional expense to owner. Owner reserves the right to employ an Independent Testing

Laboratory and to direct any testing that is deemed necessary. Contractor shall provide free access to site for testing activities.

1.5 SUBMITTALS

- A. Submit a sample of each type of off-site fill materials that is to be used at the site in an air tight, 10 lb container for the testing laboratory.
- B. Submit the name of each material supplier and specific type and source of each material. Any change in source throughout the job requires approval of the owner or engineer.
- C. For use of fabrics or geogrids, a sample and "cut sheet" shall be submitted for approval by the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Excavated and re-used material for subsoil fill as specified herein (outside limits of pavement only).
- B. Aggregate fill as specified in Section 02227.
- C. Imported select material - sandy clay having a PI of 4 to 15, a maximum LL of 35, and less than 60% passing #200 sieve.
- D. Topsoil fill as specified in Section 02100.
- E. Acceptable stabilization fabrics and Geogrids:
 - 1. Mirafi 500X or 600X
 - 2. Phillips 66 Supac 6WS
 - 3. Dupont Typar 3401 and 3601

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify required lines, levels, contours and datum.
- B. Locate and identify existing utilities that are to remain and protect them from damage.
- C. Notify utility companies to remove and/or relocate any utilities that are in conflict with

the proposed improvements.

- D. Protect plant life, lawns, fences, existing structures, sidewalks, paving and curbs from excavating equipment and vehicular traffic.
- E. Protect benchmarks, property corners and all other survey monuments from damage or displacement. If a marker needs to be removed it shall be referenced by a licensed land surveyor and replaced, as necessary, by the same.
- F. Remove from site material encountered in grading operations that, in opinion of owner, is unsuitable or undesirable for backfilling, subgrade or foundation purposes. Dispose of in a manner satisfactory to owner. Backfill areas with layers of suitable material and compact as specified.
- G. Prior to placing fill in low areas, such as previously existing ditches, perform following procedures:
 - 1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain same results.
 - 2. After drainage of low area is complete, remove mulch, mud, debris, and other unsuitable material by using acceptable equipment and methods that will keep natural soils underlying low areas dry and undisturbed.
 - 3. If material is found to be unsuitable, all unsuitable material shall be removed from site.

3.2 EXCAVATION FOR FILLING AND GRADING

- A. Classification of Excavation: Contractor by submitting bid acknowledges that he has investigated the site to determine type, quantity, quality, and character of excavation work to be performed. Excavation shall be considered unclassified common excavation.
- B. Perform excavation using capable, well maintained equipment and methods acceptable to owner and governing agencies.
- C. When performing grading operations during periods of wet weather, provide adequate drainage and ground water management to control moisture of soils.
- D. Shore, brace, and drain excavations as necessary to maintain safe, secure, and free of water at all times.
- E. Excavated material is unacceptable as fill within the paving area.

3.3 FILLING AND SUBGRADE PREPARATION

- A. Fill areas to contours and elevations shown with unfrozen materials.

- B. Place fill in continuous lifts specified herein.
- C. Refer to Section 02223 for filling requirements for pavements.
- D. Areas exposed by excavation or stripping and on which subgrade preparations are to be performed shall be proofrolled to detect any areas of yielding material. Proofrolling shall be accomplished by making a pass with a fully-loaded tandem-axle dump truck, or approved equivalent. Areas of failure shall be excavated and re-compacted as stated above. Care shall be taken to not overload soils; pumping of soft material shall be avoided.
- E. Place geofabric directly on smooth graded native subgrade prior to placement of any fill. Install in accordance with manufacturer's instructions.
- F. Fill materials used in preparation of subgrade shall be placed in lifts or layers not to exceed 8" loose measure and compacted to a minimum density of 95% of optimum density, in accordance with ASTM D 1557, at a moisture content of not less than 1% below and not more than 3% above the optimum moisture content.
- G. Material imported from off-site shall be capable of producing a CBR (California Bearing Ratio) value equal to or above the pavement design subgrade CBR value of 6 as indicated on the Drawings.

3.4 MAINTENANCE OF SUBGRADE

- A. Finished subgrades and subbase shall be verified to ensure proper elevation and conditions for construction above subgrade.
- B. Protect subgrade and subbase from excessive wheel loading during construction, including concrete trucks and dump trucks.
- C. Remove areas of finished subgrade or subbase found to have insufficient compaction density to depth necessary and replace in a manner that will comply with compaction requirements by use of select material. Surface of subgrade or subbase after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.
- D. After all filling and grading operations are complete, and prior to cutting of cement into base material, all areas of roadway will be proofrolled in the presence of the OPPJ Public Works designated representative in accordance with their policy. Weight ticket for the tandem dump truck used shall indicate on 18 ton are load for this operation.

3.5 FINISH GRADING

- A. Grade all areas where finish grade elevations or contours are indicated on Drawings, other than paved areas and buildings, including excavated areas, filled and transition areas, and landscaped areas. Graded areas shall be uniform and smooth, free from rock,

debris, or irregular surface changes. Finished subgrade surface shall not be more than 0.10 feet above or below established finished subgrade elevation, and all ground surfaces shall vary uniformly between indicated elevations. Finish ditches shall be graded to allow for proper drainage without ponding and in a manner that will minimize erosion potential. For topsoil application, refer to Section 02900 Landscaping.

- B. Correct all settlement and eroded areas within one year after date of completion at no additional expense to owner. Bring grades to proper elevation. Replant or replace any grass, shrubs, bushes, or other vegetation that appears dead, dying or disturbed by construction activities. Refer to Section 02270 for slope protection and erosion control.

END OF SECTION 02200

SECTION 02221 - EXCAVATION, BACKFILLING AND COMPACTING FOR STRUCTURE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavate to line, grade and configuration as shown in the plans and specifications for proposed structures and expansion areas.
- B. Fill to line, grade and configuration as shown in the plans and specifications for proposed structures and expansion areas.
- C. Compacting for materials in an acceptable manner as stated herein.

1.2 RELATED SECTIONS

- A. Section 02200 - Earthwork
- B. Section 02227 - Aggregate Material
- C. Section 02520 - Portland Cement Concrete Paving
- D. Geotechnical report (if available) for boring locations and findings of subsurface materials and conditions.
- E. Construction drawings.
- F. Architectural plans and specifications as they relate specifically to earthwork beneath the buildings, where the architectural requirements are more stringent than the civil requirements.

1.3 REFERENCE STANDARDS

- A. American society for testing and materials (ASTM) latest edition.
 - D 422 Method for particle size analysis of soils.
 - D 698 Test for moisture-density relations of soils using 5.5 lb. (2.5 kg) Rammer and 12 inch (304.8 mm) drop (Standard Proctor).
 - D 1556 Test for density of soil in place by the sand cone method.
 - D 1557 Test for moisture-density relations of soils using 10-lb (4.5 kg) Rammer and 18-inch (457 mm) drop (Modified Proctor).
 - D 1559 Test method for resistance to plastic flow of bituminous mixtures using Marshall Apparatus.
 - D 2167 Test for density of soil in place by the Rubber Balloon Method.
 - D 2216 Laboratory determination of moisture content of soil.

- D 2487 Classification of soils for engineering purposes.
 - D 2922 Tests for density of soil and soil-aggregate in place by nuclear methods (shallow depth).
 - D 3017 Test for moisture content of soil and soil aggregate in place by nuclear methods (shallow depth).
 - D 4318 Test for plastic limit, liquid limit, & plasticity index of soils.
 - C 25 Chemical analysis of limestone, quicklime and hydrated lime.
 - C 110 Physical testing for quicklime and hydrated lime, wet sieve method.
 - C 618 Specification for fly ash and raw or calcined natural pozzolan for use as a mineral admixture in portland cement concrete.
 - C 977 Quicklime and hydrated lime for soil stabilization.
- B. American Association of State Highway and Transportation Officials (AASHTO) latest edition.
- T 88 Mechanical Analysis of Soils.

1.4 QUALITY ASSURANCE

Independent testing laboratory selected and paid by owner shall be retained to perform construction testing on filling operations and subgrade analysis as specified in section 02200 and as stated herein.

1.5 SUBMITTALS

- A. Shop drawings or details pertaining to excavating and filling for structures are not required unless otherwise shown on the drawings or specifications or if contrary procedures to the project documents are proposed.
- B. Submit a sample of each type of off-site fill material that is to be used in backfilling in an air-tight, 10 lb. container for the testing laboratory or submit a gradation and certification of the aggregate material that is to be used to the testing laboratory for review.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fill material from on-site as specified in section 02200 and approved by the owner or owner's representative.
- B. Fill material from off-site as specified in section 02200 and approved by the owner or owner's representative.
- C. Aggregate material as specified in section 02227.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify all lines, elevations and grades necessary to construct building subgrades as shown in the plans and specifications.
- B. Carefully protect benchmarks, property corners, monuments or other reference points.
- C. Locate and identify all site utilities that have previously been installed and may be in danger of damage by grading operations.
- D. Locate and identify all existing utilities that are to remain and protect them from damage.
- E. Over excavate and properly prepare areas of subgrade that are not capable of supporting the proposed systems. These areas shall be stabilized by using acceptable filter fabrics and/or aggregate materials placed and compacted as specified.

3.2 EXCAVATION

- A. Excavate building areas to line and grade as shown in the plans and specifications being careful not to over excavate beyond the elevations needed for building subgrades.
- B. Engage all suitable material into the project fill areas as specified in Section 02200.
- C. Unsuitable excavated material is to be disposed of in a manner and location that is acceptable to the owner and local governing agencies.
- D. Perform excavation using capable, well maintained equipment and methods acceptable to the owner and the project document requirements.

3.3 FILLING AND SUBGRADE PREPARATION

- A. Building area subgrade pad shall be that portion of site directly beneath and ten feet (10') beyond the building and appurtenances including the limits of any future building expansion areas as shown on the civil site drawings.
- B. The building area subgrade pad shall be prepared in strict accordance with the "foundation subsurface preparation" as shown on the civil-site drawings and/or the architectural-structural drawings whichever is more stringent. Rock larger than six inches (6") shall not be part of building subgrade fill.
- C. Areas exposed by excavation or stripping and on which building subgrade preparations are to be performed shall be scarified to a minimum depth of 8" and compacted to a minimum of 95% of the optimum density, in accordance with ASTM D 698, (or 92% of the optimum density, in accordance with ASTM D1557) at a moisture content of not less

than 1% below and not more than 3% above the optimum moisture content. These areas shall then be proof-rolled to detect any areas of insufficient compaction. Proof-rolling shall be accomplished by making a minimum of two (2) complete passes with a fully-loaded tandem-axle dump truck, or approved equivalent, in each of the two perpendicular directions under the supervision and direction of a field geotechnical engineer. Areas of failure shall be excavated and recompacted as stated above.

- D. Fill materials used in preparation of building subgrade shall be placed in lifts or layers not to exceed 8" loose measure and compacted to a minimum density of 95% of optimum density, in accordance with ASTM D 698 (or 92% of the optimum density, in accordance with ASTM D 1557), at a moisture content of not less than 1% below and not more than 3% above the optimum moisture content. Unless specifically stated otherwise in the "foundation subsurface preparation" on the Drawings, the following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of suitable materials to be used as fill in the specified areas:

<u>Location</u>	<u>PI</u>	<u>LL</u>
*Building area, below upper four feet	20	50
*Building area, upper four feet	12	40

(*References to depth are to proposed subgrade elevations)

3.04 COMPACTION

- A. Maintain optimum moisture content of fill materials to attain required compaction density.
- B. All materials shall be tested in accordance with Section 02200.
- C. An independent testing laboratory selected and paid by the owner, shall be retained to perform testing on site.
- D. Compaction tests will be as specified in Section 02200 together with the following for building subgrade areas including 10'-0" outside exterior building lines:

In cut areas, not less than one compaction test for every 2,500 square feet.

In fill areas, same rate of testing for each 8" lift (measured loose).

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

3.5 MAINTENANCE OF SUBGRADE

- A. Finished subgrades shall be verified to ensure proper elevation and conditions for construction above subgrade.

- B. Protect subgrade from excessive wheel loading during construction, including concrete trucks and dump trucks.
- C. Remove areas of finished subgrade found to have insufficient compaction density of depth necessary and replace in a manner that will comply with compaction requirements by use of materials equal to or better than best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.6 FINISH GRADING

- A. Finish grading shall be in accordance with Section 02200 and as more specifically stated herein.
- B. Grading of building areas shall be checked by string line from grade stakes (blue tops) set at not more than 50' centers. Tolerance of 0.10 feet, more or less, will be permitted. Contractor to provide engineering and field staking necessary for verification of lines, grades, and elevations.

END OF SECTION 02221

SECTION 02222 - EXCAVATION, BACKFILLING AND COMPACTING FOR UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Excavating trenches for the installation of utilities
- B. Backfilling trench with bedding material as specified and indicated and finishing filling trench with suitable material to proposed subgrade.
- C. Compacting backfill materials in an acceptable manner

1.2 RELATED SECTIONS

- A. Section 02200 - Earthwork
- B. Section 02227 - Aggregate Materials
- C. Section 02660 - Water Distribution Systems
- D. Construction Drawings

1.3 REFERENCE STANDARDS

- A. American society for testing and materials (ASTM) Latest Edition
 - D 422 Method for Particle Size Analysis
 - D 698 Test for Moisture-Density Relations of Soils Using 5.5-lb. (2.5 Kg) Rammer and 12-inch (304.8mm) Drop (Standard Proctor)
 - D 1556 Test for Density of Soil in Place by the Sand Cone Method
 - D 1557 Test for Moisture-Density Relations of Soils Using 10-lb. (4.5 Kg) Rammer and 18-inch (457 mm) Drop (Modified Proctor)
 - D 1559 Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
 - D 2216 Laboratory Determination of Moisture Content of Soil
 - D 2487 Classification of Soils for Engineering Purposes
 - D 2922 Tests for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 - D 3017 Test for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
 - D 4318 Test for Plastic Limit, Liquid Limit, & Plasticity Index of Soils
- B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
 - T 88 Mechanical Analysis of Soils

1.4 QUALITY ASSURANCE

Independent testing laboratory selected and paid by owner, shall be retained to perform construction testing on backfilling operations as specified in Section 02200 and as stated herein.

1.5 SUBMITTALS

- A. Shop Drawings or details pertaining to Site Utilities are not required unless use of materials, methods, equipment, or procedures are contrary to Drawings or these specifications are proposed. Do not perform work until required shop drawings have been accepted by Owner.
- B. The Contractor shall contact all utility companies and have all existing lines located and marked prior to start of any excavation.
- C. Submit a sample of each type of offsite fill material that is to be used in backfilling in an air-tight, 10 lb container for the testing laboratory or submit a gradation and certification of the aggregate material that is to be used to the testing laboratory for review.

1.6 PROJECT RECORD DOCUMENTS

Accurately record actual locations of all subsurface utilities, structures and obstructions encountered.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Bedding Material: Processed sand and gravel free from clay lumps, organic, or other deleterious material, and complying with following gradation requirements:

<u>U. S. Sieve Size</u>	<u>Percent Passing (by weight)</u>
1 Inch	100
3/4 Inch	90-100
3/8 Inch	20-55
No. 4	0-10
No. 8	0-5

- B. Backfill material from site excavation is not allowed under or within 5 feet of paved or future pavement areas.
- C. Backfill material from offsite shall be sand as specified in Section 02227 and approved by the Engineer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Set all lines, elevations, and grades for utility and drainage system work and control system for duration of work, including careful maintenance of bench marks, property corners, monuments, or other reference points.
- B. Maintain in operating condition all existing utilities, active utilities and drainage systems encountered in utility installation. Repair any surface or subsurface improvements shown on Drawings.
- C. Verify location, size, elevation, and other pertinent data required to make connections to existing utilities and drainage systems as indicated on Drawings. Contractor shall comply with local codes and regulations.
- D. Over excavate and properly prepare areas of subgrade that are not capable of supporting the proposed systems. These areas shall be stabilized by using acceptable filter fabrics and/or additional bedding material placed and compacted as specified.
- E. Install dewatering systems that will be required to construct the proposed utilities in a manner that is described herein.

3.2 EXCAVATION

- A. The local utility companies shall be contacted before excavation shall begin. Dig trench at proper width and depth for laying pipe, conduit, or cable. Over excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding.
- B. All trench excavation side walls greater than 5 feet in depth shall be sloped, shored, sheeted, braced or otherwise supported by means of sufficient strength to protect the workmen within them in accordance with the applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to an exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.
- C. Perform excavation as indicated for specified depths. During excavation, stockpile materials far enough from bank of trench to avoid overloading, slides, or cave-ins.
- D. Remove excavated materials not suitable for backfill or embankments and waste as specified. Any structures discovered during excavation(s) shall be disposed of as specified. Assure that no boulders or rocks exist in the subgrade for a depth of at least 6" below the bottom of the pipe.
- E. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches or other excavations by pumping or other acceptable methods.

- F. Open cut excavation with trenching machine or backhoe. Dispose of unsuitable material and provide other suitable material at no additional cost to Owner.
- G. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length, except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.
- H. Trench width requirements below the top of the pipe shall not be less than 12" nor more than 18" wider than outside surface of any pipe or conduit that is to be installed to designated elevations and grades. All other trench width requirements for pipe, conduit, or cable shall be the least practical width that will allow for proper compaction of trench backfill.
- I. Trench depth requirements measured from finished grade or paved surface shall be as indicated on the Drawings.
- J. Provide sheeting and bracing, when necessary, in trenches and other excavations where protection of workmen required. Sheeting may be removed after sufficient backfilling to protect against damaging or injurious caving.

3.3 PIPE BEDDING

- A. Accurately cut trenches for pipe or conduit that is installed to designated elevations 4" below bottom of pipe and to width as specified. Place bedding material, compact in bottom of trench, and accurately shape to conform to lower portion of pipe barrel. After pipe installation, place backfill as specified and compact in maximum 8" layers measured loose to the top of the trench.
- B. Place bedding and backfill for utilities so as to protect geotextile fabric as specified on the plans and specifications.

3.4 BACKFILLING

- A. Criteria: Backfill trenches as specified. If improperly backfilled, reopen to depth required to obtain proper compaction. Backfill and compact, as indicated on drawings, to properly correct condition in an acceptable manner.
- B. Backfilling: After pipe or conduit has been installed, bedded, and tested as specified, backfill trench or structure excavation with specified material placed in 8" maximum loose lifts.
- C. Backfill trenches to the contours and elevations shown on the plans.
- D. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

3.5 COMPACTION

- A. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as a method of compaction.
- B. Maintain optimum moisture content of fill materials to attain required compaction density.
- C. An independent testing laboratory shall perform testing at intervals not exceeding 200' of trench for the first and every other eight-inch (8") lift of compacted trench backfill and furnish copies of test results as specified. Compact to minimum density of 95% of optimum density in paved areas or 92% of optimum density outside paved areas in accordance with ASTM D1557.
- D. All materials used for backfill shall comply with the requirements of Section 02200.

END OF SECTION 02222

SECTION 02223 - EXCAVATION, BACKFILLING AND COMPACTING FOR PAVEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Excavate to line, grade and configuration as shown in the plans and specifications for proposed and future pavement areas.
- B. Fill to line, grade and configuration as shown in the plans and specifications for proposed and future pavement areas.
- C. Compacting fill materials in an acceptable manner as stated herein.

1.2 RELATED SECTIONS

- A. Section 02200 - Earthwork
- B. Section 02227 - Aggregate Materials
- C. Section 02505 - Paving Base Course
- D. Section 02511 – Asphaltic Concrete Paving
- E. Section 02520 - Portland Cement Concrete Paving
- F. Section 02525 - Concrete Curbs and Sidewalks
- G. Construction Drawings

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM) latest edition.
 - D 422 Method for Particle Size Analysis of Soils
 - D 698 Test for Moisture-Density Relations of Soils Using 5.5 lb. (2.5 kg) Rammer and 12-inch (304.8 mm) Drop (Standard Proctor)
 - D 1556 Test for Density of soil in Place by the Sand Cone Method
 - D 1557 Test for Moisture-Density Relations of Soils Using 10-lb (4.5 Kg) Rammer and 18-inch (457 mm) Drop (Modified Proctor)
 - D 1559 Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
 - D 2167 Test for Density of Soil in Place by the Rubber Balloon Method
 - D 2216 Laboratory Determination of Moisture content of Soil
 - D 2487 Classification of Soils for Engineering Purposes
 - D 2922 Tests for Density of Soil and Soil-Aggregate in Place by Nuclear

Methods (Shallow Depth)

- | | |
|--------|---|
| D 3017 | Test for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) |
| D 4318 | Test for Plastic Limit, Liquid Limit, and Plasticity Index of Soils |
| C 25 | Chemical Analysis of Limestone, Quicklime and Hydrated Lime |
| C 110 | Physical Testing for Quicklime and Hydrated Lime, Wet Sieve Method |
| C 618 | Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete |
| C 977 | Quicklime and Hydrated Lime for Soil Stabilization |
- B. American Association of State Highway and Transportation Officials (AASHTO) latest edition
- T 88 Mechanical Analysis of Soils

1.4 QUALITY ASSURANCE

Independent testing laboratory selected and paid by owner shall be retained to perform construction testing on filling operations and subgrade analysis as specified in Section 02200 and as stated herein.

1.5 SUBMITTALS

- A. Shop drawings or details pertaining to excavating and filling for pavement are not required unless otherwise shown on the drawings or specifications or if contrary procedures to the project documents are proposed.
- B. Submit a sample of each type of off-site fill material that is to be used in backfilling in an air-tight, 10 lb. container for the testing laboratory or submit a gradation and certification of the aggregate material that is to be used to the testing laboratory for review.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Common fill material from on-site shall not be used under paved areas.
- B. Select fill material from off-site as specified in Section 02200 and approved by the owner's representative.
- C. Aggregate material as specified in Section 02227.
- D. Acceptable stabilization fabrics and geogrids:

1. Mirafi 500X or 600X
2. Phillips 66 Supac 6WS
3. Dupont Typar 3401 and 3601

PART 3 - EXECUTION

3.1 PREPARATION

- A. Identify all lines, elevations and grades necessary to construct pavements, curb and gutter, bases, walkways and roadways as shown in the plans and specifications.
- B. Carefully protect benchmarks, property corners, monuments or other reference points.
- C. Locate and identify all site utilities that have previously been installed and may be in danger of damage by grading operations.
- D. Locate and identify all existing utilities that are to remain and protect them from damage.
- E. Over excavate and properly prepare areas of subgrade that are not capable of supporting the proposed systems. These areas shall be stabilized by using acceptable filter fabrics and/or aggregate material placed and compacted as specified.

3.2 EXCAVATION

- A. Excavate roadway and pavement areas to line and grade as shown in the plans and specifications.
- B. Engage all suitable material into the project fill areas as specified in Section 02200.
- C. Unsuitable excavated material is to be disposed of off-site in a manner and location that is acceptable to the Owner. Locations of spoil of this material will be made available adjacent to the site of Contractor desires.
- D. Perform excavation using capable, well maintained equipment and methods acceptable to the owner and the project document requirements.

3.3 FILLING AND SUBGRADE PREPARATION

- A. Areas exposed by excavation or stripping shall be prepared as subgrade in accordance with Sections 02100 and 02200.
- B. Fill materials used under pavements shall be placed in lifts or layers not to exceed 8" loose measure and compacted to a minimum density of 98% of optimum density, in accordance with ASTM D 698, (or 95% of the optimum density, in accordance with ASTM D 1557) at a moisture content of not less than 1% below and not more than 3% above the optimum moisture content.

- C. Fill material under pavements shall meet the requirements as specified in Section 02200.
- D. Material imported from off-site shall have a CBR (California Bearing Ratio) value equal to or above the pavement design subbase CBR value of 6, when compacted to specified minimum values.

3.4 COMPACTION

- A. Maintain optimum moisture content of fill materials to attain required compaction density.
- B. All materials shall be tested in accordance with Section 02200.
- C. An independent testing laboratory selected and paid by the owner, shall be retained to perform testing on-site.
- D. Compaction test will be as specified in Section 02200 together with the following for paving areas:
 - 1. In cut areas not less than one compaction test for every 5,000 square feet.
 - 2. In fill areas, same rate of testing for each 8" lift (measured loose).
- E. If compaction requirements are not complied with at any time during construction process, remove and re-compact deficient areas until proper compaction is obtained at no additional expense to owner.

3.5 MAINTENANCE OF SUBGRADE

- A. Finished subgrade and subbase shall be verified to ensure proper elevation and conditions for construction above subgrade.
- B. Protect subgrade from excessive wheel loading during construction including concrete trucks and dump trucks.
- C. Remove areas of finished subbase found to have insufficient compaction density to depth necessary and replace in a manner that will comply with compaction requirements by use of material. Surface of subbase after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.
- D. After all filling and grading operations are complete, and prior to cutting of cement into base material, all areas of roadway will be proofrolled in the presence of the OPPJ Public Works designated representative in accordance with their policy. Weight ticket for the tandem dump truck used shall indicate on 18 ton are load for this operation.

3.6 FINISH GRADING

- A. Finish grading shall be in accordance with Section 02200 and as more specifically stated

herein.

- B. Grading of paving areas shall be checked by string line from grade stakes (blue tops) set at not more than 50' centers. Tolerances of 0.10 feet, more or less, will be permitted. Contractor to provide engineering and field staking necessary for verification of lines, grades, and elevations.

END OF SECTION 02223

SECTION 02227 - AGGREGATE MATERIALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

Aggregate and Soil Materials

1.2 RELATED SECTIONS

- A. Section 02050 - Demolition
- B. Section 02100 - Site Preparation
- C. Section 02200 - Earthwork
- D. Section 02222 - Excavation, Backfill and Compaction for Utilities
- E. Section 02223 - Excavation, Backfill and Compaction for Pavement
- F. Section 02270 - Slope Protection and Erosion Control
- G. Construction Drawings

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM) latest edition.
 - ANSI/ASTM C136 Method for Sieve Analysis of Fine and Coarse Aggregates.
 - ANSI/ASTM D698 Test Methods for Moisture-Density Relations of Soils and Soil-aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
 - ANSI/ASTM D1557 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
 - ASTM D2167 Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - ASTM D2487 Classification of Soils for Engineering Purposes.
 - ASTM D2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - ASTM D3017 Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
 - ASTM D4318 Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- B. American Association of State Highway and Transportation Officials (AASHTO) latest edition.
 - AASHTO T180 Moisture-Density Relations of Soils Using a 10-lb (4.54 Kg) Rammer and an 18 inch (457 mm) Drop.
 - AASHTO M147 Materials for Aggregate and Soil-Aggregate.

1.4 QUALITY ASSURANCE

Tests and analysis of aggregate material will be performed in accordance with standard ASTM and AASHTO procedures listed herein.

1.5 SUBMITTALS

- A. Submit in air tight containers a 10-pound sample of each aggregate or mixture that is to be incorporated into the project to the testing laboratory designated by the owner.
- B. Submit the name of each material supplier and specific type and source of each material. Any change in source throughout the job requires approval of the owner and engineer.
- C. Submit materials certificate to on-site independent testing laboratory which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All construction and materials shall meet or exceed the requirements of this section and any state highway department specification section referred to or noted on the drawings which pertain to paving base course design, materials, preparation, and/or execution. All materials shall be as indicated on Drawings and shall comply with applicable state highway specification regarding source, quality, gradation, liquid limit, plasticity index, and mix proportioning.
- B. Crushed stone base course material shall meet LDOTD, Section 1003.03(d), or AHD Classification SB-2.
- C. Select fill material used for paving subgrade shall be sandy –clay material, having a maximum Plasticity Index of 12, a maximum Liquid Limit of 30, and a maximum percent passing the #200 sieve of 60%.
- D. Select granular material shall be sand conforming to the following requirements:

<u>Gradation</u>	
<u>U. S. Sieve No.</u>	<u>Per Cent Passing (By Weight)</u>
½"	100
10	75-100
200	0-15

PART 3 - EXECUTION

3.1 STOCKPILING

Stockpile on-site at locations indicated by the owner in such a manner that there will be no standing water or mixing with other materials.

3.2 BORROW SITES

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

3.3 TRANSPORTATION

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

END OF SECTION 02227

SECTION 02270 - SLOPE PROTECTION AND EROSION CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Temporary and permanent erosion control systems.
- B. Slope Protection Systems.

1.2 RELATED SECTIONS

- A. Section 02100 - Site Preparation
- B. Section 02200 - Earthwork
- C. Construction Drawings

1.3 ENVIRONMENTAL REQUIREMENTS

The contractor shall protect adjacent properties and water resources from erosion and sediment damage throughout the life of the contract.

1.4 COORDINATION

Coordinate erosion control grassing with required permanent grassing required by landscape plans.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Quick growing grasses such as wheat, rye or oats.
- B. Hay or straw bales.
- C. Fencing for siltation control as specified on the plans.
- D. Curlex blankets by American Excelsior Company or approved equal.

- E. Bale stakes for each bale shall be a minimum of 4 feet in length and shall be either 2 #4 rebars, 2 steel pickets or 2-2"x2" hardwood stakes driven 1'-6" to 2'-0" into ground.
- F. Temporary mulches such as loose hay, straw, netting, wood cellulose or agricultural silage.
- G. Fence stakes shall be metal stakes a minimum of 8 feet in length.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare a site Storm Water Pollution Prevention Plan in accordance with the erosion control plan and submit any variations "for information only" to the Owner.
- B. Deficiencies or changes in the erosion control plan as it is applied to current conditions will be evaluated and implemented as necessary by the Contractor and brought to the attention of the Owner and the Engineer.

3.2 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

- A. Place erosion control systems in accordance with the erosion control plan.
- B. The contractor will be required to incorporate all permanent erosion control features into the project at the earliest practical time to minimize the need for temporary controls. Cut slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and practical.
- C. The temporary erosion control systems installed by the contractor shall be maintained to control siltation at all times during the life of the contract. The contractor must respond to any maintenance or additional work ordered by the Owner within a 48 hour period.
- D. Any additional material and work required and authorized by the Owner which is beyond the extent of the erosion control plan shall be paid for by the owner.
- E. Slopes that erode easily shall be temporary seeded as the work progresses with a rye grass application.
- F. Upon acceptance of stabilized slopes and permanent erosion protection measures, the Contractor shall remove all temporary devices and dress areas to the satisfaction of the Owner.

END OF SECTION 02270

SECTION 02281 - TERMITE CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work included: Provide soil poisoning to control subterranean termites as specified herein and needed for a complete and proper treatment.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

- A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Qualifications of subcontractor:
 - 1. Properly licensed to provide such services by governmental agencies having jurisdiction.
 - 2. Not less than five years' successful experience in soil treatment for subterranean termites.

1.3 SUBMITTALS

- A. Comply with pertinent provisions of Section 01340.
- B. Product data: Within 30 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Manufacturers specifications and other data needed to prove compliance with the specified requirements.

1.4 WARRANTY

- A. Upon completion of the Work, and as a condition of its acceptance, deliver to the Architect/Engineer two (2) copies of a Warranty signed by an authorized representative of the installing subcontractor, and co-signed by the Contractor, agreeing:
 - 1. To make an inspection of the Work once each year for a total period of five years following Date of Substantial Completion for the purpose of detecting termite infestation;

2. If termite infestation is found during that five-year period, to retreat in accordance with prevailing practices of the trade and within ten calendar days after such infestation is discovered;
3. To repair damage to the Work caused by subterranean termites during that five-year period, to a maximum cost of \$5,000;
4. To make such inspections, re-treatment, and repairs at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. To the extent approved by governmental agencies having jurisdiction, use working solutions containing any one of the following chemicals at the listed minimum concentration:
 1. Aldrin: 0.5%
 2. Heptachlor: 0.5%
 3. Chlordane: 1.0%
 4. Dieldrin: 0.5%
- B. If combinations of toxicant are approved by government agencies having jurisdiction, provide toxicant having such approval and in the maximum strength so approved, at no additional cost to the Owner.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 APPLICATION

- A. Begin soil poisoning only after all preparation for slab preparation is complete.
- B. Slabs on grade:
 1. Apply toxicant as an overall treatment at the minimum rate of one gallon of toxicant to each 10 sq ft of area under slabs on grade within building lines.
- C. Walls:
 1. Apply toxicant at the rate of two gallons of toxicant per five linear ft along both sides of all foundations walls, cross walls, and grade beams, after all nearby excavation has been completed.
 2. Apply toxicant at the rate of one gallon of toxicant per five linear ft to voids in masonry walls.

- D. Miscellaneous: Apply toxicant at the rate of two gallons of toxicant per five linear ft at the following areas:
1. Immediately below expansion joints, control joints, and all areas where slab will be penetrated by construction features.
 2. Where exterior facings or veneers extend below grade level along the exterior side of all foundation walls.
 3. Where unit masonry foundation construction is used.
- E. If soil is disturbed after treatment, retreat disturbed areas.

END OF SECTION 02281

SECTION 02505 - PAVING BASE COURSE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Granular Base

1.2 RELATED SECTIONS

- A. Section 02100 - Site Preparation
- B. Section 02200 - Earthwork
- C. Section 02227 - Aggregate Materials
- D. Section 02520 - Portland Cement Concrete Paving
- E. Section 02525 - Concrete Curb and Gutter
- F. Construction Drawings

1.3 REFERENCES

- A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- C. ASTM D2167 - Test Method for Density and Unit Weight of Soil in-place by the Rubber Balloon Method.
- D. ASTM D1556 - Test Method for Density of Soil in-place by the Sand-Cone Method.
- E. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in-place by Nuclear Methods (Shallow Depth), Method B (Direct Transmission).
- F. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. Submit materials certificate to Owner which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein.
- B. Where indicated, paving base course shall be constructed utilizing existing materials from on-site excavations or in-place native material. Verification of suitability shall be made by the Engineer after examination of conditions on site following rough grading operations. If unsuitable material is found, it shall be removed and replaced with select fill meeting the requirements of Section 02227.
- C. Provide test results of cement stabilized soil mix proposed for use on job prior to delivery of any base material to site.

PART 3 - EXECUTION

3.1 EXAMINATION

Contractor shall verify that the subbase has been inspected, tested and the gradients and elevations are correct, dry and properly prepared.

3.2 CONSTRUCTION

- A. Perform base course construction in a manner that will drain surface properly at all times and at the same time prevent runoff from adjacent areas from draining onto base course construction.
- B. Granular Base: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 8", measured loose.
- C. Cement Stabilized Base: Provide a cement stabilized base course of indicated total thickness, using select fill or approved native material, at a cement content not to exceed 8% by weight, in accordance with LDOTD requirements.
- D. Compact base material to not less than 98% of optimum density as determined by ASTM D 698 or 95% of optimum density, as determined by ASTM D 1557, unless otherwise indicated on the Drawings.

3.3 FIELD QUALITY CONTROL

- A. An Independent Testing Laboratory, selected and paid by Owner, shall be retained to perform construction testing of in-place base courses for compliance with requirements for thickness, compaction, density and tolerance. Paving base course tolerances shall be verified (by rod and level readings on not more than fifty-foot centers) to be not more

than 0.05 feet above design elevation which will allow for paving thicknesses as shown in the Drawings. Contractor shall provide instruments and a suitable benchmark.

- B. The following tests shall be performed on each type of material used as base course material:
1. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
 2. Mechanical Analysis: AASHTO T-88.
 3. Plasticity Index: ASTM D-4318.
 4. Base material thickness: Perform one test for each 5,000 square feet of in-place base material area.
 5. Base material compaction: Perform one test in each lift for each 5,000 square feet of in-place base material area.
 6. Test each source of base material for compliance with these specifications.

END OF SECTION 02505

SECTION 02511 - ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Asphaltic concrete paving; surface course and binder course.

1.2 RELATED SECTIONS

- A. Section 02223 - Excavation, Backfill and Compacting for Pavement
- B. Section 02505 - Paving Base Course
- C. Section 02520 - Portland Cement Concrete Paving
- D. Section 02525 – Concrete Curb and Gutter
- E. Construction Drawings

1.3 SUBMITTALS

- A. Design Mix: Before any asphaltic concrete paving is constructed, submit actual design mix to the Engineer for review and/or approval. Design mix submittal shall follow the format as indicated in the Asphalt Institute Manual MS-2, Marshall Stability Method; and shall include the type/name of the mix, gradation analysis, grade of asphalt cement used, Marshall Stability (lbs.), flow, effective asphalt content (percent), and direct references to the applicable highway department specifications sections for each material. The design shall be for a mixture listed in the current edition of the applicable state roadway specifications. Mix designs over three (3) years old will not be accepted by the owner.
- B. Material Certificates: Submit materials certificate to Owner which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein.

1.4 JOB CONDITIONS

- A. Weather Limitations:
 - 1. Apply prime and tack coats when ambient temperature is above 40°F, and when temperature has been above 35°F for 12 hours immediately prior to application. Do not apply when base is wet, contains excess moisture, or during rain.
 - 2. Construct asphaltic concrete paving when atmospheric temperature is above 40°F.

1.5 REFERENCES

- A. MS-2-Mix design methods for asphaltic concrete and other hot mix types per The Asphalt Institute (AI)

- B. MS-3-Asphalt Plant Manual per The Asphalt Institute (AI)
- C. Hot Mix Asphalt Paving Handbook per US Army Corp of Engineers, UN-13 (CE MP-ET)
- D. MS-19-Basic Asphalt Emulsion Manual per The Asphalt Institute (AI)
- E. ASTM D946 - Penetration - Graded Asphalt Cement for use in Pavement Construction
- F. AASHTO M-226/ASTM D3381 Asphalt Cement
- G. AASHTO M-140/ASTM D997 or AASHTO M-208/ASTM D-2397 Tack Coat
- H. AASHTO M-117/ASTM D242 Mineral Filler
- I. AASHTO T-245/ASTM D1559 Marshall Mix Design

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide asphalt-aggregate mixture as recommended by local or state paving authorities to suit project conditions. Use locally available materials and gradations which meet state highway specifications and exhibit satisfactory records of previous installations. LDOTD (2000 Edition) Mix 3 is recommended.
- B. Asphalt Cement: Comply with AASHTO M-226/ASTM D 3381; Table 2 AC-10, AC-20, or AC-30, viscosity grade, depending on local mean annual air temperature. (See chart below):

<u>Temperature Condition</u>	<u>Asphalt Grades</u>
Cold, mean annual air temperature at 7 degrees C (45 degrees F) or lower	AC-10 85/100 pen.
<u>Temperature Condition</u>	<u>Asphalt Grades</u>
Warm, mean annual air temperature between 7 degrees C (45 degrees F) and 24 degrees C (75 degrees F)	AC-20 60/70 pen.
Hot, mean annual air temperature at 24 degrees C (75 degrees F) or higher	AC-30

- C. Prime Coat: A medium curing cut-back asphalt or an asphalt penetrating prime coat consisting of either MC-30 or SS-1h.
- D. Tack Coat: Emulsified asphalt; AASHTO M-140/ASTM D 997 or AASHTO M 208/ASTM D 2397, SS-1h, CSS-1, or CSS-1h, diluted with one-part water to one part emulsified asphalt.
- E. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M-17/ASTM D 242, if recommended by applicable state highway standards.
- F. Asphalt-Aggregate Mixture: Unless otherwise noted on the Drawings, the Design Mix shall have a minimum stability based on a 50-blow Marshall complying with ASTM D 1559 of 1500

lb with a flow between 8 and 16. The Design Mix shall be within sieve analysis and bitumen ranges below:

SIEVE ANALYSIS OF MIX

<u>Square Sieve</u>	<u>Total Percent Passing</u>	<u>Percent Tolerance</u>
3/4"	100	7%
1/2"	80 - 100%	5%
3/8"	65 - 93%	4%
#8	40 - 55%	4%
#50	12 - 27%	2%
#200	0 - 10%	0%

Percent bitumen by weight of total mix: 5.0 - 8.5.

Air voids: 3-6%

Percent aggregate voids filled with asphalt cement: 70 - 82%.

Allowable variance of percent bitumen by weight of total mix = 0.4

2.2 EQUIPMENT

Maintain equipment in satisfactory operating condition and correct breakdowns in a manner that will not delay or be detrimental to progress of paving operations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove loose material from compacted base material surface immediately before applying prime coat.
- B. Proof roll prepared base material surface to check for areas requiring additional compaction and areas requiring removal and recompaction.
- C. Do not begin paving work until deficient base material areas have been corrected and are ready to receive paving.

3.2 APPLICATIONS

A. Prime Coat:

1. Apply bituminous prime coat to all base material surfaces where asphaltic concrete paving will be constructed.
2. Apply bituminous prime coat in accordance with APWA Section 2204 and applicable state highway specifications.
3. Apply at minimum rate of 0.25 gallon per square yard over compacted base material. Apply to penetrate and seal, but not flood surface.
4. Make necessary precautions to protect adjacent areas from overspray.
5. Cure and dry as long as necessary to attain penetration of compacted base and evaporation of volatile substances.

B. Tack Coat:

1. Apply to contact surfaces of previously constructed asphaltic concrete base courses or portland cement concrete and surfaces abutting or projecting into asphaltic concrete or into asphaltic concrete pavement.
2. Apply tack coat to asphaltic concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat between each lift or layer of full depth asphaltic concrete and sand asphalt bases and on surface of all such bases where asphaltic concrete paving will be constructed.
3. Apply emulsified asphalt tack coat in accordance with APWA Section 2204 and applicable state highway specifications.
4. Apply at minimum rate of 0.05 gallon per square yard of surface.
5. Allow to dry until at proper condition to receive paving.

3.3 ASPHALTIC CONCRETE PLACEMENT

- A. Place asphaltic concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum temperatures:
 1. When ambient temperature is between 40°F and 50°F, mixture temp. = 285°F
 2. When ambient temperature is between 50°F and 60°F, mixture temp. = 280°F
 3. When ambient temperature is higher than 60°F, mixture temp. = 275°F
- B. Whenever possible, all pavement shall be spread by a finishing machine; however, inaccessible or irregular areas may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated course aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster than they can be properly spread. Workers shall not stand on the loose mixture while spreading.
- C. Paving Machine Placement: Apply successive lifts of asphaltic concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10'-0" wide.
- D. Joints: Make joints between old and new pavements, or between successive days and work in a manner that will provide a continuous bond between adjoining work. Construction joints shall have same texture, density, and smoothness as other sections of asphaltic concrete course. Clean contact surfaces of all joints and apply tack coat.

3.4 ROLLING AND COMPACTION

- A. The mixture, after being spread, shall be thoroughly compacted by rolling as soon as it will bear the weight of the rollers without undue displacement. The number, weight, and types of rollers and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in a workable condition.
- B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

- C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling with hot material.
- D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.
- E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.
- F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphaltic concrete. Compact by rolling to maximum surface density and smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.5 FIELD QUALITY CONTROL

- A. Independent Testing Laboratory, selected and paid by Owner, shall be retained to perform construction testing of in-place asphaltic concrete courses for compliance with requirements for thickness, compaction and surface smoothness. Asphaltic surface and base courses shall be randomly cored at a minimum rate of one core for every 20,000 square feet of paving. However, no less than three cores in light duty areas and three cores in heavy duty areas shall be obtained. Coring holes shall be immediately filled with full-depth asphalt or with concrete. Asphaltic Concrete pavement samples shall be tested for conformance with the mix design.
- B. Grade Control: Establish and maintain required lines and elevations.
- C. Thickness: In-place compacted thickness shall not be less than thickness specified on the drawings. Areas of deficient paving thickness shall receive a tack coat and a minimum 1" overlay; or shall be removed and replaced to the proper thickness, at the discretion of the Owner; until specified thickness of the course is met or exceeded at no additional expense to the Owner.
- D. Surface Smoothness: Testing shall be performed on the finished surface of each asphalt concrete course for smoothness, using 10'-0" straightedge applied parallel with, and at right angles to centerline of paved area. The results of these tests shall be made available to the owner upon request. Surfaces will not be acceptable if the following 10' straightedge tolerances for smoothness are exceeded.

Wearing Course Surface: 3/16"
- E. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Owner.
- F. Compaction: Field density test for in place materials shall be performed by examination of field cores in accordance with one of the following standards:
 - 1. Bulk specific gravity of paraffin-coated specimens: ASTM D-1188.
 - 2. Bulk specific gravity using saturated surface-dry specimens: ASTM D-2726.

Rate of testing shall be one core per 10,000 square feet of pavement.

Areas of insufficient compaction shall be delineated, removed, and replaced in compliance with the specifications at no expense to the Owner.

END OF SECTION 02511

SECTION 2520 - PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Concrete, integral curbs, median barriers, parking areas and roads.

1.2 RELATED SECTIONS

- A. Section 02100 - Site Preparation.
- B. Section 02227 - Aggregate Material.
- C. Section 02525 - Concrete Curbs and Sidewalks.
- D. Section 02584 - Pavement Markings.
- E. Section 03300 - Cast-in-place concrete
- F. State Highway Department Standard Specifications.
- G. Construction Drawings.

1.3 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- C. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- D. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
- E. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural construction.
- F. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- G. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
- H. ASTM C33 - Concrete Aggregates.
- I. ASTM C94 - Ready Mix Concrete.

- J. ASTM C150 - Portland Cement
- K. ASTM C260 - Air-Entraining Admixtures for Concrete.
- L. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- M. ASTM C494 - Chemical Admixtures for Concrete.
- N. FS TT-C-800 - Curing Compound, Concrete, for New and Existing Surfaces.

1.5 PERFORMANCE REQUIREMENTS

- A. Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Coat forms with nonstaining type coating that will not discolor or deface surface of concrete.
- B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185. Furnish in flat sheets, not rolls, unless otherwise acceptable to Owner.
- C. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40.
- D. Concrete Materials: Comply with requirements of applicable Section 03300 for concrete materials, admixtures, bonding materials, curing materials, and others as required.
- E. Joint Fillers: Resilient premolded bituminous impregnated fiberboard units complying with ASTM D 1751 FS HH-F-341, Type II, Class A; or AASHTO M 153, Type I.
- F. Joint Sealants: Non-priming, pourable, self-leveling polyurethane. Acceptable sealants are Sonneborn "Sonolastic Paving Joint Sealant" Sonneborn "Sonomeric CT 1 Sealant", Sonneborn "Sonomeric CT 2 Sealant", Mameco "Vulken 45", or Woodmont Products "Chem-Caulk".

2.2 MIX DESIGN AND TESTING

- A. Concrete mix design and testing shall comply with requirements of applicable Section 03300.
- B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate,

water-reducing admixture, air-entraining admixture, and water to produce the following properties:

1. Compressive Strength: 4,000 psi, minimum at 28 days, unless otherwise indicated on the Drawings.
2. Slump Range: 3"-5" at time of placement
3. Air Entrainment: 5% to 8%.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proof-roll prepared base material surface to check for unstable areas. The paving work shall begin after the unsuitable areas have been corrected and are ready to receive paving. Compaction testing for the base material shall be completed prior to the placement of the paving.
- B. Surface Preparation: Remove loose material from compacted base material surface to produce a firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

- A. Form Construction
 1. Set forms to required grades and lines, rigidly braced and secured.
 2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place a minimum of 24 hours after concrete placement.
 3. Check completed formwork for grade and alignment to following tolerances:

Top of forms not more than 1/8" in 10'-0".
Vertical face on longitudinal axis, not more than 1/4" in 10'-0".
 4. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.
- B. Reinforcement: Locate, place and support reinforcement per applicable Section 03 30 00.
- C. Concrete Placement
 1. Comply with applicable requirements of Section 03300.
 2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structures until they are at the required finish elevation and alignment.
 3. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side

- forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place construction joint.
- D. Joint Construction: Construct expansion, weakened-plane Control (contraction), and construction joints straight with face perpendicular to concrete surface. Construct transverse joints perpendicular to centerline, unless otherwise detailed.
1. Weakened-Plane Control (Contraction) Joints: Provide joints at a spacing of 15'-0" o.c. maximum each way. Construct control joints for depth equal to at least 1/4 concrete thickness, as follows:
 - a. Form tooled joints in fresh concrete by grooving top portion with recommended tool and finishing edges with jointer.
 - b. Form sawed joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
 2. Construction Joints: Place concrete joints at end of placements and at locations where placement operations are stopped for period of more than 1/2 hour, except where such placements terminate at expansion joints. Construct joints using standard metal keyway-section forms.
 3. Expansion Joints: Locate expansion joints at 180'-0" o.c. maximum each way. Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects.
- E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.
- F. Joint Sealants: All joints shall be sealed with approved exterior pavement joint sealants and shall be installed per manufacturer's recommendations.

3.3 CONCRETE FINISHING

- A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.
- B. Work edges of slabs, gutters, back top edge of integral curb, and formed joints with an edging tool, and round to 1/2" radius. Eliminate tool marks on concrete surface. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
 1. Inclined Slab Surfaces: Provide coarse, nonslip finish by scoring surface with

stiff-bristled broom perpendicular to line of traffic.

2. Paving: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to line of traffic.
- C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed.
- D. Protect and cure finished concrete paving using acceptable moist-curing methods, more particularly described in the "water-curing" section of ACI 308-01.

3.4 CLEANING AND ADJUSTING

- A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.
- B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

3.5 FIELD QUALITY CONTROL

An independent testing laboratory shall randomly core the pavement at a minimum rate of one core per 20,000 square feet of pavement, with a minimum of 3 cores from heavy-duty areas and 3 cores from standard duty areas. Core shall be tested for thickness and quality of aggregate distribution. Core holes shall be patched immediately with portland cement concrete conforming to section 2.02 and shall be finished to provide a level surface conforming to section 3.03 A & 3.03 B.

END OF SECTION 02520

SECTION 02525 - CONCRETE CURB AND SIDEWALKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Combination concrete curb and gutter
- B. Concrete Curb
- C. Concrete Flume
- D. Concrete Sidewalk

1.2 RELATED SECTIONS

- A. Section 02227 - Aggregate Material.
- B. Section 03300 - Cast-in-place Concrete (See Architectural/Building Specifications).
- C. State Highway Department Standard Specifications.
- D. Construction Drawings.

1.3 REFERENCES

- A. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- B. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural construction.
- C. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
- D. ASTM C33 - Concrete Aggregates.
- E. ASTM C94 - Ready Mix Concrete.
- F. ASTM C150 - Portland Cement
- G. ASTM C260 - Air-Entraining Admixtures for Concrete.
- H. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- I. ASTM C494 - Chemical Admixtures for Concrete.

- J. FS TT-C-800 - Curing Compound, Concrete, for New and Existing Surfaces.

1.5 PERFORMANCE REQUIREMENTS

- A. Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. The forms shall be of a depth equal to the depth of curbing or sidewalk, and so designed as to permit secure fastening together at the tops. Coat forms with nonstaining type coating that will not discolor or deface surface of concrete.
- B. Concrete Materials: Comply with requirements of applicable Section 03300 for concrete materials, admixtures, bonding materials, curing materials, and others as required.
- C. Joint Fillers: Resilient premolded bituminous impregnated fiberboard units complying with ASTM D 1751 FS HH-F-341, Type II, Class A; or AASHTO M 153, Type I.
- D. Joint Sealers: Non-priming, pourable, self-leveling polyurethane. Acceptable sealants are Sonneborn "Sonolastic Paving Joint Sealant" Sonneborn "Sonomeric CT 1 Sealant," Sonneborn "Sonomeric CT 2 Sealant," Mameco "Vulken 45," or Woodmont Products "Chem-Caulk."

2.2 MIX DESIGN AND TESTING

- A. Concrete mix design and testing shall comply with requirements of applicable Section 03300.
- B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce the following properties:
 - 1. Compressive Strength: 3,500 psi, minimum at 28 days, unless otherwise indicated on the Drawings.
 - 2. Slump Range: 2"-5" at time of placement.
 - 3. Air Entrainment: 5% to 8%.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proof-roll prepared base material surface to check for unstable areas. The paving work shall begin after any unsuitable areas have been corrected and are ready to receive paving. Compaction testing for the base material shall be completed prior to the placement of the paving.
- B. Surface Preparation: Remove loose material from compacted base material surface to produce a firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

A. Form Construction

- 1. Set forms to required grades and lines, rigidly braced and secured.
- 2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place a minimum of 24 hours after concrete placement.
- 3. Check completed formwork for grade and alignment to following tolerances:
 - Top of forms not more than 1/8" in 10'-0."
 - Vertical face on longitudinal axis, not more than 1/4" in 10'-0."
- 4. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

B. Concrete Placement

- 1. Comply with applicable requirements of Section 03300.
- 2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structures until they are at the required finish elevation and alignment.
- 3. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of dowels, and joint devices.
- 4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hours, place construction joint. Automatic machine may be used for curb and gutter placement at Contractor's option. Machine placement must produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

C. Joint Construction

- 1. Contraction Joints: Concrete curb, concrete gutter or concrete curb and gutter, where specified on the plans, shall be constructed in uniform sections of the length specified on the plans. The joints between sections shall be formed either by steel templates 1/8 inch

in thickness, of a length equal to the width of the gutter and/or curb, and with a depth which will penetrate at least 2 inches below the surface of the curb and/or gutter; or with 3/4-inch thick preformed expansion joint filler cut to the exact cross section of the curb and/or gutter; or by sawing to a depth of at least 2 inches while the concrete is between 4 to 24 hours old. If steel templates are used, they shall be left in place until the concrete has set sufficiently to hold its shape, but shall be removed while the forms are still in place.

2. Longitudinal Construction Joints: Concrete curb, concrete gutter or combination concrete curb and gutter, where specified on the plans, shall be tied to concrete pavement with 1/2 inch-round deformed reinforcement bars of the length and spacing shown on the plans.
 3. Transverse Expansion Joints: Transverse expansion joint in curb, curb and gutter, gutter or sidewalk shall have the filler cut to the exact cross section of the curb, curb and gutter, gutter or sidewalk. The joints shall be similar to the type of expansion joint used in the adjacent pavement.
- D. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.
- E. Joint Sealants: All joints shall be sealed with approved exterior pavement joint sealants and shall be installed per manufacturer's recommendations.

3.3 CONCRETE FINISHING

- A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.
- B. Work edges of sidewalks, gutters, back top edge of integral curb, and formed joints with an edging tool, and round to 1/2" radius. Eliminate tool marks on concrete surface. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
1. Inclined Slab Surfaces: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to line of traffic.
 2. Curbs, gutters, and walks: Broom finish by drawing fine-hair broom across surface perpendicular to line of traffic. Repeat operation as necessary to produce a fine line texture.
- C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed.
- D. Protect and cure finished concrete paving using acceptable moist-curing methods, more particularly described in the "water-curing" section of ACI 308-81.

3.4 BACKFILL

- A. After the concrete has set sufficiently, the spaces in front and back of the curb and gutter or sidewalk shall be refilled to the required elevation with suitable material which shall be compacted until firm and solid and neatly graded.

3.5 CLEANING AND ADJUSTING

- A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.
- B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

END OF SECTION 02525

SECTION 02584 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Painted pavement marking symbols.
- B. Painted striping for parking.

1.2 RELATED SECTIONS

- A. Section 02200 - Earthwork
- B. Section 02505 - Paving Base Course
- C. Section 02511 - Asphaltic Concrete Paving
- D. Section 02520 – Portland Cement Concrete Paving

1.3 PROJECT CONDITIONS

- A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Plastic Pavement marking shall meet LDOTD Standard Specification Section 732.
- B. Raised pavement markers shall meet LDOTD Standard Specification Section 731 and shall be reflectorized.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Sweep and clean surface to eliminate loose material and dust.

- B. Where existing pavement markings are indicated on the drawings to be removed or would interfere with the adhesion of new paint, a motorized abrasive device shall be used to remove the markings. The equipment employed shall not damage the existing paving or create a surface hazardous to vehicle or pedestrian traffic. In all areas within public rights-of-way, the method of marking removal shall be approved by governing authority.

3.2 APPLICATION

- A. Installation shall be in accordance with LDOTD Standard Specifications.
- B. The following items shall be provided:
 - 1. Center line (Broken line), 4" wide.
 - 2. Center line delineators @ 40' o.c. (red/amber).
 - 3. Step bars, 24" wide.
 - 4. Symbols as indicated on drawings.
 - 5. Fire hydrant delineators (blue).

END OF SECTION 02584

SECTION 02605 - SEWER STRUCTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Monolithic concrete manhole barrel with the option of monolithic concrete or masonry transition to lid frame, covers, anchorage and accessories.
- B. Modular precast concrete manhole barrel with tongue-and-groove joints and with the option of precast concrete or masonry transition to lid frame, covers, anchorage and accessories.

1.2 RELATED SECTIONS

- A. Section 02222 - Excavation, Backfill, and Compacting for Utilities
- B. Section 02720 - Storm Sewer Systems
- C. Section 02730 - Sanitary Sewer Systems
- D. Section 03300 - Cast-In-Place Concrete
- E. Construction Drawings

1.3 REFERENCES

- A. ANSI/ASTM C55 - Concrete Building Brick.
- B. ASTM A48 - Gray Iron Castings.
- C. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
- D. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate reference to drawings of manhole locations, elevations, piping with sizes, locations and elevations of penetrations.
- B. Product Data: Provide data for manhole covers, manhole steps, component construction, features, configuration, and dimensions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Manhole Barrel: Reinforced precast concrete, in accordance with ASTM C478 with gaskets in accordance with ASTM C923.
 - 1. Construct manholes of precast concrete sections as required by Drawings to size, shape, and depth indicated, but never less than 4'-0" inside diameter.
- B. Concrete Brick Units: ANSI/ASTM C55, Grade N Type I - Moisture Controlled, normal weight, of same Grade, Type and weight as block units, nominal modular size of 3 5/8 x 7 5/8 x 2 1/4 inches.
- C. Mortar and Grout: Mortar for finishing and sealing shall be Class "C". Honeycombing less than two (2) inches deep shall be repaired using Class "D" mortar.

2.2 COMPONENTS

- A. Lid and Frame: As indicated on plans, meeting ASTM A48, Class 30B Heavy Duty Cast iron construction, machined flat bearing surface, removable lid, closed or open as specified on plans; sealing gasket; manufactured by Neenah Foundry Company or approved equal.
- B. Base Pad: Cast-in-place concrete as specified in Section 03300.

2.3 CONFIGURATION

- A. Barrel Construction: Concentric with eccentric cone top section.
- B. Shape: Cylindrical.
- C. Clear Inside Dimensions: 48-inch diameter or as indicated on plans.
- D. Design Depth: As indicated on plans.
- E. Clear Lid Opening: 22 inches minimum.
- F. Pipe Entry: Provide openings as indicated on plans.
- G. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls, and point up irregularities and rough edges with non-shrinking grout.
- H. Inverts: Shape inverts for smooth flow across structure floor as shown on Drawings. Use

concrete and mortar to obtain proper grade and contour and finish surface with fine textured wood float.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

3.2 PREPARATION

Coordinate placement of inlet and outlet pipe as indicated on plans.

3.3 PLACING PRE-CAST MANHOLE BARREL SECTIONS

- A. Place base pad to proper elevation and location and trowel top surface level for placement of manhole barrel.
- B. Place manhole barrel plumb and level to correct elevations and anchor to base pad.
 - 1. After completion of slab foundation, the first joint of manhole barrel shall be lowered into position, grooved end first, and set level and plumb on concrete base. Align and adjust to proper grade prior to placing and forming invert which shall be poured immediately after setting of first section of manhole barrel.
 - 2. Prior to setting subsequent manhole barrel sections, apply primer to tongue and groove ends and allow to set in accordance with manufacturer recommendations. Place "Ram-nek", or equivalent, plastic rope on tongue end. Lower next section into position, and remove excess material from interior of structure. Add additional material on exterior of joint, if necessary, for completely watertight joint.

END OF SECTION 02605

SECTION 02660 - WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

Providing labor, materials, services, equipment, and other necessary items required for the construction of water systems. This shall include, but not be limited to the following: pipe and fittings for water lines, including domestic water line and fire sprinkler system water line, valves and fire hydrants, setting line locations, elevations, and grades for water distribution systems work and control system for duration of work including careful maintenance of benchmarks, property corners, monuments, or other reference points.

1.2 RELATED SECTIONS

- A. Section 02222 - Excavating, Backfill and Compacting for Utilities.
- B. Section 02227 - Aggregate Materials.
- C. Local Governing Authority and Code Requirements.
- D. Construction Drawings

1.3 REFERENCES

- A. AASHTO T180 Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.
- B. ANSI/ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings.
- C. ANSI/ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- D. ANSI/ASTM D1557 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- E. ANSI/AWS A5.8 Brazing Filler Metal.
- F. ANSI/AWWA C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
- G. ANSI/AWWA C111 Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.
- H. ANSI/AWWA C151 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- I. ANSI/AWWA C502 Dry Barrel Fire Hydrants.
- J. ANSI/AWWA C509 Resilient Seated Gate Valves 3 inch through 12 inch NPS, for Water and Sewage Systems.
- K. ANSI/AWWA C600 Installation of Ductile-Iron Water Mains and Appurtenances.

- L. ANSI/AWWA C651 Disinfecting Water Mains.
- M. ASTM B88 Seamless Copper Water Tube.
- N. ASTM D1785 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- O. ASTM D2241 Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR).
- P. ASTM D2855 Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.
- Q. ASTM D2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- R. ASTM D3017 Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.
- S. ASTM D3139 Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- T. AWWA C600-82 Hydrostatic Testing.
- U. UL 246 Hydrants for Fire Protection Service.

1.4 SUBMITTALS

- A. Product Data: Provide Engineer with data on pipe materials, pipefittings, hydrants, valves and accessories.
- B. Manufacturer's Certificate: Certify that products meet or exceed state or local requirements.

1.5 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of piping mains, valves, connections, and top of pipe elevations.
- B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with Greater Ouachita Water Company requirements.
- B. Valves and Hydrants: Manufacturer's name and pressure rating marked on valve body.

1.7 COMPLIANCE WITH STATE SANITARY CODE

Installation of potable water mains shall in all cases be in compliance with the Sanitary Code of the State of Louisiana. This shall include the maintaining of proper vertical and horizontal separation between water and sewer lines as provided for in LAC 51: XII.341 of the Code. The minimum separation of 6' horizontal when running and parallel, 18" vertical when crossing shall apply in all cases. Where horizontal or vertical separation cannot be met at crossings, the Engineer shall be notified and directions provided on proper methods of installation utilizing encasement of the line.

PART 2 PRODUCTS

2.1 PIPE

- A. All pipe materials used in the installation of water systems shall bear the NSF stamp of approval.
- B. Pipe sizes less than 3 inch that are installed below grade and outside building shall comply with one or combination of following:
 - 1. Seamless Copper Tubing: Type "K" soft copper to comply with ASTM B 88-62 and installed with wrought copper (95-5 Tin Antimony solder joint) fittings in accordance with ASTM B16.22.
 - 2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall conform to ASTM D-2241 with an SDR 21 rating and shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 1784 classification. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3139 with factory supplied elastomeric gaskets and lubricant. All PVC pipe shall have a 10-gauge insulated copper wire installed with the pipe.
- C. Pipe sizes 3 inch and larger that are installed below grade and outside building shall comply with one of the following:
 - 1. Ductile Iron Water Pipe and Fittings: In accordance with ANSI A21.51, Fittings shall be mechanical joint complying with ANSI A21.10 or ANSI 21.11 (AWWA C-151) compact body, and furnished with "Mega-Lug" retainer glands.
 - 2. Polyvinyl Chloride (PVC) Water Pipe: Pipe shall comply with ASTM D 2241, Class 160 (SDR26) except that all water mains to be located under roads shall be Class 200 (SDR21). Pipe shall be continually marked with tracer wire. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant. All PVC pipe shall have a 10-gauge insulated copper wire installed with the pipe.

2.2 GATE VALVES - 2 Inches and Larger

- A. Manufacturers:

Mueller Resilient Seat Gate Valves or approved equal.
- B. ANSI/AWWA C509, Iron body, bronze mounted double disc, parallel seat type, non-rising stem with square nut, single wedge, resilient seat, mechanical joint ends, control rod, extension box and valve key.

2.3 BALL OR PLUG VALVES - 2 Inches and Smaller

- A. Manufacturers:

Mueller Oriseal or approved equal.
- B. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground

connector, with control rod, extension box and valve key.

2.4 HYDRANT

- A. Hydrant: Mueller Improved or approved equal, meeting AWWA C502, traffic model.
- B. Hydrant Extensions: Fabricate in multiples of 6 inches with rod and coupling to increase barrel length.
- C. Hose and Steamer Connection: Match sizes and threads with Ouachita Parish, two 2½" hose nozzles, one 4½" pumper nozzle.
- D. Finish: Primer and two coats of enamel or special coating to color as required by Greater Ouachita Water Co.

2.5 ACCESSORIES

- A. Concrete for Thrust Blocks: Place thrust blocking consisting of 2,500 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends (of 45° or greater), tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 lbs/sq ft when water main pressure is 100 psi.
- B. Locked Mechanical Joint glands shall be installed on all fittings and valves using "Mega-Lugs" and shall be installed in addition to the above thrust blocking requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions.
- B. Verify that building service connection and fire protection water main size, location and depth are as indicated.

3.2 PREPARATION

- A. Ream pipe and tube ends and remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare pipe for connections to equipment with flanges or unions.

3.3 BEDDING

Excavate pipe trench and place bedding material in accordance with plans and Section 02222 for work of this Section.

3.4 INSTALLATION - PIPE AND FITTINGS

- A. Maintain separation of water main from sanitary and storm sewer piping in accordance with state or local code.

- B. Install pipe and fittings in accordance with ANSI/AWWA C600.
- C. Install pipe to allow for expansion and contraction without stressing pipe or joints or as specified by pipe manufacturer.
- D. Install access fittings in accordance with local codes to permit disinfection of water system performed under this Section.
- E. Connections with Existing Pipelines: Where connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline and coordinated through Greater Ouachita Water Company.
- F. Form and place concrete for thrust blocks or other specified methods of retainage at each change of direction or end of pipe main.
- G. Establish elevations of buried piping in accordance with Section 02222 for work in this Section.
- H. Backfill trench in accordance with Section 02222.

3.5 INSTALLATION - VALVES AND HYDRANTS

- A. Install gate valves as indicated on Drawings with valve stem vertical and plumb. Install valve boxes in a manner that will not transmit loads, stress, or shock to valve body. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.
- B. Install fire hydrant assemblies as indicated on Drawings in vertical and plum position with steamer/pumper nozzle pointed perpendicular to traffic where hydrant is adjacent to a street, roadway or parking lot drive or toward the protected building unless otherwise directed by local authorities. Support hydrant assembly and firmly braced on side opposite inlet pipe against undisturbed soil and concrete blocking. Place minimum of 6 cu. ft. of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

In accordance with LAC 51: XII.351 and 353 of the State Sanitary Code, all new water mains, including appurtenances, shall be disinfected following the acceptance of hydrostatic/leak tests. Disinfection shall be in accordance with the latest issue of AWWA C651. Mains shall be thoroughly flushed before the introduction of disinfectant. A minimum dosage of disinfectant shall be introduced to provide a chlorine concentration of 50 ppm and shall be retained in the pipe for a minimum of three (3) hours. The chlorine residual after the retention time shall be at least 5 ppm at the most remote location.

The system shall be flushed and bacteriological tests shall be performed by a laboratory certified by the State Office of Public Health. No part of the new system shall be placed into customer use until approval by the Engineer and until test results by the certified laboratory have shown the system to be free of bacteriological contamination.

If test results show insufficient disinfection, the procedure shall be repeated as required until satisfactory disinfection is obtained. Disinfection shall be considered an incidental item to the acceptance of the pipe and appurtenances, and full payment for the per foot bid items will not be

made until completed.

Performance of flushing, disinfection, and testing shall be made under direct observation by Greater Ouachita Water Company. The opening of valves required to put the system into service shall be performed only by Greater Ouachita Water Company personnel.

3.7 SERVICE CONNECTIONS

Coordinate tie-in connections to existing mains with the Greater Ouachita Water Company.

3.8 FIELD QUALITY CONTROL

A. Compaction testing of trench backfill shall be performed in accordance with Section 02222.

B. Water distribution system pipe installed below grade and outside building shall be tested in accordance with following procedures:

1. The Contractor shall perform the testing of pipe materials, joints, and/or other materials incorporated into the construction of water mains and force mains to determine leakage and watertightness. All pressure pipeline shall be tested in accordance with Section 5 of AWWA C600-99.
2. Pressure Test: After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of 120 psi at the point of testing and held for 4 hours.
3. Leakage Test: The leakage test shall be conducted concurrently with the pressure test. Leakage is defined as the quantity of water that must be supplied into the newly laid pipeline, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipeline has been filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

No pipeline installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SDP}{133200}$$

L = allowable leakage, (gallons per hour)

S = length of pipe tested, (feet)

D = nominal diameter of pipe, (inches)

P = average test pressure during test, (psig)

4. Visible Leakage: All visible leaks shall be repaired regardless of the amount of leakage.
5. Acceptance of Installation: If any test of pipe laid in place discloses leakage greater than that specified, the Contractor shall, at his own expense, locate the leak and make repairs as necessary until the leakage is within the specified allowance.
6. Contractor shall furnish one copy of results of disinfection test and hydrostatic pressure test to the Owner and utility company upon completion of water distribution backfilling operations.
7. Contractor shall furnish "as-built" drawings of the water system additions to include dimensions of underground piping from surface features.

END OF SECTION 02660

SECTION 02720 - STORM SEWER SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Site storm drainage piping, fittings and accessories, and bedding.
- B. Connection of building storm water drainage system and connection to municipal storm drains.
- C. Catch basins, paved area drainage, site surface drainage, and drainage swales, ditches, and flumes.

1.2 RELATED REQUIREMENTS

- A. Section 02222 - Excavation, Backfill, and Compacting for Utilities
- B. Section 02270 - Slope Protection and Erosion Control
- C. Section 02605 - Sewer Structures
- D. Section 03300 - Cast-in-Place Concrete
- E. Local governing authority and code requirements.
- F. Construction Drawings

1.3 REFERENCES

- A. AASTHO M294 and M252 Corrugated Polyethylene pipe smooth interior.
- B. AASHTO T180 – Moisture Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.
- C. ANSI/ASTM C76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- D. ANSI/ASTM C443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- E. ANSI/ASTM D1557 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- F. ASTM D2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- G. ASTM D3017 Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.4 DEFINITIONS

Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.5 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

PART 2 - PRODUCTS

2.1 SEWER PIPE MATERIALS AND ACCESSORIES

- A. Reinforced Concrete Pipe: Comply with requirements of ASTM C 76, Class III unless another class type is indicated on Drawings, installed with flexible plastic (Bitumen) gaskets at all joints. Gaskets shall comply with AASHTO M-198 75I, Type B, and shall be installed in strict accordance with pipe manufacturer's recommendations. Joints are to be wrapped with filter fabric.
- B. Polyvinyl Chloride Pipe (PVC): Polyvinyl Chloride Pipe shall be Corrugated with smooth interior and conform to ASTM F949. Pipe shall have ring stiffness of 46 psi in accordance with ASTM test method D2412. The pipe shall be fabricated with a PVC compound having a cell classification of 12454 as defined by ASTM D1784. Joints shall be integrally formed bell and spigot with rubber gaskets. Joints are to be wrapped with filter fabric.
- C. Polyethylene pipe (PEP): Only where permitted on the drawings shall conform to AASHTO M294 Type S. Joints shall be made with rubber gaskets and rated as "water tight". All joints shall be wrapped with filter fabric.
- D. Corrugated Steel Pipe (CSP): Shall be polymer coated, spiral-rib pipe with $\frac{3}{4}$ " x $\frac{3}{4}$ " x $7\frac{1}{2}$ " continuous ribs in accordance with ASTM A-760. Minimum gauge shall be 14. Pipe shall be coated with a polymer coating meeting AASHTO M-246 Joints shall be bonded meeting AASHTO M-36, and wrapped with filter fabric.

2.2 INLETS, CATCH BASINS AND JUNCTION BOXES

- A. Lid and frame per details shown on plans.
- B. Structure construction in accordance with details shown on plans.
- C. Precast concrete structures are permitted, as approved by the Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on civil engineering drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Excavate pipe trench and place bedding material in accordance with the Drawings and Section 02222 for work of this Section.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM C12, ASTM D2321 or manufacturer's instructions and state or local requirements.
- B. Install pipe on bedding in accordance with Section 02222 for work in this Section.
- C. Lay pipe to slope gradients noted on construction drawings.
- D. Refer to Section 02222 for trenching requirements. Do not displace or damage pipe when compacting.
- E. Wrap all joints of RCP storm drainage pipe with a minimum 24" wide strip of filter fabric. Lap the ends of wrap a minimum of 12" Band filter fabric to pipe on each end. Take care in backfilling to protect the wrapped joint.
- F. CSP shall be installed in accordance with ASTM A 798.

3.5 INSTALLATION - CATCH BASINS, INLETS AND JUNCTION BOXES

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe to be placed at proper elevation.
- C. Cast-in -place: Form and place cast-in-place concrete walls, sleeved at proper elevation to receive storm sewer pipe and cast-in-place top in accordance with details shown on the plans.
- D. Place precast structures and tops in accordance with details shown on the plans.

END OF SECTION 02720

SECTION 02730 - SANITARY SEWER SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

Furnish labor, materials, services, equipment, and other necessary items required for accompanying the construction of the sanitary sewer systems. This shall include, but not be limited to, the following:

Sanitary sewer drainage piping, Fittings and Accessories, Manholes, Cleanouts, and Bedding.

Set lines, elevations, and grades for sanitary sewer system work and control system for duration of work, including careful maintenance of benchmarks, property corners, monuments, or other reference points.

1.2 RELATED REQUIREMENTS

- A. Construction Drawings
- B. Section 02222 - Excavation, Backfilling, and Compacting for Utilities
- C. Section 02605 - Sewer Structures
- D. Local governing authority and code requirements
- E. All necessary construction permits

1.3 REFERENCES

- A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D3034 - Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
- C. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
- D. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- E. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.4 DEFINITIONS

Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.5 SUBMITTALS

- A. Product Data: Provide catalog materials indicating pipe, pipe accessories, and fittings.
- B. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- C. Manufacturer's Certificate: Certify that products meet or exceed ASTM designations.

1.6 COORDINATION

- A. Coordinate the Work with termination of sanitary sewer connection outside building, connection to municipal sewer utility service, and trenching.

1.7 COMPLIANCE WITH STATE SANITARY CODE

Installation of sanitary sewer mains shall in all cases be in compliance with the State Sanitary Code of Louisiana. This shall include the maintaining of proper vertical and horizontal separation between sewer mains and potable water lines. The minimum separation of 6 feet horizontal and 18 inches vertical shall apply in all cases. Where horizontal or vertical separation requirements cannot be met at crossings, the Engineer shall be notified and directions will be provided on proper methods of separation utilizing encasement of the line.

PART 2 - PRODUCTS

2.1 SEWER PIPE MATERIALS

- A. Polyvinyl Chloride Sanitary Sewer
 - 1. Pipe and fittings shall comply with ASTM D 3034, rated SDR 35. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.
 - 2. Pipe joints shall be integrally molded bell ends per ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant.

2.2 PIPE ACCESSORIES

- A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting

sleeve, neoprene ribbed gasket for positive seal.

- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.3 CLEANOUTS

- A. Lid and Frame: Heavy Duty cast iron construction, manufactured by Mueller: Lid Design: Closed Lid.
- B. Shaft Construction: PVC shaft of internal diameter as specified on plans with 2500 psi concrete collar for cleanouts.

PART 3 - EXECUTION

3.1 EXAMINATION

Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on civil engineering drawings.

3.2 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate.
- B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

- A. Excavate pipe trench and place bedding material in accordance with Section 02222 for work of this Section.

3.4 INSTALLATION - PIPE

- A. Install pipe, fittings, and accessories in accordance with ASTM C14, and/or manufacturer's instructions and state or local requirements.
- B. Lay pipe to slope gradients noted on Drawings.
- C. Install pipe on bedding in accordance with Drawings and Section 02222 for work in this Section.

- D. Refer to Section 02222 for trenching requirements. Do not displace or damage pipe when compacting.
- E. Refer to Section 02605 for manhole requirements.
- F. Connect to existing municipal sewer system as indicated on the drawings.

3.5 INSTALLATION - CLEANOUTS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Set cleanouts during installation of sewer pipe; extend to point above grade. Trim riser and set cleanout box after grading operations to be flush with finished ground elevation.
- C. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe to be installed to proper elevations.

3.6 FIELD QUALITY CONTROL

- A. Compaction testing will be performed in accordance with ANSI/ASTM D698, ASTM D2922 or ASTM D3017.
- B. Test sanitary sewer pipe system installed below grade and outside building in accordance with the following procedures:
 - 1. The Contractor shall perform the testing of pipe materials, joints and/or other materials incorporated into the construction of the sanitary sewer system to determine leakage and watertightness.
 - 2. Flexible Pipe Deflection Testing:
 - a. Allowable Deflection: The maximum allowable pipe deflection shall not exceed (5) five percent of the nominal inside diameter.
 - b. Mandrel: The mandrel (go/no-go) device shall be cylindrical in shape and constructed with either 9 or 16 evenly spaced arms or prongs. Mandrels with less arms will be rejected as not sufficiently accurate. The contact length of the mandrel's arms shall equal or exceed the nominal inside diameter of the sewer to be inspected. Critical mandrel dimensions shall carry a tolerance of plus or minus 0.01 inch. The mandrel and all necessary equipment for the mandrel test shall be provided by the Contractor.
 - c. Procedure: The mandrel shall be hand-pulled by the contractor through all flexible pipe sewer lines no earlier than 30 days after the trench has been completely backfilled. Any sections of the sewer not passing the mandrel shall be uncovered and the Contractor shall rebed, reround, or replace the sewer to the satisfaction of the Owner and/or Governing Agency. Any repaired section shall be retested.
 - d. Mandrel O.D. (outside diameter): The outside diameter of the mandrel shall

be set according to the following table:

NOMINAL DIAMETER (IN.)	MANDREL O.D. (IN.)
6"	5.40
8"	7.12
10"	8.87
12"	10.55

- e. Contractor's Warranty: The Owner reserves the right to mandrel test any flexible pipe sewer line before acceptance, and also prior to expiration of the first year of operation. If a previously accepted line fails a mandrel test performed during the first year of operation, the defects must be corrected at the Contractor's expense.

3. Air Testing of Gravity Sewers:

a. Procedure:

- i. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
- ii. Pipe air supply to the pipeline to be tested in such a manner that the air supply may be shut off, pressure observed, and air pressure released from the pipe without workmen entering the manhole.
- iii. Add air slowly to the portion of pipe under test until the internal pressure of the line is raised to approximately 4 psig, but less than 5 psig.
- iv. Shut the air supply off and allow at least two minutes for the air pressure to stabilize.
- v. When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi, start the test.
- vi. Determine the time in seconds with a stopwatch for the pressure to fall 0.5 psig so that the pressure at the end of the time is at or above 3.0 psig.
- vii. Compare the observed time with the minimum allowable times in the chart following for pass/fail determination:

1 Pipe Dia- meter (in.)	2 Minimum Time (min: sec.)	3 Length for Minimum Time (ft.)	4 Time for Longer Length (sec.)	SPECIFICATION TIME FOR LENGTH (L) SHOWN (MIN:SEC)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	46:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

- b. Safety Precautions: The low pressure air test may be dangerous to personnel if, through lack of understanding or carelessness, a line is over pressurized or plugs are installed improperly. It is extremely important that the various plugs be installed so as to prevent the sudden expulsion of a poorly inflated plug. As an example of the hazard, a force of 250 pounds is exerted on an 8-inch plug by an internal pressure of 5 psi. Observe the following safety precautions:
- No person shall be allowed in the manholes during the test or when a plugged pipe is under pressure.
 - Gauges, air piping manifolds, and valves shall be located at the top of the ground.
 - Install and brace all plugs securely.
 - Do not over pressurize the lines.
- c. Ground Water Elevation: If the pipeline to be tested is below the ground water level, the starting test pressure shall be increased by 0.433 psi for each foot the groundwater level is above the invert of the sewer pipe. In no case shall the starting test pressure exceed 9.0 psig.
- d. Acceptance of Installation: No gravity sewer or manhole will be accepted that does not comply with the minimum requirements of tests described in this specification.
- e. Test Equipment: All necessary equipment to perform the air test in accordance with this specification shall be provided by the contractor. The test gauge shall preferably have incremental division of 0.10 psi and have an accuracy of at least plus or minus 0.04 psi. In no case shall a test gauge be used which has incremental divisions of greater than 0.25 psi. The gauge shall be of sufficient size in order to determine this accuracy.

- f. Contractor shall furnish one copy of gravity sewer test results to the Owner upon completion of gravity sewer system backfilling operations.

END OF SECTION 02730

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formwork, shoring, bracing, and anchorage.
2. Reinforcement and accessories.
3. Cast-in-place concrete, including sidewalks adjacent to building, light pole foundations and equipment pads.
4. Curing and finishing.
5. Grout, for setting and anchoring items in masonry and concrete.
6. Expansion joint fillers.

B. Related Sections:

1. Section 02520 - Portland Cement Concrete Paving: Requirements for exterior concrete paving.
2. Section 02525 - Concrete Curb and Sidewalks.

1.2 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 301 - Specifications for Structural Concrete for Buildings.
2. ACI 304.2R - Placing Concrete by Pumping Methods.
3. ACI 305R - Hot Weather Concrete.
4. ACI 306R - Cold Weather Concreting.
5. ACI 308 - Standard Practice for Curing Concrete.
6. ACI 315 - Details and Detailing of Concrete Reinforcement.
7. ACI 318 - Building Code Requirements for Reinforced Concrete.
8. ACI 347 - Recommended Practice for Concrete Formwork.

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

1. ASTM A82 - Standard Specification for Cold Drawn Steel Wire for Concrete Reinforcement.
2. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
3. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. ASTM C31 - Making and Curing Concrete Test Specimens in the Field.
5. ASTM C33 - Concrete Aggregates.
6. ASTM C39 - Compressive Strength of Cylindrical Concrete Specimens.

7. ASTM C42 - Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
8. ASTM C94 - Specification for Ready-Mixed Concrete.
9. ASTM C138 - Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
10. ASTM C143 - Test Method for Slump of Portland Cement Concrete.
11. ASTM C150 - Specification for Portland Cement.
12. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
13. ASTM C172 - Method of Sampling Freshly Mixed Concrete.
14. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
15. ASTM C231 - Test Method for Air Content of Freshly Mixed Concrete By the Pressure Method.
16. ASTM C260 - Air-Entraining Admixtures for Concrete.
17. ASTM C309 - Liquid Membrane Forming Compounds for Curing Concrete.
18. ASTM C494 - Chemical Admixtures for Concrete.
19. ASTM C881 - Epoxy Resin Base Bonding Systems for Concrete.
20. ASTM D676 - Tentative Method of Test for Indentation of Rubber by Means of a Durometer.
21. ASTM D2240 - Standard Test Method for Rubber Property-Durometer Hardness.

C. American Welding Society (AWS):

1. AWS D1.4 - Structural Welding Code Reinforcing Steel.

D. Concrete Reinforcing Steel Institute (CRSI):

1. CRSI - Manual of Practice
2. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.
3. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

E. Product Standard (PS):

1. PS 1 - Construction and Industrial Plywood.

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

1. AASHTO M182.
2. AASHTO M73.

1.3 SUBMITTALS

- A. Submit mix designs for each type concrete for use. See individual sections of these specifications for requirements.

1.4 TESTS

- A. Testing as indicated in Section 01410.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Concreting: Perform work in accordance with ACE 306R during cold weather concreting operations.
1. Comply with the following for minimum temperature of concrete delivered to job site:
 - a. Air Temperature 30-45°F: Concrete temperature 60°F minimum.
 - b. Air Temperature 0-30°F: Concrete temperature 65°F minimum.
 - c. Air Temperature below 0°F: Concrete temperature 70°F minimum.
 - d. The maximum concrete temperature shall not exceed the minimum required temperature by more than 10°F.
 2. Combine water heated to above 100°F with aggregates before cement is added. Do not add cement to water or aggregates having temperature greater than 100°F.
 3. When temperatures of 40°F or lower occur during the placing and curing of concrete, maintain temperature of concrete at not less than 55°F for at least 3 days.
 - a. Make arrangements before placement to maintain required temperature without damage from excessive heat.
 - b. Do not use combustion heaters during first 48 hours without precautions to prevent exposure of concrete to exhaust gases containing carbon dioxide and carbon monoxide.
 4. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306R and as herein specified.
 5. When the air temperature has fallen to or is expected to fall below 40°F, provide adequate means to maintain the temperature of the plastic concrete as placed, at 55°F minimum, for at least 3 days. Provide temporary housings or coverings including tarpaulins or plastic film. Keep protection in place and intact at least 24 hours after artificial heat is discontinued. Avoid rapid dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.
 6. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost, snow, and ice and temperature of these materials is above 32°F before placing concrete.
 7. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators.

- B. Hot Weather Concreting: Perform work in accordance with ACI 305R.
1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305R and as herein specified.
 2. Temperature of concrete at time of placing shall not exceed 90°F. Contractor shall maintain an accurate reading thermometer at the job site to check temperature of concrete. Concrete shall be rejected before placing if temperature of concrete exceeds 90°F.
 3. Special precautions to protect fresh concrete before and during finishing shall be mandatory when the rate of evaporation of surface moisture from concrete exceeds 0.2 pounds per square foot per hour. Rate of evaporation shall be determined in accordance with ACI 305R. Special precautions shall be provided as required:
 - a. Cool ingredients before mixing to reduce concrete temperature at time of placement. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.
 - b. Dampen subgrade and forms.
 - c. Cover reinforcing steel with water-soaked burlap so the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

PART 2 - PRODUCTS

2.1 FORMWORK

- A. Design, engineer and construct forms, shores, bracing, and other temporary supports to support loads imposed during construction, in accordance with ACI 347. Design under the direct supervision of a licensed professional engineer experienced in design of this Work.
1. Plywood: PS 1, sound, undamaged sheets with straight edges.
 2. Lumber: Construction grade.
 3. Steel: Minimum 16 gage sheet, well matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
 4. Carton Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete until initial set.
- B. Accessories:
1. Form Ties: Removable or snap-off metal, of fixed or adjustable length as applicable, with cone ends.
 2. Form Release Agent: Colorless mineral oil which will not stain concrete.

3. Waterstops: Select one of the following.

- a. Volclay RX-101
- b. Synko-Flex

2.2 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615; 60 ksi yield grade billet-steel deformed bars, uncoated finish.
- B. Welded Steel Wire Fabric: ASTM A185 plain type. Provide mats for welded wire fabric with wire sizes larger than W2.9.

2.3 REINFORCEMENT ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete.

2.4 CONCRETE MATERIALS

- A. Cement: ASTM C150, normal - Type I. Fly ash, slag, and pozzolans are not permitted as substitutes for cement.
- B. Fine and Coarse Aggregate: (ASTM C33) Use maximum coarse aggregate size per ACI 301, but not larger than 1-1/2 inches. Meet the following grading requirements of fine aggregates.

<u>Sieve</u>	<u>Percent Passing</u>
3/8 inch	100
#4	95 - 100
#8	80 - 90
#16	50 - 75
#30	30 - 50
#50	10 - 20
#100	2 - 5

- C. Water: Clean potable water, not detrimental to concrete.

2.5 CHEMICAL ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Chemical Admixtures: ASTM C494; Type A - water reducing.
 - 1. Admixtures containing Thiocyanates, Calcium Chloride or more than 0.1 percent

chloride ions are not permitted. Admixtures shall not contain more corrosives than are present in municipal drinking water.

2. The maximum water soluble chloride ion content in hardened concrete at 28 days shall not exceed 0.15 percent by weight of cement.

- C. Obtain Engineer's written approval prior to the use of any other admixtures.

2.6 RELATED MATERIALS

- A. Non-shrink Grout: Pre-mixed non-shrinking, high strength grout, COE CRD-621; compressive strength of 5000 psi in 28 days.
 1. Masterflow 713 by Master Builders Co.
 2. Gilco Construction Grout by Cormix Construction Chemicals, Dallas, TX, (800) 869-0300. (Formerly Gifford-Hill Co.)
 3. Crystex by L&M Construction Chemicals, Inc.
 4. Euco-N-S Grout by Euclid Chemical Company.
 5. SonogROUT by Sonneborn Building Products.
- B. Epoxy Bonding Agent: ASTM C881.
 1. Concrese 1001 LPL by Adhesive Engineering Co.
 2. Uniweld by Permagine.
 3. EVA-POX HI MOD GEL #23 by E-Poxy Industries, Inc.
 4. Similar product by other manufacturers; submit name, compressive strength and tensile strength for acceptance.

2.7 CONCRETE CURING MATERIALS

- A. Chemical Cure for Slabs: Kure-N-Seal by Sonneborn Building Products, ASTM C309.
- B. Moisture Cure:
 1. Water: Potable.
 2. Moisture-retaining Coverings: Burlap, cotton mats, or other moisture-retaining fabrics; AASHTO M182, ASTM C171, or AASHTO M73. Provide burlap free if sizing; rinse thoroughly in caustic soda to remove soluble substances and make burlap more absorbent.

2.8 CONCRETE MIX

- A. Mix and deliver concrete in accordance with ASTM C94.
- B. Provide concrete with the following characteristics:
 1. Compressive Strength: As specified or indicated for the specific use.

2. Air Content: 5%, plus or minus 1%.
3. Slump for conventionally placed concrete: Not to exceed 4 inches, maximum.
4. Slump for pumped concrete: Not to exceed 4 inches at the point of discharge from the pipe or hose after pumping.
5. Maximum Water-Cement Ratio: 0.46.
6. Minimum Cement Content: 493.5 lbs. per cu. yd.

C. Admixtures:

1. Air Entraining Admixtures: ASTM C260. Add to concrete mix for concrete work subject to freeze-thaw cycling. Air Content: See above.
2. Water Reducing Admixtures: ASTM C494, Type A. Use at interior slabs on grade, at Contractor's option and when approved by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's instructions. Do not apply bonding agent at slab-on-grade construction joints.

3.3 PLACING REINFORCEMENT

- A. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice, Documents 63 and 65.
1. Accurately place and secure saddle ties at every other intersection with 16 gage black annealed wire; hold rigidly in place with metal chairs or spacers during placing of concrete.
 2. Hold bars in beams and slabs to exact location during concrete placement. Use spacers, chairs, or other necessary supports with the following tolerances:
 - a. Bars in Slabs and Beams:
 - 1) Members 8 Inches Deep or Less: 1/4 inch.
 - 2) Members 8 Inches to 2'-0" Deep: 1/2 inch.
 - 3) Members More than 2'-0" Deep: 1 inch.
- B. Welded Reinforcement (AWS D1.4): Do not weld reinforcement in the shop or field.

3.4 PLACING CONCRETE

- A. Notify Testing Laboratory minimum 24 hours prior to commencement of concreting operations.
- B. Place concrete in accordance with ACI 301; including hot and cold weather placement procedures.
- C. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.
- D. Place concrete in reasonably uniform layers, approximately horizontal, 12 to 18 inches thick, exercising care to avoid vertical joints or inclined planes. Place concrete continuously between predetermined construction joints shown on structural drawings. Piling up of concrete in forms to cause separation or loss of ingredients is not permitted.
- E. Do not deposit concrete which has partially set or hardened. Do not deposit initial lubricating mortar when pumping concrete. Remove hardened or partially hardened concrete which has accumulated on forms or reinforcement. Do not place concrete on previously deposited concrete which has hardened sufficiently to cause formation of seams or planes of weakness within respective member or section except as specified.
- F. Deposit concrete as nearly in final position as practical to avoid rehandling. Exercise care to prevent splashing forms or reinforcing with concrete. Do not permit concrete to drop freely a distance greater than 3 feet. Where longer drops are necessary, use chute, tremie, or other conveyance to help avoid separation.
- G. Do not deposit concrete into excavation where water is standing. If place of deposit cannot be successfully pumped dry, place through tremie with outlet end near bottom of place of deposit.
- H. Do not deposit concrete when plasticity, measured by slump test, is outside specified limits.
- I. Consolidate and screed concrete slabs-on-grade by use of vibratory screed of size to allow construction joint patten as indicated on Structural Drawings and specified.
- J. Vibration: As soon as concrete is deposited, thoroughly agitate with mechanical vibrators and suitable hand tools to work mixture into corners of forms and around reinforcing and embedded items. Use mechanical vibrators to transport concrete within forms. Insert and withdraw vibrators at approximately 18 inches apart. At each insertion, vibrate generally 5-15 seconds, sufficient to consolidate concrete but not long enough to cause segregation. Keep spare vibrator on job site during concrete placement operations. Do not insert vibrator into lower courses that have begun to set.
- K. Excessive honeycomb or embedded debris in concrete is not acceptable.

- L. Pumping: Maintain controls for proportioning, mixing, adjustment of mix and placement in accordance with ACI 301 and ACI 304.2R.

3.5 FORM REMOVAL

- A. Do not remove forms until concrete has attained sufficient strength. Clamps or tie rods may be loosened 24 hours after concrete is placed. Ties, except for sufficient number to hold forms in place, may be removed at that time.
- B. Minimum Curing Period Prior to Form Removal:
 - 1. Air Temperature: Above 60°F: 3 days.
 - 2. Air Temperature: 50°F to 60°F: 5 days.
 - 3. Air Temperature: 40°F to 50°F: 7 days.
 - 4. Air Temperature: Less than 40°F: When temperature below 40°F prevails, leave forms until concrete reaches 75% of 28-day design strength.
- C. Observance of minimum curing periods listed above does not relieve Contractor of responsibility for safety of structure during construction.

3.6 FINISHING

- A. Schedule of Finishes:
 - 1. Unexposed Exterior Formed Surfaces: Rough form finish.
 - 2. Exposed Exterior Formed Surfaces: Rubbed/stoned.
 - 3. Sidewalks: Light broom.
 - 4. Ramps and Steps: Heavy broom.
- B. Initial Working:
 - 1. Remove surface irregularities with bull float before water appears on concrete surface.
 - 2. Do no further working of surface until time for floating; do not work surface while water is present.
 - 3. "Dry Sprinkle" method finishing is not acceptable and will be cause for rejection.
- C. Floating:
 - 1. Begin float operations when bleed water sheen has disappeared and concrete has stiffened sufficiently to allow walking on surface without leaving heel prints more than 1/4 inch deep. Use magnesium or aluminum power float.
 - 2. Premature finishing brings excessive fines to surface and causes finished slab to have soft surface which will dust.

D. Troweling:

1. Delay troweling as long as possible to prevent working excess fines and water to surface. Do not begin until surface moisture film and shine remaining after floating have disappeared.
2. Power trowel where possible; use hand trowel in inaccessible areas.
3. Do not over-trowel Stockroom floor. Slab must be able to accept specified floor treatment. Coordinate with floor treatment manufacturer's application instructions for proper finish and for procedures when finish is too dense for proper floor treatment application.
4. Do not re-wet surface to trowel.

E. Provide ACI "Class A" tolerance; 1/8-inch variation in 10 feet, measured with straight edge laid in any direction.

3.7 CURING

- A. Chemical Cure for Slabs (ACI 308): Apply in accordance with manufacturer's single coat application instructions. Obtain from the curing compound manufacturer a written guarantee that the compound will not be detrimental to bonding of flooring adhesives or surface materials. This guarantee shall be submitted to the Owner at the time request is made for use of curing compound.
- B. Moisture Cure: Moisture curing method is optional for all areas except stockroom.
1. Place wet, moisture-containing fabric covering as soon as concrete has hardened sufficiently to prevent surface damage.
 2. Cover entire surface, including edges of slabs such as paving or sidewalks.
 3. Keep coverings continually moist so that a film of water remains on concrete surface throughout curing period.
 4. Maintain concrete in moist condition for not less than seven days after placement.

3.8 DEFECTIVE CONCRETE

- A. Modify or replace concrete not confirming to required strength, levels and lines, details and elevations.
- B. Repair or replace concrete not properly placed or of the specified type.
- C. Do not impair appearance or strength of structure in removal or replacement procedures.

3.9 FIELD QUALITY CONTROL

- A. Testing as indicated in Section 01410.

- B. Provide and pay for the following:
 - 1. Qualification of proposed materials and establishment of mix designs in accordance with ACI 318.
 - 2. Testing services needed or desired by Contractor for his purposes.
- C. Evaluation and Acceptance:
 - 1. Strength level of concrete will be considered satisfactory if the average of all sets of three consecutive strength tests equal or exceed specified strength and no individual strength test (average of two cylinders) results are below specified compressive strength by more than 500 psi.
 - 2. Complete concrete work will not be accepted unless requirements of ACI 301, Chapter 18, have been complied with.
 - 3. Where average strength of cylinders, as shown by tests, falls below minimum ultimate compressive strength specified, Owner reserves the right to require Contractor to provide improved curing conditions of temperature and moisture to secure required strength. If average strength of laboratory control cylinders should fall so low as to cause portions of structure to be in question by Owner, Contractor shall follow core procedure set forth in ASTM C42. If results of core test indicate that strength of structure is inadequate, removal or replacement may be ordered by Owner and shall be provided by Contractor without additional cost to Owner. If core tests are so ordered and results of such tests disclose that strength of structure is as required by provisions of Specifications and Drawings, cost of test will be borne by Owner.

3.10 PROTECTION

- A. Protect finished work.
- B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

3.11 CLEANING

- A. Remove forms, equipment, protective coverings, and rubbish resulting from concreting operations. Leave finished concrete surfaces in clean conditions.

END OF SECTION 03300